THE FOOD ENVIRONMENT IN HOSPITALS AND LONG-TERM CARE FACILITIES

Shifting towards a healthy and sustainable food environment for patients, staff, and visitors

JOLINE J. WIERDA

PROPOSITIONS

1. It is a duty of a hospital to only serve and sell healthy food options to its patients.
   (this thesis)
2. Labeling food as a healthcare budget post rather than facilities enhances the availability of healthy foods.
   (this thesis)
3. PhD students need a teaching qualification to participate in teaching activities.
4. Practice-based evidence advances evidence-based practice.
5. Sound scientific conduct hinders its timely societal impact.
6. Making a first aid certificate mandatory to obtain or renew a driver's license is vital for saving lives.
7. Digitalization reduces loneliness among the elderly.

Propositions belonging to the thesis, entitled
The food environment in hospitals and long-term care facilities
Shifting towards a healthy and sustainable food environment for patients, staff, and visitors

Joline J. Wierda
Wageningen, 2 July 2025

The food environment in hospitals and long-term care facilities

Shifting towards a healthy and sustainable food environment for patients, staff, and visitors

Joline J. Wierda

Thesis committee

Promotors
Dr M.P. Poelman
Associate professor in Consumption and Healthy Lifestyles
Wageningen University & Research

Prof. Dr E.W.M.L. de Vet
Professor of Consumption and Healthy Lifestyles
Wageningen University & Research

Co-promotor
Dr S.K. Djojosoeparto
Postdoctoral researcher in Consumption and Healthy Lifestyles
Wageningen University & Research

Other members
Prof. Dr M.R. Crone, Maastricht University
Prof. Dr E. Kampman, Wageningen University & Research
Prof. Dr K.F.M. Joosten, Erasmus MC University Medical Center Rotterdam
Prof. Dr C.M. Renders, Vrije Universiteit Amsterdam

This research was conducted under the auspices of the Graduate School Wageningen School of Social Sciences (WASS).

The food environment in hospitals and long-term care facilities

Shifting towards a healthy and sustainable food environment for patients, staff, and visitors

Joline J. Wierda

Thesis

Submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus,
Prof. Dr C. Kroeze
in the presence of the
Thesis Committee appointed by the Academic Board
to be defended in public
on 2 July 2025
at 10:30 a.m. in the Omnia Auditorium.

Joline J. Wierda
The food environment in hospitals and long-term care facilities
Shifting towards a healthy and sustainable food environment for patients, staff, and visitors
229 pages.

PhD thesis, Wageningen University, Wageningen, the Netherlands (2025)
With references, with summaries in English and Dutch

DOI 10.18174/681374

TABLE OF CONTENTS

CHAPTER

1

General introduction

There is growing attention to nutrition in healthcare settings, with healthy nutrition increasingly recognized as one of the key solutions to improve health and support recovery. Healthy and sustainable nutrition can not only confer health and well-being benefits to patients, staff, and visitors, but can also benefit planetary health. Paradoxically, hospitals and long-term care facilities do not always provide healthy and sustainable food options, which may inadvertently contribute to conditions they aim to prevent, manage, or cure. More recently, the importance of the food environment is increasingly recognized in the healthcare setting. However, there is a lack of knowledge about the food environment in healthcare settings and to what extent a shift towards healthy and sustainable food environments is ongoing. This thesis examines the food environment in the Dutch healthcare setting - both hospitals and long-term care facilities - and identifies which factors, mechanisms, and actions, contribute to shifting towards a healthy and sustainable food environment for patients, staff, and visitors.

1.1 Burden of disease and its burden on the healthcare system

The healthcare setting has an exemplary role in promoting health, however, Western healthcare systems currently face pressing challenges related to an increased burden of disease. The healthcare setting in this thesis refers to hospitals and long-term care facilities. Hospitals are healthcare facilities that provide acute medical care, treatments, and surgical procedures to people. In the Netherlands, nearly three million people utilized short-term hospital care in 2022 [1]. Long-term care facilities are defined in this thesis as intramural long-term care institutions where people reside to receive care, cure, and support for an extended period. Almost 400.000 people resided in long-term healthcare institutions in 2023 [2]. This thesis included the following long-term care facility types: rehabilitation centers, nursing homes, institutions for people with intellectual disabilities, and mental healthcare institutions.

Several trends cause an increasing burden on the healthcare system. *First*, the increasing burden of disease, and more specifically the prevalence of non-communicable diseases (NCDs) [3, 4]. Globally, NCDs accounted for at least 43 million deaths in 2021, nearly 75% of all deaths [5]. Common types of NCDs include cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes type 2 [4, 6]. NCDs lead to higher healthcare costs and significantly burden healthcare spending and a higher demand of care [7]. *Second*, demographic changes resulting in an aging population further increase the healthcare burden, as longevity often leads to more age-related diseases, disability, and vulnerability, and thus the use of care [8, 9]. Because of the increasing burden of disease, it can be expected that the number of individuals depending on healthcare will continue to grow further in

the next decades [10, 11]. This will not only further rise healthcare costs, but also result in the demand for the extra healthcare workforce [12, 13]. This introduces a *third* challenge, namely to secure sufficient and qualified staff, as staff shortages are present, further increasing the burden on the healthcare system [14]. In 2022, more than 15% of the total workforce in the Netherlands accounted for people employed in the healthcare and welfare sector, and it is expected that this will have to increase in 2040 to 1 in 4 people working in healthcare to maintain the current healthcare quality [13]. To withstand the burden on the healthcare system, resilient healthcare systems must be created [15]. As part, health-promoting environments should be one of the priority areas in this [16, 17]. In this way, health-promoting healthcare environments are not only supportive for those receiving cure or care, but also for those working within these settings, as fostering well-being for both patients and staff is essential in addressing the growing burden on the healthcare system.

1.2 Increased attention to nutrition in the healthcare setting

The role of nutrition is increasingly recognized as a critical component of health-promoting healthcare environments, emphasizing its benefit for improved health outcomes, recovery, quality of life, thereby enhancing clinical outcomes and reducing healthcare costs [18]. Healthy diets can substantially benefit human health and the EAT-Lancet Commission describes a universal healthy reference diet as high in "vegetables, fruits, whole grains, legumes, nuts, and unsaturated oils, includes a low to moderate amount of seafood and poultry, and includes no or a low quantity of red meat, processed meat, added sugar, refined grains, and starchy vegetables" [19, p447]. In addition to the benefits of a healthy diet for human health, a healthy diet is often more sustainable, promoting both human and environmental health. The need to support healthy and sustainable diets has been recognized and international efforts emerged, for example via the Sustainable Development Goals [20], and the Global Action Plan for the Prevention and Control of NCDs 2013-2020 of the World Health Organization [21].

In the healthcare setting, the role of clinical nutrition in disease management is well-established, e.g. in the treatment of chronic diseases, such as type 2 diabetes [22–24]. Clinical nutrition addresses nutritional and metabolic challenges related to acute and chronic diseases [23]. Significant focus is placed on malnutrition, as it has been shown to affect patient outcomes negatively and is related to increased morbidity, mortality, length of hospital stay, readmission rates, and hospital costs compared to well-nourished patients [25]. Nutrition is a key component in prehabilitation and rehabilitation programs [26, 27]. Prehabilitation programs aim to enhance functional capacity of individuals in the run-up to surgery to improve outcomes, focusing on modifiable risk factors, where

in addition to exercise and psychosocial components, nutrition is of utmost importance [28]. Prehabilitation is part of the process leading to rehabilitation, to preserve functional capacity and enable patients to enhance resilience to treatment and promote long-term health [29].

Beyond the clinical focus, the preventive role of nutrition is receiving increasing attention in the healthcare setting. According to the ESPEN guidelines, preventive nutrition addresses the role of nutrition on the potential risk of disease development [23]. This preventive role of nutrition is acknowledged in the growing discipline of lifestyle medicine [30], which focuses on the role of lifestyle factors in prevention, treatment, and reversing many chronic diseases and negative health conditions, including type 2 diabetes,, obesity, and cardiovascular diseases [31]. The deployment of lifestyle medicine within the healthcare setting is emerging, for example, lifestyle counseling by healthcare staff during consultations [32] and the upcoming in-hospital lifestyle front-offices [33]. The healthcare setting has the opportunity to harness the potential of nutrition beyond its clinical application.

1.3 The healthcare food environment and its varied nature and role

Focusing on optimal nutrition in clinical and preventive nutrition applications within healthcare institutions requires not only embedding this in the treatment and integration into preventive strategies but also requires a healthy healthcare food environment. The **food environment** can be defined as the "collective physical, economic, policy, and sociocultural surroundings, opportunities, and conditions that influence people's food and beverage choices and nutritional status" [34]. This definition is based on the ANGELO framework (analysis grid for environments linked to obesity), for understanding the 'obesogenicity' of environments [35]; the conceptual framework for conceptualizing the multiple influences on what people eat [36]; and the conceptual model of community nutrition environments [37]. Using the ANGELO framework, hospitals and long-term care facilities can be viewed as microenvironments, within different types of food environments exist, physical (e.g. what is available), economic (e.g. what are the costs), political (e.g. what are the rules), and sociocultural (e.g. what are the norms and beliefs) [35]. The macroenvironment (such as government and food industry practices) influences the microenvironment (e.g., policies or food availability in healthcare settings) [35]. Prior work showed that food choices are largely influenced by the food environment [38–40]. Current food environments are largely unsupportive of healthy diets [41–43].

While improving the food environment in healthcare settings is essential, the practical approach to attaining this goal is far from straightforward, as it encompasses various healthcare types and diverse customer needs, it has to serve the needs of various patients, staff, and visitors. In this thesis, patients refer to health care receivers, hospitalized patients (in-patient and outpatients), clients and residents, people who stay in long-term care institutions. Staff refer to all types of occupations in hospitals and long-term care facilities, such as medical, paramedical, facility, and management. Visitors refer to people who visit the hospital or long-term care facilities, e.g. for a clinical appointment, or visiting their relatives, who are the patients, clients, or residents. In hospitals, visitors can refer to out-patients for whom treatment does not require an overnight stay. The food environment serves the staff for which the healthcare food environment is their work environment, that may experience different wishes and have different needs than health care recipients. Furthermore, hospitals and long-term care facilities are often visited by relatives, family, and friends of patients ('visitors'). This presents an opportunity to welcome these different target groups in a health-promoting environment and stimulate healthy and sustainable food choices.

The current literature on the healthcare food environment reveals several gaps. First, a comprehensive insight into the characteristics of the totality of the healthcare food environment is lacking. Studies have been limited to particular aspects of the food environment, for example mainly focusing on the physical aspects [44–47], political aspects [48–51], or sustainable aspects [52–55], while the healthcare food environment is far more extensive and all-encompassing. Second, the healthcare food environment is often studied for distinctive target groups, e.g. only for patients [56], or only the food environment for staff, and/or visitors [57, 58], thereby missing insights that fully grasp the healthcare food environment for all its customers. Third, most insights into the healthcare food environment center around hospitals, however, insights into the food environment of long-term care facilities such as rehabilitation centers and mental healthcare institutions remain largely unexplored. Expanding research to long-term care facilities is needed to increase knowledge on how to improve the food environment and adapt strategies accordingly for shifting towards a healthy and sustainable healthcare food environment. The aforementioned gaps can be addressed by characterizing the comprehensive healthcare food environment (Chapter 2).

1.4 Applying a systems lens for transforming the healthcare food environment

As illustrated above, the food environment in the healthcare setting is complex, and likely shaped by the type of healthcare, facilities available, stakeholders, interests, the

various beneficiaries, and multiple dynamic relationships between them. To shift towards a healthy and sustainable healthcare food environment, it is essential to consider and better understand the food environment within the healthcare setting as a complex adaptive system. This system consists of various elements, interconnections between these elements, and purposes that influence people's food and beverage choices and nutritional status [59]. Analyzing and understanding how this system behaves and works can help shift the system [59] toward a healthy and sustainable healthcare food environment, supportive of healthy and sustainable food choices.

There is growing interest in applying systems science in public health [60–63]. However, limited studies have explored the healthcare food environment from a systems perspective. To the best of my knowledge only one recent study applied Group Model Building, a common method to apply a system dynamic approach [64], to improve a hospital café food environment [65]. However, this was only a single aspect of the food environment in one hospital. Only a few other studies used Group Model Building in the healthcare setting, for example in acute care delivery [66] and to unravel geriatric problems [67]. As previously stated, research on how to change the food environment in the specific setting of long-term care facilities is limited and we cannot rely solely on the insights of the hospital food environment. Understanding the system dynamics underlying the food environment in long-term care facilities may help to explore how to accomplish shifting towards a healthy and sustainable food environment and inform strategies (Chapter 3).

In the Netherlands, an increasing number of hospitals are realizing a healthy and sustainable food environment [68], however, the factors influencing the implementation of actions to enhance the healthiness and sustainability of the food environment are largely unknown. To further enhance the understanding of the factors influencing realizing a healthy and sustainable food environment in hospitals, stakeholders' perspectives can provide valuable insights, as stakeholders know the system first-hand. Capturing diverse perspectives of multiple stakeholders is crucial to view the system holistically. Moreover, successful actions and interactions of these actors can foster system changes [69]. Transforming healthcare food environments is a multi-stakeholder process, which involves changes at various levels of healthcare organizations, with a variety of stakeholders with different roles and distinct spheres of influence. To gain insight into how hospital food environments for patients, staff, and visitors are moving towards healthy and sustainable food environments, it is imperative to explore this from the various stakeholders throughout the entire hospital organization. Understanding stakeholders' perspectives across all levels of the hospital organization would provide insight into factors that influence shifting towards a healthy and sustainable food environment (Chapter 4).

1.5 The need for monitoring the implementation of measures for a healthier and more sustainable healthcare food environment

As stated above, an increasing number of hospitals and long-term care facilities are currently implementing actions to shift towards healthy and sustainable food environments. These efforts are based on several agreements in the Netherlands that contribute to prevention strategies aiming to enhance the healthiness and sustainability of the healthcare food environment. For example, the National Prevention Agreement (NPA), signed in 2018 by the Dutch government and more than seventy public and private organizations aimed to achieve a healthier Netherlands by reducing and preventing overweight, obesity, smoking and alcohol consumption [70]. Several goals in the Prevention Agreement focus on creating healthy food environments and one is specifically focused on the healthcare setting stating that in 2025, 50% of hospitals are expected to offer healthy foods to patients, staff, and visitors, with the goal of reaching full implementation in all hospitals in 2030, and additionally efforts are directed toward healthcare institutions. The Dutch Ministry of Health, Welfare and Sport commissioned the national expertise centre in nutrition and healthcare, the Nutrition & Healthcare Alliance, to support hospitals and healthcare institutions to accomplish the NPA ambition [71]. Therefore, the Nutrition & Healthcare Alliance launched a national program, a voluntary ongoing learning network of hospitals and healthcare institutions, called 'A Taste of Excellent Healthcare' (TEH), that offers hospitals and healthcare institutions support in achieving a healthy and sustainable food environment [71]. Alliances, such as networks, are considered crucial in achieving transformative systems change [69]. There are several other signed agreements where the food environment is mentioned. For example, the Integral Care Agreement (IZA) [72] states that from the 1st of January, 2030, the food for patients, clients and residents of healthcare institutions is offered based on the guideline eating environment of The Netherlands Nutrition Centre [73]. Also the GALA agreement (Healthy and Active Living Agreement) of the Dutch Ministry of Health, Welfare and Sport, municipalities, municipal public health services and care insurers states that a healthy food environment is needed for healthier people [74]. An agreement specifically focused on making the healthcare sector more sustainable is the Green Deal on Sustainable Healthcare 3.0, in which one theme focuses on promoting the health of patients, clients and staff [75].

Despite measures included in these agreements to create healthier and sustainable food environments in the healthcare setting, it remains unclear to what extent these measures contribute to transforming the Dutch healthcare landscape towards a healthy and sustainable food environment. This highlights the need for monitoring the healthcare food environment, to give insight into current performance, effectiveness of measures, track

progress in achieving goals, and provide focus where actions are most needed [76, 77] (Chapter 5).

1.6 Aims and research questions

Given the specified knowledge gaps above, this thesis aims to gain insight into the food environment within the Dutch healthcare setting and to identify which factors, mechanisms, and actions contribute to shifting to a healthy and sustainable food environment in hospitals and long-term care facilities. To address these aims, four chapters of original research are outlined. An overview of the research in the respective chapter can be found in Fig. 1. More specifically, the following research questions are addressed in Chapter 2-5 of this thesis:

- 'What are the characteristics of the healthcare food environment and what are the differences between hospitals and long-term care facilities? (Chapter 2)
- 'What are the system dynamics underlying the food environment in long-term care facilities in the Netherlands and what actions can contribute to improving the food environment?' (Chapter 3)
- 'Which factors influence the shift towards a healthy and sustainable food environment in Dutch hospitals?' (Chapter 4)
- 'To what degree have hospitals and long-term care facilities implemented actions to improve the healthiness and sustainability of the food environment?' (Chapter 5)

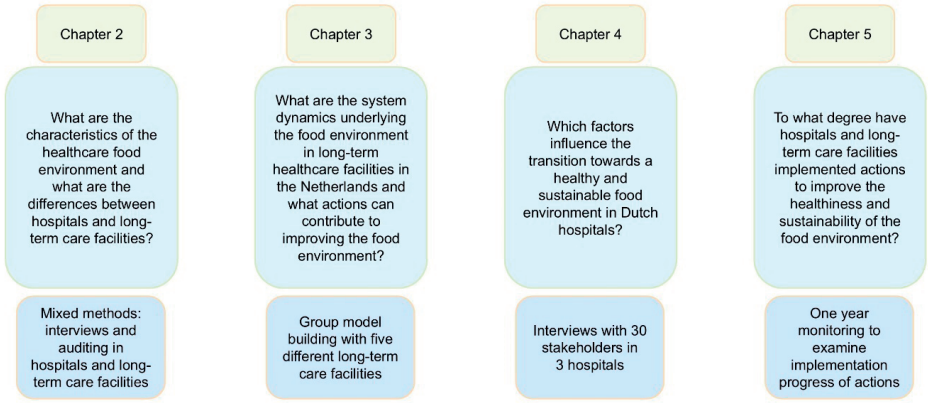


Fig. 1. Schematic overview of the central research question and used methods per chapter.

1.7 Thesis outline

Chapter 2 describes a complete picture of the comprehensive food environment in the healthcare setting. The objective of this study was to characterize the food environment in the healthcare setting in the Netherlands and compare the food environment between hospitals and long-term care facilities. **Chapter 3** describes the system dynamics underlying the food environment of healthcare institutions and formulates actions to create a healthy and sustainable food environment. Moreover, the study in this Chapter aimed to evaluate stakeholder perspectives about the systems process and to evaluate the progress towards implementing the actions up to one-year follow-up. **Chapter 4** gives insight into the factors that influence the shift to transition to a healthy and sustainable food environment in the hospital setting in the Netherlands, from the perspective of different stakeholders in this setting. **Chapter 5** examines the implementation of actions for a healthy and sustainable food environment in hospitals and healthcare institutions after one year of commitment to the TEH program 'A Taste of Excellent Healthcare'. In the last chapter, **Chapter 6**, the General Discussion, the main findings of this thesis are summarized and reflected upon, thereby placing the results into a broader perspective, methodological considerations are discussed, implications for policy and practice are presented and directions for further research are given.

References Chapter 1

1. Centraal Bureau voor de Statistiek (CBS). StatLine Ziekenhuisopnamen en -patienten; diagnose-indeling VTV [Internet]. StatLine; 2024. Available from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/84067NED/table?dl=A181F
2. Centraal Bureau voor de Statistiek (CBS). StatLine Monitor Langdurige Zorg Personen met indicatie zorg met verblijf; grondslag [Internet]. StatLine; 2024. Available from: https://mlzopendata.cbs.nl/#/MLZ/nl/dataset/40005NED/table?dl=1F5E4
3. Wang H, Naghavi M, Allen C, Barber RM, Bhutta ZA, Carter A, et al. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388(10053):1459–544.
4. Boutayeb A, Boutayeb S. The burden of non communicable diseases in developing countries. Int J Equity Health. 2005;4:2.
5. World Health Organization. Factsheet. 2024. Noncommunicable diseases. Available from: https://www.who.int/news-room/fact-sheets/detail/noncommunicablediseases
6. Statista. Distribution of causes of death worldwide in 2021 [Internet]. Available from: https://www.statista.com/statistics/1493203/share-of-deaths-worldwide-bycause-2021/
7. Muka T, Imo D, Jaspers L, Colpani V, Chaker L, van der Lee SJ, et al. The global impact of noncommunicable diseases on healthcare spending and national income: a systematic review. Eur J Epidemiol. 2015;30(4):251–77.
8. Prince MJ, Wu F, Guo Y, Gutierrez Robledo LM, O'Donnell M, Sullivan R, et al. The burden of disease in older people and implications for health policy and practice. Lancet. 2015;385(9967):549–62.
9. World Health Organization. Regional Office for Europe, Health Evidence Network, European Observatory on Health Systems and Policies, Rechel B, Doyle Y, Grundy E, McKee M. How can health systems respond to population ageing?. 2009.
10. Choi M, Sempungu JK, Lee EH, Lee YH. Living longer but in poor health: healthcare system responses to ageing populations in industrialised countries based on the Findings from the Global Burden of Disease Study 2019. BMC Public Health. 2024;24:576.
11. Kingston A, Comas-Herrera A, Jagger C. Forecasting the care needs of the older population in England over the next 20 years: estimates from the Population Ageing and Care Simulation (PACSim) modelling study. Lancet Public Health. 2018;3(9):e447–55.
12. Haakenstad A, Irvine CMS, Knight M, Bintz C, Aravkin AY, Zheng P, et al. Measuring the availability of human resources for health and its relationship to universal health coverage for 204 countries and territories from 1990 to 2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2022;399(10341):2129–54.
13. Wetenschappelijke Raad voor het Regeringsbeleid. Kiezen voor houdbare zorg. Mensen, middelen en maatschappelijk draagvlak. WRR-Rapport 104. Den Haag;2021.
14. Haakenstad A, Irvine CMS, Knight M, Bintz C, Aravkin AY, Zheng P, et al. Measuring the availability of human resources for health and its relationship to universal health coverage for 204 countries and territories from 1990 to 2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet. 2022;399(10341):2129–54.
15. World Health Organization. Building health systems resilience for universal health coverage and health security during the COVID-19 pandemic and beyond: WHO position paper. Geneva: WHO; 2021. (WHO/UHL/PHC-SP/2021.01)

16. Aujoulat I, Le Faou AL, Sandrin-Berthon B, Martin F, Deccache A. Implementing health promotion in health care settings: conceptual coherence and policy support. Patient Educ Couns. 2001;45(4):245–54.
17. Hagenaars L, Waterlander W, den Hertog K, Stronks K. Een veerkrachtige publieke gezondheid in 2030: #hoedan? [Resilient public health in 2030: #how?]. TSG. 2022;100(Suppl 3):119–23.
18. Tappenden KA, Quatrara B, Parkhurst ML, Malone AM, Fanjiang G, Ziegler TR. Critical role of nutrition in improving quality of care: an interdisciplinary call to action to address adult hospital malnutrition. J Acad Nutr Diet. 2013;113(9):1219–37.
19. Willett W, Rockstrom J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. Lancet. 2019;393:447–92.
20. United Nations. Transforming Our World: The 2030 Agenda for Sustainable Development. [Internet]. New York, UN; 2015. Available from: https://sdgs.un.org/sites/default/files/publications/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf
21. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020. In Global action plan for the prevention and control of noncommunicable diseases 2013-2020. [Internet]. Geneva: WHO;2013. Available from: https://www.who.int/publications/i/item/9789241506236
22. van Bokhorst-de van der Schueren MAE, Guaitoli PR, Jansma EP, de Vet HCW. Nutrition screening tools: does one size fit all? A systematic review of screening tools for the hospital setting. Clin Nutr. 2014;33(1):39–58.
23. Cederholm T, Barazzoni R, Austin P, Ballmer P, Biolo G, Bischoff SC, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. Clin Nutr. 2017;36(1):49–64.
24. Keller HH, Laur C, Dhaliwal R, Allard JP, Clermont-Dejean N, Duerksen DR, et al. Trends and novel research in hospital nutrition care: a narrative review of leading clinical nutrition journals. JPEN J Parent Enteral Nutr. 2021;45(4):670–84.
25. Correia MITD, Hegazi RA, Higashiguchi T, Michel JP, Reddy BR, Tappenden KA, et al. Evidence-based recommendations for addressing malnutrition in health care: an updated strategy from the feedM.E. Global Study Group. J Am Med Dir Assoc. 2014;15(8):544–50.
26. West MA, Wischmeyer PE, Grocott MPW. Prehabilitation and nutritional support to improve perioperative outcomes. Curr Anesthesiol Rep. 2017;7(4):340–49.
27. Nishioka S, Aragane H, Suzuki N, Yoshimura Y, Fujiwara D, Mori T, et al. Clinical practice guidelines for rehabilitation nutrition in cerebrovascular disease, hip fracture, cancer, and acute illness: 2020 update. Clin Nutr ESPEN. 2021;43:90–103.
28. Robinson TN, Carli F, Scheede-Bergdahl C. Medical optimization and prehabilitation. In: The SAGES / ERASR Society Manual of Enhanced Recovery Programs for Gastrointestinal Surgery. Cham: Springer International Publishing; 2015. p. 25–39.
29. Davis JF, van Rooijen SJ, Grimmett C, West MA, Campbell AM, Awasthi R, et al. From theory to practice: an international approach to establishing prehabilitation programmes. Curr Anesthesiol Rep. 2022;12(1):129–37.
30. Poelman MP, Djojosoeparto SK, Dijkstra SC, van Lenthe FJ, de Vet EWML, Kamphuis CBM. AANPASSING VAN DE VOEDSELOMGEVING IS GEEN BETUTTELING MAAR VAN ESSENTIEEL BELANG VOOR HET SUCCES VAN LEEFSTIJLGENEESKUNDE. NED TIJDSCHR LEEFSTIJLGENEESKD. 2023;1:34–9.
31. Lippman D, Stump M, Veazey E, Guimaraes ST, Rosenfeld R, Kelly JH, et al. Foundations of lifestyle medicine and its evolution. Mayo Clin Proc Innov Qual Outcomes. 2024;8(1):97–111.

32. Nelson A, de Normanville C, Payne K, Kelly MP. Making every contact count: an evaluation. Public Health. 2013;127(7):653–60.
33. van Dijk ML, te Loo LM, Vrijsen J, van den Akker-Scheek I, Westerveld S, Annema M, et al. LOFIT (Lifestyle front Office For Integrating lifestyle medicine in the Treatment of patients): a novel care model towards community-based options for lifestyle change—study protocol. Trials. 2023;24:114.
34. Swinburn B, Sacks G, Vandevijvere S, Kumanyika S, Lobstein T, Neal B, et al. INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. Obes Rev. 2013;14(Suppl 1):1–12.
35. Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: The development and application of a framework for identifying and prioritizing environmental interventions for obesity. Prev Med. 1999;29(6 Pt 1):563–70.
36. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: policy and environmental approaches. Annu Rev Public Health. 2008;29:253–72.
37. Glanz K, Sallis JF, Saelens BE, Frank LD. Healthy nutrition environments: Concepts and measures. Vol. 19, American Journal of Health Promotion. Am J Health Promot. 2005;19(5):330-3.
38. Larson N, Story M. A review of environmental influences on food choices. Ann Behav Med. 2009;38(Suppl 1):56–73.
39. Caspi CE, Sorensen G, Subramanian SV, Kawachi I. The local food environment and diet: A systematic review. Health Place. 2012;18(5):1172–87.
40. Giskes K, van Lenthe F, Avendano-Pabon M, Brug J. A systematic review of environmental factors and obesogenic dietary intakes among adults: are we getting closer to understanding obesogenic environments? Obes Rev. 2011;12(5):e95–e106.
41. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, Gortmaker SL. The global obesity pandemic: shaped by global drivers and local environments. Lancet. 2011;378(9793):804-14.
42. Poelman MP, Dijkstra SC, Djojosoeparto SK, de Vet EWML, Seidell JC, Kamphuis CBM. Monitoring van de mate van gezondheid van het aanbod en de promoties van supermarkten en out-of-home-ketens : Inzicht in de huidige stand van zaken en aanbevelingen voor het opzetten van een landelijke monitor. Wageningen: Wageningen University & Research; 2021.
43. Food and Agriculture Organization of the United Nations (FAO). Influencing Food Environments for Healthy Diets. Rome: FAO; 2016. Available from: https://openknowledge.fao.org/server/api/core/bitstreams/14a2828e-2b07-444a-a0b2-af111b0efd30/content
44. Derrick JW, Bellini SG, Spelman J. Using the Hospital Nutrition Environment Scan to evaluate health initiative in hospital cafeterias. J Acad Nutr Diet. 2015;115(11):1855–60.
45. Lesser LI, Hunnes DE, Reyes P, Arab L, Ryan GW, Brook RH, et al. Assessment of food offerings and marketing strategies in the food-service venues at California children's hospitals. Acad Pediatr. 2012;12(1):62–7.
46. Horton Dias CE, Dawson RM, Harris DM, Wirth MD, Abshire DA. Foods and beverages available to nurses in hospital cafeterias, vending machines, and gift shops. Am J Health Promot. 2022;36(7):1133–41.
47. Champ CE, Iarrobino NA, Haskins CP. Hospitals lead by poor example: An assessment of snacks, soda, and junk food availability in Veterans Affairs hospitals. Nutrition. 2019;60:70–3.
48. Djojosoeparto SK, Verain MCD, Schebesta H, Biesbroek S, Poelman MP, Candel JJL. Harnessing the potential of public procurement for the protein transition – perceived barriers and facilitators. Agric Human Values. 2025;42:351-68.

49. Stephens LD, Porter J, Lawrence M. Healthy and Environmentally Sustainable Food Procurement and Foodservice in Australian Aged Care and Healthcare Services: A Scoping Review of Current Research and Training. Sustainability. 2021;13(20):11207.
50. Rosin M, Mackay S, Gerritsen S, Te Morenga L, Terry G, Ni Mhurchu C. Barriers and facilitators to implementation of healthy food and drink policies in public sector workplaces: a systematic literature review. Nutr Rev. 2024;82(4):503–35.
51. Gerritsen S, Rosin M, Te Morenga L, Jiang Y, Kidd B, Shen S, et al. Awareness, support, and opinions of healthy food and drink policies: a survey of staff and visitors in New Zealand healthcare organisations. BMC Public Health. 2024;24:2179.
52. Carino S, Collins J, Malekpour S, Porter J. Environmentally sustainable hospital foodservices: Drawing on staff perspectives to guide change. Sustain Prod Consum. 2021;25:152–61.
53. Carino S, Collins J, Malekpour S, Porter J. The role of policy in supporting environmentally sustainable foodservice in healthcare: lessons from exemplar hospitals. Front Nutr. 2023;10:1122911.
54. Carino S, Malekpour S, Porter J, Collins J. The drivers of environmentally sustainable hospital foodservices. Front Nutr. 2021;8:740376.
55. Carino S, Porter J, Malekpour S, Collins J. Environmental sustainability of hospital foodservices across the food supply chain: a systematic review. J Acad Nutr Diet. 2020;120(5):825-73.
56. Osman NS, Md Nor N, Md Sharif MS, Hamid SBA, Rahamat S. Hospital food service strategies to improve food intakes among inpatients: A Systematic Review. Nutrients. 2021;13(10):3649.
57. al-Tamimi K, van Herwerden L, Abdul M, Utter J. Hospital-based food environment interventions to improve workforce dietary behaviour: a systematic literature review. Am J Lifestyle Med. 2023;19(4):616-25.
58. Richardson S, McSweeney L, Spence S. Availability of healthy food and beverages in hospital outlets and interventions in the UK and USA to improve the hospital food environment: a systematic narrative literature review. Nutrients. 2022;14(8):1566.
59. Meadows D. Thinking in systems: a primer. White River Junction (VT). Sustainability Institute; 2008.
60. Carey G, Malbon E, Carey N, Joyce A, Crammond B, Carey A. Systems science and systems thinking for public health: a systematic review of the field. BMJ Open. 2015;5(12):e009002.
61. Rutter H, Savona N, Glonti K, Bibby J, Cummins S, Finegood DT, et al. The need for a complex systems model of evidence for public health. Lancet. 2017;390(10112):2602–4.
62. Felmingham T, Backholer K, Hoban E, Brown AD, Nagorcka-Smith P, Allender S. Success of community-based system dynamics in prevention interventions: a systematic review of the literature. Front Public Health. 2023;11:1103834.
63. Estrada-Magbanua WM, Huang TT-K, Lounsbury DW, Zito P, Iftikhar P, El-Bassel N, et al. Application of group model building in implementation research: A systematic review of the public health and healthcare literature. PLoS One. 2023;18:e0284765.
64. Baugh Littlejohns L, Hill C, Neudorf C. Diverse approaches to creating and using causal loop diagrams in public health research: recommendations from a scoping review. Public Health Rev. 2021;42:1604352.
65. Vargas C, Venegas Hargous C, Grainger F, Perera L, Pymer S, Bell C, et al. Applying systems thinking to improve a hospital food retail environment. J Nutr Educ Behav. 2024;56:569–78.
66. Muttalib F, Ballard E, Langton J, Malone S, Fonseca Y, Hansmann A, et al. Application of systems dynamics and group model building to identify barriers and facilitators to acute care delivery in a resource limited setting. BMC Health Serv Res. 2021;21(1):26.

67. Smeekes OS, Willems HC, Blomberg I, Rouwette EAJA, Buurman BM. Implementing online group model building to unravel complex geriatric problems, a methodological description. BMC Geriatr. 2023;23(1):431.
68. Pot GK, Winkels RM, van Loenhout T. Letter to the Editor: An omission in guidelines. Cardiovascular disease prevention should also focus on dietary policies for healthcare facilities. Clin Nutr. 2023;42:1240–42.
69. de Haan FJ, Rotmans J. A proposed theoretical framework for actors in transformative change. Technol Forecast Soc Change. 2018;128:275–86.
70. Ministerie van Volksgezondheid Welzijn en Sport. Nationaal Preventieakkoord. Naar een gezonder Nederland. 2018.
71. Alliantie Voeding in de Zorg. Goede zorg proef je [Internet]. Available from: https://goedezorgproefje.nl/
72. Ministerie van Volksgezondheid, Welzijn en Sport. Integraal Zorgakkoord (IZA): "Samen werken aan gezonde zorg." Den Haag: VWS; 2022.
73. Voedingscentrum. Richtlijn Eetomgevingen. [Internet]. Available from: https://www.voedingscentrum.nl/professionals/gezonde-eetomgeving/de-richtlijn-gezondere-eetomgevingen.aspx.
74. Ministerie van Volksgezondheid, Welzijn en Sport. GALA Gezond en Actief Leven Akkoord. 2023.
75. Government of the Netherlands. Green Deal on Sustainable Healthcare 3.0 [Internet]. Available from: https://www.greendealduurzamezorg.nl/
76. Vandevijvere S, Tseng M. Towards comprehensive global monitoring of food environments and policies to reduce diet-related non-communicable diseases. Public Health Nutr. 2013;16:2101–4.
77. Fanzo J, Haddad L, Schneider KR, Bene C, Covic NM, Guarin A, et al. Viewpoint: rigorous monitoring is necessary to guide food system transformation in the countdown to the 2030 global goals. Food Policy. 2021;104:102163.

CHAPTER

2

Characterizing food environments of hospitals and long-term care facilities in the Netherlands: a mixed methods approach

Authors:
Joline J. Wierda, Emely de Vet, Ellemijn Troost & Maartje P. Poelman

Published as:
Wierda, J. J., de Vet, E., Troost, E., & Poelman, M. P. (2024). Characterizing food environments of hospitals and long-term care facilities in the Netherlands: a mixed methods approach. BMC Health services research, 24(1), 31.

https://doi.org/10.1186/s12913-023-10399-6

Abstract

Background: Hospitals and long-term care facilities, which are key institutions to serve health and well-being, have an important exemplary role in providing supportive food environments to encourage healthy and sustainable food choices. The objective of this study is to characterize the physical, socio-cultural, political and economic dimensions of the food environment for health care receivers, health workforce and visitors in healthcare settings, and make comparisons between the food environment of hospitals and long-term care facilities.

Methods: To characterize the food environment in healthcare settings, two sub-studies were conducted. In sub-study 1, semi-structured interviews were held with staff members (n = 46) representing 11 hospitals and 26 long-term care facilities (rehabilitation centres, nursing homes, institutions for people with intellectual disabilities and mental healthcare institutions). In sub-study 2, staff members audited the food environment in hospitals (n = 28) and long-term care facilities (n = 36) using a predefined checklist.

Results: The food environment in Dutch healthcare settings varies substantially between locations although noticeable differences between hospitals and long-term care facilities were identified. Hospitals and larger long-term care facilities featured more often restaurants and utilized central spaces for preparation of meals, while smaller long-term care facilities often operated as household-like settings. Type of healthcare shaped the socio-cultural food environment, with hospitals primarily emphasizing nutrition for fast recovery, while long-term care facilities more often as an instrument (i.e., to structure the day). Participants highlighted the importance of food policies and broad organizational support for realizing and regulating improvement of the food environment. Yet, long-term care facilities were less familiar with national guidelines for food environments compared to hospitals. Several economical aspects, like profit motives, strict budgets and contracts with external parties affected and shaped the food available within all healthcare settings.

Conclusions: This study characterized the food environment in Dutch healthcare settings. Disclosed differences between hospitals and long-term care facilities should be incorporated in strategies for a transition of the food environment. Future research should investigate the underlying mechanisms of the healthcare food environment attaining all healthcare stakeholders - health care receivers, staff and visitors - while prioritizing sustainability alongside healthiness.

2.1 Background

Healthcare organizations, including hospitals and long-term care facilities, are essential environments to serve health and well-being. These organizations have an important role to lead by example in promoting health and sustainability. Healthy diets are key in promoting health, including the prevention of malnutrition and diseases, appropriate healing, recovery and promotion of quality of life and a healthy lifestyle [1, 2]. While a myriad of factors shape peoples' diet, it is well understood that food environments play a crucial role in shaping food choices and thus health and environmental outcomes [3, 4].

The food environment can be dissected into four dimensions, a physical-, socio-cultural-, political-, and economic dimension, rooted in the analysis grid for environments linked to obesity (ANGELO) framework of Swinburn et al. [5, 6]. The physical dimension of the food environment refers to the food available, its characteristics (e.g. healthiness, quality) and information about the food (e.g. communicated via nutrition labels). The socio-cultural dimension defines the culture, ethos or climate related to food consumption in a particular context (e.g. within a healthcare setting), and includes attitudes, beliefs and values. The political dimension comprises rules, for example food policies or -regulations, laws and standards, for example about food availability within a certain context. Finally, the economic dimension refers to food costs, for example for catering and retailing, but also pricing policies (e.g. taxes) and incentives (e.g. subsidies). In hospitals and long-term care facilities the food environment is characterized by its diversity and the complex interplay of these dimensions, involving multiple stakeholders with diverse interests. Moreover, the food environment has to serve the needs of health care receivers as well as staff and visitors [7]. Although prior studies have explored aspects of the healthcare food environment, there remains a need for a comprehensive understanding of all of its dimensions in order to identify potential areas for intervention and achieve healthy and sustainable food environments in healthcare settings. Such knowledge can identify targets for actions to improve food environments in the healthcare setting, and expose health care receivers, staff and visitors to a healthy food environment, thereby enhancing public and environmental health. The current literature exhibits a scarcity of research focused on this wide perspective, revealing three primary gaps that require further exploration.

First, prior studies predominantly focus on the physical food environment. A recent systematic review into the availability of healthy food and drinks in hospitals in the United Kingdom and United States of America concluded that the nutritional quality of items varies and differs between and within healthcare facilities [8]. Horton Dias et al. [9] found that the consumer food environment in hospitals did not promote a healthy diet, based on observations in cafeterias, vending machines and gift shops in 31 hospitals in the United States of America. Also the food assortment of food outlets in hospitals are pre-

dominantly unhealthy and widely available [10,11,12,13]. While these studies offer valuable insights, there is still a lack of research on the economic, political and socio-cultural dimensions, leaving important aspects of the healthcare food environment understudied.

Second, to the best of our knowledge, insights into the healthcare food environment predominantly centre around hospitals, leaving out understanding about the food environment of long-term care facilities. However, the healthcare landscape extends far beyond hospitals. Long-term care facilities are equally important as hospitals in promoting health and sustainability. Health care receivers frequently reside in long-term care facilities for longer periods compared to hospital stays, making the food environment there more influential in shaping dietary patterns of health care receivers. The ESPEN guidelines on hospital nutrition do include rehabilitation centres and nursing homes, however, it was indicated that more knowledge is needed for organization of nutritional issues and good patient safety in nutritional care [14]. This has also been acknowledged by the National Prevention Agreement in the Netherlands, an agreement signed in 2018 by the Dutch government and seventy public and private organizations aimed to achieve a healthier Netherlands by reducing and preventing overweight and obesity, smoking and alcohol consumption [15]. Several goals focus on creating healthy food environments and one emphasizes that *by 2025, 50% of hospitals are expected to offer healthy foods to patients, visitors and staff, with the goal of reaching full implementation across all hospitals no later than 2030.* The Nutrition & Healthcare Alliance (the national expertise center dedicated to achieving health benefits through the application of scientific findings on nutrition and exercise in prevention and healthcare), supports to realize this ambition through the national 'Goede Zorg Proef Je' program (translated to English: 'A Taste of Excellent Healthcare') [16]. By means of 'Goede Zorg Proef Je', the Alliance collaborates with several parties including the Dutch Hospital Association (NVZ), Netherlands Nutrition Centre, Dutch Association of Dietitians and private parties (like caterers and food suppliers). Currently, 80% of Dutch hospitals are actively pursuing this ambition with the support of the Nutrition & Healthcare Alliance. Long-term care facilities are also getting involved in these ambitions, but vary substantially in the organization and type of care they deliver. It is therefore currently unknown if the approach for realizing a healthy food environment in hospitals is applicable to long-term care facilities. Comparing these two can provide valuable insights for designing and implementing actions to enhance the food environment in all healthcare settings.

Third and final, characterizing the food environment of healthcare settings is predominantly targeted at the publicly available food options (e.g., for everybody) or staff restaurants, with little regard for the food environment of inpatients or health care receivers. For example, one study found that hospitals nurses experiences the food environment in hospitals oppressively unhealthy [17] and others concluded that health care staff heavily

favored healthy foods [18]. Another study reported that visitors of a hospital percepted low availability of healthy food options [19]. And Lederer et al. [20] described that supporting a healthy food environment had no priority for staff managing cafeterias in hospitals. Moreover, the priorly mentioned review of Richardson et al. [8] fully excluded the food environment for inpatients.

This study will address the three aforementioned gaps and will add to the literature a complete picture of the totality of the food environment in the healthcare setting. The objective of this study is to characterize the food environment in the healthcare setting in the Netherlands and compare the food environment between hospitals and long-term care facilities, both specifically concerning health aspects of the food environment.

2.2 Methods

This study used a mixed methods approach to assess the food environment, divided into sub study 1 (qualitative approach) and sub study 2 (quantitative approach). The study was approved by the Social Sciences Ethics Committee of Wageningen University & Research and it complies with the Netherlands Code of Conduct for Research Integrity. The study was part of a project that was financially supported by a grant (grant number 162135) from the Regio Deal Foodvalley, a collaboration between the Dutch government and different regional governments, entrepreneurs, education- and knowledge institutions, including the Nutrition & Healthcare Alliance.

The sampling frame for both sub study 1 and sub study 2 included all intramural healthcare facilities in the Netherlands where health care receivers reside including hospitals and long-term care facilities (nursing homes, rehabilitation centres, institutions for people with intellectual disabilities and institutions for mental healthcare). Exclusion criteria were extramural healthcare facilities or polyclinical care institutions. Via the network of the Nutrition & Healthcare Alliance and several healthcare associations in the Netherlands, both convenience and purposive sampling were used to recruit hospitals and long-term care facilities. Then, via existing key-contacts or general email addresses of the organizations, participants for both sub study 1 and sub study 2 were invited when they were professionally engaged with the food environment within their healthcare organization (e.g., facility manager, dietitian, food service manager or similar). Participants in sub study 1 do not necessarily correspond with those in sub study 2. The emphasis during this study was on health and less on sustainability, however when following the national dietary guidelines the consumption pattern is generally also more sustainable.

Methods sub study 1

Design

Semi-structured interviews were conducted with staff of hospitals and long-term care facilities to assess four (physical, socio-cultural, political and economic) dimensions of the food environment.

Sample and participant characteristics

A total of 37 interviews were conducted with 46 participants, of which 29 individual interviews, 7 interviews with 2 participants and one interview with 3 participants. The interviewees represented 11 hospitals, 6 nursing homes, 6 rehabilitation centers, 5 institutions for people with intellectual disabilities and 9 mental healthcare institutions. General characteristics of the interview participants can be found in Table 1.

Procedure

Interviews were conducted between July 2021 and February 2022 and the majority was administered online (n = 31) via Microsoft Teams and a minority face-to-face (n = 6). Participants were invited via e-mail, received an information letter with explanation and purpose of the interview and all provided signed informed consent. The principle of saturation was applied for each type of healthcare institution to determine the sample size. The interviews with hospitals and institutions for intellectual disabilities were conducted by one author (JJW) (n = 16) and the interviews with nursing homes, mental healthcare institutions and rehabilitation centers were conducted by another author (ET) (n = 21). Interview duration ranged from roughly 40 to 90 min. Interviews were audio-recorded and were transcribed verbatim by one of the authors (ET) or by an external company (Transcript Online) and anonymized.

Interview guide

The interviews were semi-structured to allow room for emerging concepts. An interview guide was created for this study and pilot tested within one hospital and minor adjustments were made in e.g. the order of questions. The interview guide was used to obtain information regarding four dimensions of the food environment in hospitals and healthcare institutions, see Table 2 for a concise version of the interview guide with exemplary questions. The full interview guide (translated from Dutch to English) can be found in Supplementary file 1.

Table 1 Participant characteristics of sub-study 1 (qualitative semi-structured interviews)

Participant #	Representing hospital or long-term care setting	Gender	Function of participant	Individual, two or three participants during interview
P1	Hospital #1	Female	Head of hotel services	Individual (live)
P2	Hospital #2	Male	Team leader catering	Individual (online)
P3	Hospital #3	Female	Policy advisor food and beverages	Individual (live)
P4	Hospital #4	Male	Manager hotel services	Individual (online)
P5	Hospital #5	Female	Project leader catering and services	Individual (online)
P6	Hospital #6	Male	Catering coordinator	Two (live)
P7	Hospital #6	Female	Manager foodservice & hospitality	Two (live)
P8	Hospital #7	Female	Leader nutrition program	Individual (online)
P9	Hospital #8	Female	Facilities manager	Two (online)
P10	Hospital #8	Female	Head of dietitian department	Two (online)
P11	Hospital #9	Female	Head of nutrition department	Individual (online)
P12	Hospital #10	Male	Implementation coordinator inpatient catering	Three (online)
P13	Hospital #10	Female	Coordinator nutrition and quality	Three (online)
P14	Hospital #10	Male	Team leader staff catering	Three (online)
P15	Hospital #11	Female	Manager hotel services	Individual (online)
P16	Intellectual disabilities #1	Male	Hospitality manager	Individual (online)
P17	Intellectual disabilities #2	Female	Team leader client services	Individual (online)
P18	Intellectual disabilities #3	Female	Assistant living	Two (online)
P19	Intellectual disabilities #3	Female	Assistant living	Two (online)
P20	Intellectual disabilities #4	Male	Director	Individual (online)
P21	Intellectual disabilities #5	Female	Team leader specialistic long-term care	Two (online)
P22	Intellectual disabilities #5	Female	Care assistant	Two (online)
P23	Rehabilitation #1	Female	Head of residing services	Individual (online)
P24	Rehabilitation #2	Female	Manager housing, services and facilities	Individual (online)
P25	Rehabilitation #3	Male	Team manager business operations	Individual (online)
P26	Rehabilitation #4	Female	Facilities manager	Individual (online)
P27	Rehabilitation #5	Male	Nutrition manager	Individual (online)
P28	Rehabilitation #6	Female	Dietitian	Individual (online)
P29	Mental health #1	Male	Psychiatric nurse	Individual (online)
P30	Mental health #2	Female	Psychiatric nurse	Individual (online)
P31	Mental health #3	Male	Facilities manager	Individual (online)

Table 1 Participant characteristics of sub-study 1 (qualitative semi-structured interviews) (*continued*)

Participant #	Representing hospital or long-term care setting	Gender	Function of participant	Individual, two or three participants during interview
P32	Mental health #4	Female	Chef	Two (online)
P33	Mental health #4	Male	Chef	Two (online)
P34	Mental health #5	Male	Head of facility services	Two (live)
P35	Mental health #5	Male	Concierge	Two (live)
P36	Mental health #6	Male	Team leader food and beverages	Individual (online)
P37	Mental health #7	Female	Nurse	Individual (online)
P38	Mental health #8	Male	Coordinator services	Individual (online)
P39	Mental health #9	Female	Practice assistant	Two (live)
P40	Mental health #9	Female	Assistant living	Two (live)
P41	Nursing home #1	Female	Team manager food and beverages	Individual (online)
P42	Nursing home #2	Female	Manager transition facilities services	Individual (online)
P43	Nursing home #3	Female	Ad interim facilities manager	Individual (online)
P44	Nursing home #4	Male	Director	Individual (online)
P45	Nursing home #5	Male	Facilities manager	Individual (online)
P46	Nursing home #6	Female	Chef	Individual (live)

Table 2 Concise version interview guide with exemplary questions

Topics	Prompts
Physical dimension food environment: organization, facilities	How are the food and drinks organized, for health care receivers, staff and visitors? Which facilities are in place?
Social cultural dimension food environment: attitude, culture, modelling, empowerment	How do health care receivers, staff, management board in the healthcare organization think about healthy and sustainable food and drinks? What are the norms, values, traditions concerning healthy and sustainable food and drinks? Nutritional needs health care receivers per type of care. Exemplary and modelling role of organization and staff. Empowerment of health care receivers, staff, visitors and external parties, e.g. caterers.
Political dimension food environment: policy, rules, guidelines	Having a policy on food within the healthcare organization, or reason why not, content of the policy for health care receivers, visitors, staff, policy created by whom, specific content on healthy and sustainable food and drinks, use of guidelines, restrictions.
Economic dimension food environment: profit and loss, price, in-house/outsourced, promotion	Economic considerations to sell/buy food and drinks and differences per facility, promotion of food and drinks, price for food and drinks for health care receivers, visitors, staff

Data analysis

First, two authors (ET and JJW) read through two different transcripts independently, discussed impressions, built consensus and created a codebook. Starting with a deductive approach, including codes based on the interview guide, followed by an inductive approach as new codes emerged from the transcripts and were included in the coding frame. Second, two authors (ET and JJW) independently coded each half of all the transcripts with the codebook using ATLAS.ti Windows (Version 9.1). The codes were grouped into main themes by both authors (ET and JJW), the four dimensions of the food environment and the process of thematic analysis was used to report the results. The four dimensions of the food environment were explored in the light of the distinction between hospitals and long-term care facilities and among health care receivers, staff and visitors. The results were illustrated with quotes derived from the interviews and translated from Dutch to English.

Methods sub study 2

Design

Sub study 2 used a cross-sectional observational design, where staff of hospitals and long-term care facilities audited the food environment within their organization with a digital inventory checklist.

Recruitment and procedure

Stakeholders were invited via email to participate in sub study 2 between November 2021 and March 2022. These stakeholders received the purpose and explanation of the study and an online link for the checklist (using Qualtrics software (Qualtrics, Provo, UT). Reminder emails were sent twice. Participants had to give online informed consent to start the checklist. Participants were asked to audit the food environment of the main location of their hospital or long-term care facility. Participants had to complete the checklist online via a tablet or laptop so they could walk around in the hospital or long-term care facility (e.g., visit the restaurants, kitchen). It was instructed to only complete one checklist per institution during a weekday and peak time of that day, assuming that most of the available food items were displayed. It should be noted that only fully completed checklists are included in the analysis.

Participant and health care organization characteristics

Participants of 28 hospitals and 36 long-term care facilities responded to the checklist, including 7 nursing homes, 8 rehabilitation centers, 9 institutions for people with intellectual disabilities, 11 mental healthcare institutions and 1 institution was a combination

of a nursing home and rehabilitation center, as detailed in Table 3. The checklist was predominantly completed by facility staff in both hospitals (64.3%) and long-term care facilities (55.6%), followed in hospitals by policy, quality and management staff (25.0%) and in long-term care facilities by health workforce (22.2%).

Table 3 Characteristics of hospitals and long-term care facilities of sub-study 2 (quantitative checklist)

Total healthcare organizations (n = 64)	**n (%)**
Hospitals total	28 (100)
General	18 (64.3)
Specialized	1 (3.6)
Academic	6 (21.4)
Top-clinical	3 (10.7)
Long-term care facilities total	36 (100)
Mental healthcare institutions	11 (30.6)
Rehabilitation centers	8 (22.2)
For people with intellectual disabilities	9 (25.0)
Nursing homes	7 (19.4)
Combination of two or more	1 (2.8)
Capacity for # health care receivers	**Min-Max (Median)**
Hospitals	120–980 (405)
Long-term care facilities	4-658 (70)
Number of employees	
Hospitals	240-15550 (3050)
Long-term care facilities	5-2000 (150)
Function of respondent	**n (%)**
Hospitals	
Facility staff (e.g., manager food, head of hotel services, projectleader nutrition)	18 (64.3)
Health workforce (nurse, assistant, teammanager, lifestyle coach)	0 (0.0)
Dietitian	1 (3.6)
Policy, quality, management staff	7 (25.0)
Other (e.g. chef, intern, unknown)	2 (7.1)
Long-term care facilities	
Facility staff (e.g., manager food, head of hotel services, projectleader nutrition)	20 (55.6)
Health workforce (nurse, assistant, teammanager, lifestyle coach)	8 (22.2)
Dietitian	4 (11.1)
Policy, quality, management staff	1 (2.8)
Other (e.g. chef, intern, unknown)	3 (8.3)

Measures

In sub study 2 three dimensions of the food environment were assessed, the physical, political and economic dimension. The checklist audited these dimensions of the food environment via several sections: (1) general characteristics of the hospital or long-term care facility (including type of care, number of employees); (2) physical food environment characteristics (for example asking which type of food outlets were accessible, e.g. restaurant, vending machine, and which food products were served or sold); (3) political food environment characteristics (for example asking if there is a policy on food within the healthcare organization and if national dietary guidelines were applied) and 4) economic food environment characteristics (including asking the way food services and facilities were managed, in-house or outsourced with or without a profit motive). The checklist was partly inspired on the Hospital Nutrition Environment Scan for Cafeterias, Vending Machines and Gift Shops [21] and included inquiries about the food environment for health care receivers, staff and visitors. If more than one visitor- or staff restaurant was present, participants were asked to audit only the largest restaurant with the greatest variety of food and drinks available. The checklist was pilot tested by the first author (JJW) in consultation with a hospital dietitian. Based on this pilot, minor changes were made in the formulation of some food items. Due to expected variations in the food environment, the checklist for hospitals and long-term care facilities exhibited slight differences.

Data analysis

Descriptive statistics were used to outline general characteristics of the hospitals and long-term care facilities, and also to describe physical, political and economic characteristics of the food environment. Results were tabulated by healthcare setting type, hospital and long-term care facilities, and by food outlet type or inpatient food service. Analyses were conducted using IBM SPSS Statistics Version 28.0.

2.3 Results

Results of both sub study 1 and 2 will be discussed per dimension of the food environment.

Physical food environment

Semi-structured interviews indicated that in most hospitals and long-term care facilities, health care receivers were offered three meals a day, including breakfast, lunch and dinner, and a snack in-between meals. Preparation of meals for health care receivers varied between and within organizations from cook-chill- or freeze systems (rapid chilling or freezing of cooked food), regeneration (reheating food when serving) to freshly prepared (and immediately served) meals in kitchens or restaurants. Hospitals, and primarily the larger long-term care facilities used a central space for meal preparation and distribution. Pre-

dominantly, preprepared meals were delivered by external suppliers, assembled on trays and transported either to a smaller kitchen for final preparation or directly to the health care receivers. In hospitals and larger long-term care facilities, this was often done by qualified kitchen-, facility staff or nutrition assistants. Only a few long-term care facilities used an external supplier to deliver preprepared meals for their health care receivers. In smaller long-term care facilities food and drinks were often prepared in a kitchen per community room. These community-rooms served as household-like settings where health care providers or hostesses were responsible for cooking in addition to their caregiving duties.

All participants highlighted the importance of quality, taste and appearance of food and drinks, otherwise health care receivers, staff and visitors would not consume it. They argued specifically for health care receivers that eating anything at all is sometimes more important than eating something healthy. The majority of participants considered freshly cooked meals and fresh foods as the best option for their health care receivers as they were convinced that these are healthier and tastier. Moreover, freshly cooked meals elevate the ambiance in a healthcare setting and provides more opportunity for tailoring to individual preferences. Participants of a few healthcare institutions even mentioned that they had a garden to grow vegetables and fruit, where health care receivers gardened as daytime activity, '*They maintain the garden. It's super fun, you can use products from your own garden for dinner' (P17, team leader client services, institution for people with intellectual disabilities).* However, preparing and providing freshly cooked meals was not always feasible to do so. Participants pointed out various physical environment factors, such as the availability of facilities, logistical limitations, and the physical space of hospitals or long-term care facilities, which affected the range of methods used for their meals. For instance, a participant from a healthcare organization with multiple locations highlighted these influencing factors: *'In the larger locations we cook for 100% convenience meals, so only regenerating meals. But we also have locations where meals are freshly cooked for 100%.', (P16, hospitality manager, institution for people with intellectual disabilities)*.

Hospitals and long-term care facilities that have on-site restaurants accessible for health care receivers, generally offered a larger food assortment and provided more variety, thereby increasing options and freedom of choice compared to long-term care facilities operating as households, where often a single meal was prepared. Only a minority of the participants mentioned that the health care receivers independently purchased and prepared their own food and drinks, for example '*A large part of our health care receivers can walk outside and can visit a cafeteria and so on. It is not entirely in our hands.', (P38, coordinator services, mental healthcare institution)*. In hospitals staff often ate in the restaurant or canteen, buying something or bringing their own food and drinks from home. In long-term care facilities staff mostly ate together with health care receivers, sometimes as part of therapy. In hospitals and long-term care facilities the places where food and

drinks were sold were often targeted at visitors and visitors were occasionally allowed to eat together as relative of a health care receiver.

Participants noted recent developments to move towards making healthy and sustainable foods more accessible and available, particularly in some hospitals that were affiliated with the Nutrition & Healthcare Alliance and their program initiative to realize a healthy hospital food environment in the Netherlands. Both hospitals and long-term care facilities implemented several changes in their food offerings. These changes involved providing a greater variety of whole grain products and vegetarian options while reducing the frequency of serving soft drinks and fruit juices. Additionally, they minimized the availability of fried snacks and opted to offer snacking fruit as alternatives to sugary treats.

The results of sub study 2 showed that both hospitals and long-term care facilities reported presence of different food and drink facilities, for example an on-site restaurant accessible for everyone or a restaurant for staff only and/or a coffee-lunch corner. Restaurants for staff only were less often present at long-term care facilities (13.9%) compared to hospitals (64.3%). Also, a kiosk or small gift shop selling foods was present in most of the hospitals (89.3%) and less present in long-term care facilities (25.0%). Vending machines were almost only reported in hospitals, predominantly selling a combination of soft drinks and snacks (67.9%). Vending machines selling only healthy items were the second most common type of vending machines in hospitals (42.9%). Most of all hospitals (82.1%) and long-term care facilities (91.7%) had a kitchen to fully or partly prepare food for health care receivers, Table 4.

An overview of the food products offered in different food outlets in hospitals and long-term care facilities can be found in Supplementary file 2, Table 1. To illustrate, sugar-sweetened beverages and fruits were available in almost all food outlets in hospitals and long-term care facilities. Vegetables were offered less and plant-based beverages were present in less than half of the food outlets in hospitals and long-term care facilities. Fried snacks were offered most in hospitals with the highest percentages in restaurants for staff only (94.4%). In Table 2 of Supplementary file 2 food products offered via the food service for inpatients in hospitals and long-term care facilities can be found. All hospitals and long-term care facilities offer brown bread and whole meal bread for breakfast and lunch and white bread wass offered less. All hospitals offered fruit for breakfast and lunch. This was the case for 83.3% of the long-term care facilities. Vegetables were less often offered during breakfast and lunch (78.6% of the hospitals and 52.8% of the long-term care facilities). Long-term care facilities offered more unhealthy snacks like cake and pastries (47.2% vs. 28.6%) and fried snacks (47.2% vs. 25.0%) in-between meals. In hospitals fruits (96.4% vs. 88.9) and vegetables (64.3 vs. 41.7%) were more often available as a snack in between meals compared to long-term care facilities.

Table 4 Characteristics of the food environment dimensions assessed via the checklist in sub-study 2

	Total n (%) total n = 64	**Hospitals n (%) total n = 28**	**Long-term care facilities n (%) total n = 36**
PHYSICAL DIMENSION			
Type of on-site food and drink facility			
Restaurant accessible for everyone	47 (73.4)	26 (92.9)	21 (58.3)
Restaurant for staff only	23 (35.9)	18 (64.3)	5 (13.9)
Coffee-/lunch corner	36 (56.3)	22 (78.6)	14 (38.9)
Kiosk or small (gift) shop	34 (53.1)	25 (89.3)	9 (25.0)
Supermarket	7 (10.9)	2 (7.1)	5 (13.9)
Vending machines			
Snacks and soft drinks combined	20 (31.3)	19 (67.9)	1 (2.8)
Soft drinks	12 (18.8)	7 (25.0)	5 (13.9)
Snacks	5 (7.8)	4 (14.3)	1 (2.8)
Healthy items	13 (20.3)	12 (42.9)	1 (2.8)
On-site kitchen for health care receivers is present	56 (87.5)	23 (82.1)	33 (91.7)
The food for health care receivers is (partly) freshly cooked in on-site kitchen	37 (57.8), 10 (15.6) partly	15 (53.6)	22 (61.1), 10 (27.8) partly
POLITICAL DIMENSION			
Familiarity with national guidelines for healthy food environments (yes)	51 (79.7)	27 (96.4)	24 (66.7)
National guidelines for healthy food environments are (partly) applied for			
Staff facilities (yes)	47 (73.4)	25 (89.3)	22 (61.1)
Visitor facilities (yes)	40 (62.5)	23 (82.1)	17 (47.2)
Food and drinks for health care receivers is based on national dietary guidelines (yes)	47 (73.4)	20 (71.4)	27 (75.0)
Developed food vision is based on national dietary guidelines for (yes)			
Health care receivers	47 (73.4)	23 (82.1)	24 (66.7)
Staff	34 (53.1)	22 (78.6)	12 (33.3)
Visitors	29 (45.3)	20 (71.4)	9 (25.0)
Food policy documents are developed and administered by interdisciplinary team (yes)	36 (56.3)	21 (75.0)	15 (41.7)

Table 4 Characteristics of the food environment dimensions assessed via the checklist in sub-study 2 (*continued*)

	Total n (%) total n = 64	Hospitals n (%) total n = 28	Long-term care facilities n (%) total n = 36
ECONOMIC DIMENSION			
Restaurant for everyone accessible (health care receivers, staff, visitors)			
Yes, available	47 (73.4)	26 (92.9)	21 (58.3)
If yes, how is it managed?			
Outsourced	10 (21.3)	9 (34.6)	1 (4.8)
In-house, profit motive	12 (25.5)	9 (34.6)	3 (14.3)
In-house, no profit motive	22 (46.8)	7 (26.9)	15 (71.4)
Other	3 (6.4)	1 (3.8)	2 (9.5)
Restaurant only for staff			
Yes, available	23 (35.9)	18 (64.3)	5 (13.9)
If yes, how is it managed?			
Outsourced	2 (8.7)	2 (11.1)	0 (0.0)
In-house, profit motive	3 (13.0)	2 (11.1)	1 (20.0)
In-house, no profit motive	17 (73.9)	14 (77.8)	3 (60.0)
Other	1 (4.3)	0 (0.0)	1 (20.0)
Food-service for health care receivers			
Outsourced	5 (7.8)	3 (10.7)	2 (5.6)
In-house	56 (87.5)	25 (89.3)	31 (86.1)
Other	3 (4.7)	0 (0.0)	3 (8.3)

Socio-cultural food environment[1]

Interviews revealed that type of healthcare provided (e.g., short-term post-surgical care vs. long-term mental health care) shaped the socio-cultural food environment in healthcare settings. Participants representing hospitals highlighted that nutrition should contribute to recovery, pre-habilitation and prevention and that compliance to protein requirements was essential. This aligns with the viewpoints shared by participants representing rehabilitation centers, who further highlighted that nutrition and eating was frequently part of the health care receivers' treatment. Participants from institutions for people with intellectual disabilities emphasized the utmost importance to engage health care receivers in the entire meal preparation process. In mental healthcare, establishing a structured rhythm for eating moments was deemed crucial. Setting limits, including those related to caffeine consumption, was considered an essential aspect of this set-

1 The concepts of the socio-cultural dimension of the food environment seem to be illustrated at an individual level, however, during the interviews participants were asked to describe and reflect on a general tendency in their healthcare organization.

ting. In nursing homes, most important was that food and drinks were tasty to ensure that people would eat sufficiently, illustrated by: *'We believe it's important to establish an environment that encourages all residents to enjoy their meals. We pay especially attention to what they are accustomed to eat at home, and ensure that there are delicious options for everyone.', (P45, facility manager, nursing home).*

Cultural food practices not aligned with healthy eating were prevalent in both hospitals and long-term care facilities. For example, participants representing hospitals mentioned that health care receivers often used unhealthy food as a reward or to celebrate (un) favorable outcomes: '*Health care receivers tell us that it is nice to release tension with a cup of coffee and a sausage roll in the restaurant when they had an unpleasant doctor's appointment', (P10, head of dietitians' department, hospital).* Examples of similar practices were mentioned for staff, including the tradition of serving cake during birthday celebrations or offering fried snacks to commemorate a doctor's first surgery. Regarding the food provided to health care receivers, both hospitals and long-term care facilities were consistently willing to accommodate dietary requirements and respect cultural or religious preferences related to food and drinks.

Participants from hospitals emphasized their role as model for healthy eating. They expressed the desire to set an example for health care receivers, staff and visitors, and thereby promote healthy eating practices. Advocating this exemplary role was less advocated by participants from long-term care facilities. They described their exemplary role when eating together with the health care receivers and mainly mentioned that food should be tasty and appealing. Considering that health care receivers often stay for a longer period of time it is important that food and drinks cater to their preferences. Participants from hospitals and long-term care facilities all emphasized that the care and treatment of health care receivers always took precedence. However, they noted that food did not always have an explicit role in the care process, primarily due to a lack awareness regarding the added value of healthy food in healthcare.

While it emerged from the interviews that nutrition became increasingly important within the healthcare setting, participants highlighted that health care receivers, staff and visitors do not wish to be patronized when it comes to healthy eating. To illustrate, participants mentioned that staff and visitors in hospitals showed resistance when their preferred foods were no longer available. However, health care receivers seemed to take changes more for granted. Participants indicated that most important was to stimulate healthy eating by empowering health care receivers, staff and visitors and make it more attractive instead of to discourage unhealthy eating. One participant voiced a contrasting view, suggesting that the temptation of unhealthy foods should be entirely eliminated

and not be served or sold, illustrated by: '*Just stop tempting. Then you will see that people make different choices. It's that simple', (P4, manager hotel services, hospital)*.

Political food environment

Outcomes of the semi-structured interviews showed that all hospitals and most of the other long-term care facilities had a written document consisting of rules, goals and values concerning the food provision in the organization, often referred to as a food policy, a food vision or annual plan. Terms were interchangeably used and in this article we will refer to 'food policy' as term for these different designations.

During the interviews participants indicated that the support from the director- or management level for the food policy played a pivotal role in the success of both the implementation phase of food policies and in already established food policies improving food provision. Such support significantly increased the value placed on healthy eating within the organization. In addition, participants explained that a clear food policy document for the entire hospital or long-term care facility is particularly helpful in providing guidance in realizing and regulating a healthy and sustainable food environment. According to most participants, having a food policy is crucial, but its successful implementation and receiving broad organizational support were equally important for the policy to operate effectively. Participants recognized that fostering support for the food policy throughout the entire organization was a continuing process. In addition, almost all participants working at hospitals and long-term care facilities stated that the success of the implementation depends on individuals who put it into practice: *'It shouldn't be something top-down, the staff must be our ambassadors and transfer knowledge and skills', (P6, catering coordinator, hospital)*. For example, while most of the hospitals and long-term care facilities actively communicated their food policy to staff and explained 'the why', a minority stretched the opposite and argued that implementing a food policy without publicity helped avoiding resistance. Finally, the majority of participants representing the larger long-term care facilities mentioned that each location is unique and has the freedom to adapt and implement the food policy to suit its specific needs.

In the development of food policies, the majority of participants mentioned that they adopted an interdisciplinary approach, aiming to gain support across all layers of the organization and representing all disciplines involved. Current available food policy documents were written with the nutrition of health care receivers being the core aim. Although staff and visitors were often not explicitly mentioned as a target group for nutrition policy, they were implicitly assumed to benefit from it, illustrated by *'It [the vision/ policy] applies to everyone who eats and drinks in house', (P11, head of nutrition, hospital)*. Only a few participants of long-term care facilities mentioned not having a food policy because of conditions such as lack of priority in the organization, a high workload, or the

deliberate decision to avoid a generic food policy to be able to fully customize the food for each health care receiver.

The content of the food policy document was predominantly centralized around the positive influence healthy food has on prevention, wellbeing, treatment, pre-habilitation and enhanced recovery of health care receivers. Illustrated by: *'The policy is only two sheets of paper, it is very short, it is used as a point of departure and if I summarize it, the food policy states that food and drinks [provided by the hospital] should have a positive effect on the wellbeing of health care receivers and a positive contribution to treatment and recovery…', (P3, policy advisor food and drinks, hospital).* Most of the hospitals and long-term care facilities referred to the 'Wheel of Five', a translation of the national dietary guidelines, as a basis for their food policy. However, it was also acknowledged that these guidelines not always suffice as these are designed for healthy people and sometimes adaptations were needed to meet specific needs of health care receivers. For example, the majority of the participants representing hospitals specifically mentioned that their food policy marked the importance of sufficient provision of proteins. This was distinctive from long-term care facilities where participants highlighted the importance of hospitality and meal ambiance in their food policies. Sustainable foods were often not explicitly mentioned in the existing documents and most participants emphasized that sustainability was predominantly embedded in their policies with respect to food waste or use of medical supplies.

Results from the checklist indicated that participants of almost all hospitals reported to be aware of the guidelines for food environments of the Netherlands Nutrition Centre (96.4%) and (partly) applied the guidelines in their hospital for staff (89.3%) and visitors (82.1%), as shown in Table 4. A lower percentage of participants of long-term care facilities reported to be aware of these guidelines (66.7%) and these were even less often applied in their organization for staff (61.1%) or visitors (47.2%). A total of 71.4% of the hospitals and 75.0% of health care organizations based the food provision for health care receivers on the Dutch dietary guidelines. In the majority of hospitals policy documents were developed and administered by an interdisciplinary team (75.0%), compared to less than half of the long-term care facilities (41.7%).

Economic food environment

Based on the interviews, food services or facilities were managed either in-house or outsourced to external parties. Often, both forms were present under the same roof in a hospital or long-term care facility (e.g., there might be an outsourced visitors' restaurant and a staff canteen managed in-house). For in-house food services, there was often no profit motive and the only goal was to break even. Such in-house services provided more space and freedom to hospitals and long-term care facilities to shift the assortment towards

healthy foods. When outsourcing food services or facilities, participants mentioned that they had to deal with commercial interests and experienced less flexibility and autonomy in determining the types and prices of food offered. Illustrated by a participant: '*If you work with a caterer, the caterer must make profit. These external parties have a commercial interest, otherwise they don't exist.*', *(A1, head of hotel services, hospital)*. Moreover, external parties are driven by profit motives and participants mentioned that most of the profit was primarily generated from the sale of unhealthy products. While participants indicated that little to no promotional offers or discounts were in place in hospitals or long-term care facilities, only one participant of a hospital specifically mentioned that an agreement was made with their external party to prohibit marketing for unhealthy food and added: '*And if we do something, we ensure it is a promotion for a product we support in the context of health*.', *(P9, facility manager, hospital)*.

Participants indicated that external parties, such as caterers, play a major role in shaping the food environment, and their involvement is often tied to long-term contracts. Consequently, they find themselves dependent on the possibilities and goodwill provided by these external parties in their transition towards a healthy and sustainable food environment. To keep control, participants used procurement policies as an opportunity to incorporate healthy and sustainable food and drinks into contracts (e.g., using criteria based on national dietary guidelines for foods and beverages sold or served). Illustrated by a participant of a hospital: '*We said during the procurement process, that the food concept should lead to faster recovery of health care receivers, so we included that as a key performance indicator', (P4, manager hotel services, hospital)*. To keep flexibility, others used open-book contracts (based on actual costs, with more transparency) or best value procurement policies.

Participants mentioned that budget was an important factor in determining the foods provided for health care receivers. Hospitals and long-term care facilities usually received a fixed daily or yearly food-budget that can be used for food provision in care settings. Participants mentioned that the budget was most often enough, though sometimes challenging to provide healthy and sustainable meals. Participants' estimation of the budgets fluctuated between seven to fifteen euros per day, *'Of this amount, everything should be bought - coffee, breakfast, lunch and dinner. That's quite challenging.', (P16, hospitality manager, institution for people with intellectual disabilities)*. Participants calculations differed, as some hospitals and long-term care facilities only take the ingredient costs into account, while others also include cleaning- and staff costs. Also in budgeting processes, healthy food provision often lacked priority and was commonly included as final balance item. Some participants mentioned that it was important to add a (positive) business case to the policy.

Based on the checklist in sub study 2 (Table 4), respondents of long-term care facilities reported more in-house management of restaurants for everyone accessible with no profit motive (71.4%) compared to hospitals (26.9%), where management of restaurants for everyone accessible was more outsourced or in-house with profit motive. Management of restaurants for staff was reported more in-house with no profit motive. Food for health care receivers was predominantly managed in-house for both hospitals (89.3%) and long-term care facilities (86.1%).

2.4 Discussion

This study gained a comprehensive characterization of the food environment in hospitals and long-term care facilities. Substantial disparities in the different dimensions of the food environment between hospitals and long-term care facilities were observed. The physical dimension of the food environment in the healthcare setting is shaped by various factors, such as availability of facilities, logistic limitations and physical space. Hospitals adopt a more organized and structured method in managing the food environment for health care receivers. In contrast, long-term care facilities often exhibit a more individual-oriented approach and create an adaptable 'homely' food environment, tailored to individual requirements of health care receivers. The type of healthcare provided plays a decisive role in shaping the socio-cultural food environment and aligns with the needs of the residing target group. Hospitals place a more prominent focus on health in shaping their food environments and their main focus is to use nutrition for fast recovery, while long-term care facilities also used nutrition as an instrument, for example to structure the day. For the political dimension participants highlight the importance of food policies and broad organizational support for a transition of the food environment. Commercial interests, profit motives, contracts with external parties and strict budgets characterized the economic food environment. Despite the crucial role in fostering supportive food environments for everyone, both hospitals and long-term care facilities indicated that there was a limited focus on staff and visitors.

Given population ageing, it is expected that an increasing number of individuals will depend on healthcare services in the future, thereby also increasing the demand for extra healthcare workers [1, 22]. Therefore, it is crucial to invest in healthy and sustainable food environments for the future (e.g. adopting healthy food environment guidelines, procurement policies, adapted to the healthcare setting). This becomes even more significant within long-term care facilities, given that health care receivers often stay there for a prolonged period of time, which provides an opportunity to harness the potential of nutrition in promoting health and wellbeing. Long-term care facilities can learn from hospitals by adopting a similar emphasis on health when shaping their food

environments. On the other hand, hospitals can draw valuable lessons from long-term care facilities, going beyond mere nutritional values, employing nutrition as tool, such as for structuring daily routines or for functional recovery. The differences in the food environment of hospitals and long-term care facilities as disclosed in this study should be taken into account when designing and implementing actions for realizing healthy food environments. Particularly, actions should be made distinctive and suitable for different healthcare settings.

Our findings regarding prevailing socio-cultural norms and beliefs about food may hinder the transition towards a healthy food environment, as it was observed that health care receivers, visitors and staff do not wish to be patronized when it comes to healthy eating; their preference is stimulating healthy eating rather than discouraging unhealthy eating. This reflects the long-standing perspective within the healthcare system favoring health *promotion* over health *protection* [23]. Moreover, they align with prevailing, neoliberal, societal norms that food choices are an individual responsibility and people should have a freedom of choice [24]. Such norms and beliefs are very powerful in shaping food environments and may affect resistance for change, especially if they are held by individuals in positions of power as they play a decisive role in shaping food environments of healthcare organizations [25]. The latter was also observed by prior studies, as those operating at the management level possess the capacity to influence the culture in the organization through budget allocations or support from external stakeholders [26, 27]. In recent years, there has been a noticeable change in the support for transitioning towards healthy food environments of healthcare boards and doctors in the Netherlands, exemplified by the developments such as the emergence of lifestyle medicine, and the Nutrition and Health Care Alliance. In the upcoming years, a more drastic shift is essential as highlighted the results of the current study.

While discussed separately, this study showed that factors within and between the four dimensions of the food environment were inherently interconnected, thereby influencing each other. The social-cultural dimension of the healthcare food environment often affected the political dimension, which, in turn, was often dependent on the economic dimension. Collectively, these three dimensions shaped the physical food environment in healthcare settings. To illustrate, support from director- or management levels helped to implement policy and to have support from the entire organization for improvement of the food environment. This interrelation of determinants of the healthcare food environment has also been observed in previous studies. For example Cranney et al. [26] found that to realize healthy hospital retail food environments, policy effectiveness and broad acceptance of the policy premise were some of the key mechanisms to achieve change. Others indicated that implementing healthy and sustainable food procurement policies can help to improve the healthiness and sustainability of the physical food environment

[28, 29]. Collectively, these insights indicate that the dimensions of the food environment cannot be viewed in isolation and instead should be seen and studied as a system with factors and mechanisms around these four dimensions. Future research may use a systems approach to gain better understanding of this interconnectedness and underlying dynamics of the healthcare food environment, which has already been adopted for the wider food environment of particular settings (e.g., retail, neighborhood) [30,31,32].

A strength of this study includes the mixed methods approach to gain insight into a comprehensive picture of the food environment. Another strength is the large diversity of hospitals and long-term care facilities included as well as the focus on all relevant target groups including health care receivers, staff and visitors. This study also has some limitations. First, (in the majority of the interviews) only one representative of each healthcare setting was interviewed and may not be representative for the viewpoints of all stakeholders of that hospital or long-term care facility. The food environment checklist was also filled in by a single staff member and for example in larger long-term care facilities the checklist was sometimes filled in for and by multiple (different) locations (e.g. daycare centers). More objective insights could have been obtained by auditing the healthcare food environments by an independent person, not related to the hospital or long-term care facility, at multiple unannounced moments or by assessing the purchase orders of the healthcare food environments. Second, quantitative data was collected at a single point, not reflecting the variability over time. Third, most of the participating hospitals were part of the Nutrition & Healthcare Alliance. This should be taken into account as this may have resulted in an overestimation of the healthiness of food environments compared to the majority of hospitals not involved with the Alliance. And last, data were collected during the COVID-19 pandemic that may have caused that the food environment differed from a normal situation. It is not expected that it affected the study because participants were asked to reason from a normal situation during interviews.

This study gives first insights where there is room for improvement in the different domains of the food environment. Recommendation for future research is to explore how to accomplish a transition of the food environment in the healthcare setting towards a healthy and sustainable food environment, incorporating different types of care. A possible way to achieve this is to study the food environment in the healthcare setting as a complex environment, using systems thinking and understand the factors and mechanisms of the physical, socio-cultural, political and economic dimensions altogether. Another future research priority might be to study what facilitates a cultural shift in beliefs and norms within the entire healthcare setting to let health care receivers, staff and visitors see the importance of healthy and sustainable eating. Establishing these beliefs and norms is needed to create support for changing the food environment and overcome resistance. Although our study originally aimed to also explore sustainability consider-

ations in the food environment in hospitals and long-term care facilities, participants almost exclusively emphasized health considerations. This might suggest that in the healthcare setting there is less awareness of the role of food environments in planetary health but also that the health context may implicitly evoke healthy associations more than sustainability ones. Future studies may explicitly study sustainability aspects, as attaining sustainability alongside health remains vital for transition of the healthcare food environment.

2.5 Conclusions

This study characterized the food environment in Dutch healthcare settings, and disclosed several differences between hospitals and long-term care facilities in healthiness of the food environment. For instance, whereas hospitals emphasized nutrition for fast recovery, long-term care facilities more often approached food and eating as an instrument, i.e. to structure the day. Also it was found that hospitals are currently making positive adjustments to the food environment, such as offering whole grain breads and minimizing the availability of fried snacks. Less progress was observed in long-term care facilities. Also similarities were found. For instance, both hospitals and long term-care facilities highlighted the crucial role of having a food policy and broad organizational support for food policy. For both healthcare types, commercial interests and strict budgets were identified as important factors to recognize when improving food environments. However, food services managed in-house, without profit motive, provided often more opportunities and freedom to shift the assortment towards healthier foods. To facilitate a transition towards a healthy food environment in the entire Dutch healthcare landscape, it is imperative to incorporate all healthcare settings into designing approaches for implementation of improvements. Moreover, it is important to extend the focus beyond health care receivers and encompass the food environment for staff and visitors, and attain sustainability alongside healthiness of healthcare food environments.

References Chapter 2

1. Stanaway JD, Afshin A, Gakidou E, Lim SS, Abate D, Abate KH, et al. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the global burden of Disease Study 2017. The Lancet. 2018;392(10159):1923–94.
2. Peters R, Ee N, Peters J, Beckett N, Booth A, Rockwood K, et al. Common risk factors for major noncommunicable Disease, a systematic overview of reviews and commentary: the implied potential for targeted risk reduction. Ther Adv Chronic Dis. 2019;10:204062231988039.
3. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: shaped by global drivers and local environments. The Lancet. 2011;378(9793):804–14.
4. Food and Agriculture Organization of the United Nations (FAO). Influencing Food Environments for Healthy Diets [Internet]. 2016. Available from: https://www.fao.org/3/a-i6484e.pdf.
5. Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: the Development and Application of a Framework for identifying and prioritizing environmental interventions for obesity. Prev Med (Baltim). 1999;29(6):563–70.
6. Swinburn B, Sacks G, Vandevijvere S, Kumanyika S, Lobstein T, Neal B, et al. INFORMAS (International Network for Food and Obesity/non-communicable Diseases Research, Monitoring and Action Support): overview and key principles. Obes Rev. 2013;14(S1):1–12.
7. Winston CP, Sallis JF, Swartz MD, Hoelscher DM, Peskin MF. Consumer Nutrition Environments of Hospitals: an exploratory analysis using the Hospital Nutrition Environment scan for Cafeterias, Vending machines, and gift shops, 2012. Prev Chronic Dis. 2013;10(7):120335.
8. Richardson S, McSweeney L, Spence S. Availability of Healthy Food and Beverages in Hospital Outlets and interventions in the UK and USA to improve the Hospital Food Environment: a systematic narrative literature review. Nutrients. 2022;14(8):1566.
9. Horton Dias CE, Dawson RM, Harris DM, Wirth MD, Abshire DA. Foods and beverages available to nurses in Hospital cafeterias, Vending machines, and gift shops. Am J Health Promotion. 2022;36(7):1133–41.
10. Champ CE, Iarrobino NA, Haskins CP. Hospitals lead by poor example: an assessment of snacks, soda, and junk food availability in Veterans affairs hospitals. Nutrition. 2019;60:70–3.
11. José MER, de Castro IRR, Canella DS. Evaluation of the food environment of public hospitals in a Brazilian metropolis. Public Health Nutr. 2021;24(18):6477–87.
12. Cuschieri S, Cauchi D. Do we practice what we preach? Assessing the food environment in Malta's only state hospital. Eur J Public Health. 2019;29(Supplement_4).
13. Allan JL, Duthie S, Heddle M, McKenzie F, Webb S, Johnston M. Healthy snacks in hospitals: testing the potential effects of changes in availability. Nutr Health. 2021;27(3):321–7.
14. Thibault R, Abbasoglu O, Ioannou E, Meija L, Ottens-Oussoren K, Pichard C, et al. ESPEN guideline on hospital nutrition. Clin Nutr. 2021;40(12):5684–709.
15. Ministry of Health Welfare and Sport. The National Prevention Agreement. A healthier Netherlands [Internet]. 2019. Available from: https://www.government.nl/documents/reports/2019/06/30/the-national-prevention-agreement.
16. Pot GK, Winkels RM, van Loenhout T. Letter to the editor: an omission in guidelines. Cardiovascular Disease prevention should also focus on dietary policies for healthcare facilities. Clin Nutr. 2023;42(7):1240–2.
17. Horton Dias C, Dawson RM. Hospital and Shift Work influences on nurses' dietary behaviors: a qualitative study. Workplace Health Saf. 2020;68(8):374–83.

18. Utter J, McCray S, Denny S. Work site food purchases among healthcare staff: relationship with healthy eating and opportunities for intervention. Nutr Dietetics. 2022;79(2):265–71.
19. McSweeney L, Spence S, Anderson J, Wrieden W, Haighton C. Parental perceptions of onsite hospital food outlets in a large hospital in the North East of England: a qualitative interview study. PLoS ONE. 2018;13(11):e0205416.
20. Lederer A, Toner C, Krepp EM, Curtis CJ. Understanding hospital cafeterias: results from cafeteria manager interviews. J Public Health Manage Pract. 2014;20(SUPPL.1).
21. Derrick JW, Bellini SG, Spelman J. Using the Hospital Nutrition Environment Scan To Evaluate Health Initiative in Hospital Cafeterias. J Acad Nutr Diet. 2015;115(11):1855–60.
22. GBD 2019 Ageing Collaborators. Global, regional, and national burden of Diseases and injuries for adults 70 years and older: systematic analysis for the global burden of Disease 2019 study. BMJ. 2022;e068208.
23. Hagenaars L, Waterlander W, den Hertog K, Stronks K. Een Veerkrachtige publieke gezondheid in 2030. #hoedan? TSG. 2022;100(S3):119–23.
24. Gilmore AB, Fabbri A, Baum F, Bertscher A, Bondy K, Chang HJ, et al. Defining and conceptualising the commercial determinants of health. The Lancet. 2023;401(10383):1194–213.
25. Nobles JD, Radley D, Mytton OT. The Action scales Model: a conceptual tool to identify key points for action within complex adaptive systems. Perspect Public Health. 2022;142(6):328–37.
26. Cranney L, Thomas M, O'Connell T, Moreton R, Corbett L, Bauman A, et al. Creating healthy hospital retail food environments: multiple pathways to successful at scale policy implementation in Australia. J Health Serv Res Policy. 2023;28(2):100–8.
27. Laur C, McCullough J, Davidson B, Keller H. Becoming Food Aware in Hospital: a narrative review to Advance the Culture of Nutrition Care in hospitals. Healthcare. 2015;3(2):393–407.
28. World Health Organization. Action framework for developing and implementing public food procurement and service policies for a healthy diet. Geneva; 2021.
29. Carino S, Porter J, Malekpour S, Collins J. Environmental Sustainability of Hospital Foodservices across the Food Supply Chain: a systematic review. J Acad Nutr Diet. 2020;120(5):825–73.
30. Sawyer ADM, van Lenthe F, Kamphuis CBM, Terragni L, Roos G, Poelman MP, et al. Dynamics of the complex food environment underlying dietary intake in low-income groups: a systems map of associations extracted from a systematic umbrella literature review. Int J Behav Nutr Phys Activity. 2021;18(1):1–21.
31. Mui Y, Ballard E, Lopatin E, Thornton RLJ, Pollack Porter KM, Gittelsohn J. A community-based system dynamics approach suggests solutions for improving healthy food access in a low-income urban environment. PLoS ONE. 2019;14(5):e0216985.
32. Wopereis TM, Dijkstra SC, Wierda JJ, Rongen FC, Poelman MP. Systems thinking for local food environments: a participatory approach identifying leverage points and actions for healthy and sustainable transformations. Health Res Policy Sys 22, 101 (2024).
33. World Medical Association. World Medical Association Declaration of Helsinki. JAMA. 2013;310(20):2191.

CHAPTER

3

Identifying mechanisms that shape the food environment in long-term healthcare facilities in the Netherlands: a participatory system dynamics approach

Authors:
Joline J. Wierda, S. Coosje Dijkstra, Tamika M. Wopereis, Sanne K. Djojosoeparto & Maartje P. Poelman

Published as:
Wierda, J. J., Dijkstra, S. C., Wopereis, T. M., Djojosoeparto, S. K., & Poelman, M. P. (2025). Identifying mechanisms that shape the food environment in long-term healthcare facilities in the Netherlands: a participatory system dynamics approach. *BMC Public Health*, *25*(1), 372.

https://doi.org/10.1186/s12889-024-21124-1

Abstract

Background: Creating healthy and sustainable food environments within long-term healthcare facilities asks for a systemic approach. This study aimed to: (1) identify system dynamics underlying the food environment of long-term healthcare facilities, (2) formulate actions for changing the system to promote a healthy and sustainable food environment and (3) evaluate stakeholder perspectives about the process and progress towards action implementation up to one-year follow-up.

Methods: A group model building (GMB) approach was used during two workshops with stakeholders of five different long-term healthcare facilities in the Netherlands. Stakeholders created a causal loop diagram (CLD) and formulated actions for change. Interviews were conducted at six- and twelve months to evaluate perspectives on the GMB process and progress towards action implementation.

Results: The developed CLD consisted of 30 factors influencing the food environment in long-term healthcare facilities and four interrelated subsystems (patient; healthcare organization; national governance and policy; purchasing, procurement and budget). Stakeholders formulated 40 corresponding actions. After one year follow-up, small steps towards action implementation were observed (e.g., agenda setting, raising internal awareness, formulating plans), with several barriers hindering implementation being noted (e.g., lack of time, budget, priority).

Conclusions: This study gained a comprehensive, collectively acknowledged understanding of the system dynamics underlying the food environment in Dutch long-term healthcare institutions. The results underscore the importance of crafting a coherent set of actions that addresses various factors and underlying mechanisms to initiate systemic change. However, achieving actual system changes in long-term healthcare facilities requires prolonged efforts and overcoming barriers towards implementation.

3.1 Background

Long-term healthcare facilities are institutional healthcare settings where people reside to receive care and support for an extended period. Given that often vulnerable people reside in this setting, optimizing nutrition plays a pivotal role in promoting health, including the prevention of malnutrition and diseases and appropriate healing and recovery from illness [1, 2]. As such, these healthcare settings can play an exemplary role in stimulating healthy and sustainable food choices. Food choices are largely influenced by the food environment [3,4,5]. The food environment can be defined as the "collective physical, economic, policy, and sociocultural surroundings, opportunities, and conditions that influence people's food and beverage choices and nutritional status" [6]. Current healthcare food environments are not supportive of healthy food choices [7]. To contribute to the optimization of nutrition in long-term care facilities, from now on indicated as *healthcare institutions*, it is essential to create supportive food environments that contribute to the optimization of nutrition.

Prior research showed that patients in healthcare institutions often eat together in household settings, where it is important that food is tasty and appealing [7]. Food is often used as an instrument and is not only serving a nutritional role, but also a cultural role and is tied to social relationships. To illustrate, a study in Dutch nursing homes found that staff did not want to patronize patients and used food as a way to pamper patients, e.g. by offering unhealthy extra snacks [8]. The importance of a healthy food environment in healthcare settings is evident, however, translating this into effective practice remains a challenge and asks for a systemic approach. At this time, little is known about strategies and interventions to improve food environments in healthcare institutions. Prior research predominantly focused on isolated aspects of the healthcare food environment, for example by evaluating the effect of improving the food assortment of healthcare restaurants, shops or vending machines [9,10,11]. While these interventions show positive, but small effects of improving such aspects of the food environment, there remains a limited understanding of strategies that could improve the broader food environment in the entire healthcare institution. To create interventions with enduring structural and broad-reaching effects, it is vital to gain a comprehensive understanding of the food environment within healthcare institutions, encompassing interactions among factors, feedback loops, and underlying mechanisms.

Elements of systems thinking [12,13,14,15], could be a valuable strategy for gaining a comprehensive understanding on how to improve the food environment in healthcare institutions. In fact, the food environment in healthcare institutions can be described as a complex adaptive system with a variety of contexts, stakeholders, and interests and multiple dynamic relationships between them. It consists of a web of interconnected factors

and subsystems that affect what is offered and consumed, and where these components also influence each other in a non-linear way and adapt unpredictably over time [16]. Systems thinking gives insights (and acknowledges and addresses) into this complexity and allows to identify places in the system that can be shifted to transform the system [17]. These places can consist of points of intervention that may not be immediately visible when discussing the healthy food environment.

Several methods exist to employ systems thinking [18, 19]. Group model building (GMB) [20] is one of them and is a widely used participatory approach, facilitating collective understanding of complex systems and its dynamics while engaging stakeholders and integrating stakeholders' perspectives. The GMB process discloses the causal structures of a complex system, increases the development of systems solutions and identifies leverage points and actions for change. GMB is a method that has recently been used in public health research but only few evaluations have been conducted until the action implementation stage, and almost none were long-term evaluations [21]. Several studies used GMB to engage participants in systems thinking for improvement of the food environment in different contexts, for example for increasing fruit and vegetable intake in children [22], for recognizing the system driving unhealthy eating [23], or to improve an urban neighborhood food system [24]. To the best of our knowledge, there are no studies that used a GMB approach to improve the food environment in healthcare institutions.

The aims of this study were threefold. First, we aim to identify the system dynamics underlying the food environment of healthcare institutions and to formulate systems actions to create a healthy and sustainable food environment. Second, we aim to evaluate stakeholder perspectives about the systems process and third, we aim to evaluate the progress towards implementing the actions up to one-year follow-up. The outcomes of this study will give an understanding of the complex system that shapes the food environment in Dutch healthcare institutions and actions that could lead to a system that promotes healthy and sustainable food choices in healthcare institutions.

3.2 Methods

Context

The study was part of 'the Regio Deal Foodvalley', a long-term collaboration between the Dutch national government and parties from the region aimed at accelerating the transition towards a healthy and sustainable food system. These parties included different regional governments, entrepreneurs, education- and knowledge institutions, including the Nutrition & Healthcare Alliance, a national expertise centre that aims to realize

health benefits by applying scientific findings on nutrition and exercise in prevention and healthcare [25]. The participating healthcare institutions were situated in the Foodvalley region and were also embedded in the network and knowledge of the Nutrition & Healthcare Alliance to help them implement the actions to improve their food environment.

Design

This qualitative study used a group model building (GMB) approach. GMB is a qualitative participatory method and a form of action research [20], that engages a group of stakeholders to think in systems and to create a shared understanding of complex issues, a shared involvement of participants and to develop different actions for system change. In this study, GMB was used to gain insight into factors, their connections and underlying mechanisms that shape the food environment of healthcare institutions, and to identify actions at different system levels that could lead to a system that promotes a healthy and sustainable food environment for patients, visitors and staff. In this study, the term patients will henceforth refer to patients, as well as clients and other health care receivers. The practical contribution of the GMB to the workshop structure lies in its ability to enhance engagement and collaborative understanding of complex systems among participants. This was done by the use of standardized GMB scripts that structured the workshop in a particular order and provided concrete activities. These activities are detailed in the scripts in Supplementary file 1 [27].

Healthcare institutions engaged in a one-year study trajectory in the Netherlands which included: two GMB sessions in Wageningen, in May and June 2022 and a questionnaire after both sessions to evaluate the perspectives on the GMB process, two contact moments to stimulate implementation of action (an action implementation meeting (Sep-Dec 2022) and a webinar (Feb 2023) and a closing session in Ede, in May 2023 (see Fig. 1). Two semi-structured follow-up interviews per healthcare institution at six (T1) and twelve months (T2) evaluated the perspectives of the stakeholders on the GMB process and progress towards implementation of actions. A co-creative inquiry using a large qualitative time-line during the closing session at the end of the one-year trajectory identified the implementation progress and additional needs for future improvements to realize a transition of the food environment in healthcare institutions [26, 28]. Ethical approval (ethical approval number: 2021-38-Wierda) was obtained from the Social Sciences Ethics Committee of Wageningen University & Research.

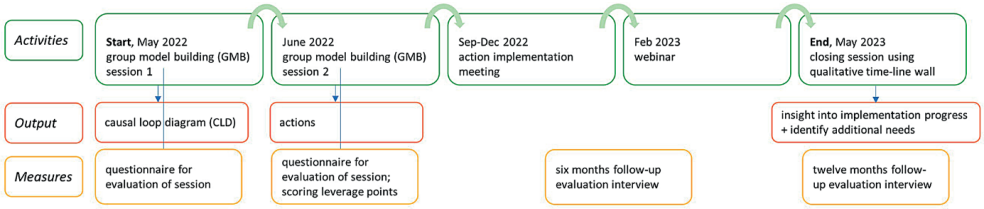


Fig. 1 One-year study trajectory: activities for participating healthcare institutions, outputs and measures

Recruitment and participant characteristics

With support of the Nutrition & Healthcare Alliance in the Netherlands, the first author (JJW) approached nine healthcare institutions, of which five agreed to participate in the one-year study trajectory, including a rehabilitation centre, two nursing homes, a mental healthcare institution and an institution for people with intellectual disabilities. Healthcare institutions were approached via e-mail and telephone and asked for a main contact person, preferably in a management function, who was professionally engaged with the food environment of their healthcare institution. Then, an introduction meeting between the first author and the main contact person was scheduled to explain the terms of the study and to officially invite them to participate. To recruit a variety of participants for the GMB sessions, we asked the main contact person to engage and invite a minimum of two and maximum of five stakeholders (i.e. nurses, facility managers, dietitians) representing their healthcare institution and who were professionally engaged with the food environment. Healthcare institutions could request a financial compensation (fifty euros per hour per participant) for participation during the sessions. For the interviews at six and twelve months, only the main contact persons were invited. Because of time constraints only the main contact persons were invited, as interviewing everyone was not feasible. We also expected that the main contact persons would also represent the other study participants, and would have a good overview of the organizational changes. Characteristics of the participants for each part of the study can be found in Table 1. All participants agreed to participate by signing an informed consent form.

Study activities

GMB session 1

The aim of the first GMB session (3,5 h) was to create a causal loop diagram (CLD), to identify and illustrate the system that promotes a healthy and sustainable food environment in healthcare institutions by identifying factors, connections and mechanisms that influence the system. Factors that were direct components of the food environment (e.g. food availability) were excluded from the CLD. The research team guided participants through

Table 1 Participant characteristics and attendance during sessions and interviews

P#	**Representative of healthcare institution type**	**Function**	**Male (M) or female (F)**	**Attended GMB[a] session 1** Total *n* = 10	**Attended GMB[a] session 2** Total *n* = 9	**Six months interview (T1)** Total *n* = 5	**Twelve months interview (T2)** Total *n* = 5	**Attended closing session** Total *n* = 9
P1	Nursing home A	Dietitian	F	V	V	V	V	V
P2	Nursing home A	Dietitian *(changed job after session 2)*	F		V			
P3	Nursing home A	Location manager rehabilitation	F					V
P4	Nursing home A	Care staff						V
P5	Nursing home A	Project employee quality, policy and innovation	F					V
P6	Rehabilitation centre A	Team leader services	M	V	V	V	V	V
P7	Rehabilitation centre A	Nurse	F	V				
P8	Rehabilitation centre A	Manager services	M					V
P9	Rehabilitation centre A	Facilities manager	F					V
P10	Intellectual disabilities A	Location manager	F	V	V		V	
P11	Intellectual disabilities A	Health scientist & dietitian	F	V		V		
P12	Intellectual disabilities A	Dietitian	F		V			
P13	Intellectual disabilities A	Policy officer	F					V
P14	Nursing home B	Dietitian	F	V	V	V	V	
P15	Nursing home B	Dietitian	F	V	V			
P16	Nursing home B	Facilities specialist	M					V
P17	Mental health care A	Nutrition coordinator	F	V	V			
P18	Mental health care A	Nutrition coordinator	M	V	V			
P19	Mental health care A	Manager facilities	M	V[b]		V	V	

[a] GMB = group model building

[b] Attended only the first hour

different activities during the sessions, that were derived from evidence-based system dynamics scripts from Scriptapedia [27]. An explanation of the full program of session 1 can be found in Supplementary file 1. During the first session, the research team fulfilled the following tasks: facilitators (MPP and SCD), physical wall builder (MPP), digital wall builder (TMW), several note takers (JJW and research assistants) and a time keeper (JJW). The STICKE software (Version 3, Deakin University) was used to visualize and project the factors and associations into a CLD.

GMB session 2

GMB session 2 took place one week after GMB session 1. In preparation of the second GMB session, the research team identified twelve leverage points that emerged from the loops in the CLD. The first aims of session 2 (3,5 h) were to perform a member check to verify the CLD, identify and prioritize leverage points on perceived changeability and impact. Two new leverage points were identified during the member check with participants. Eventually, some leverage points were merged, resulting in twelve leverage points. The second aim of this session was to identify actions for optimizing the food environment in healthcare institutions at different levels of the system, using several individual and plenary activities, that were again derived from evidence based system dynamics scripts from Scriptapedia [27]. During the second session the research team fulfilled the following tasks: facilitators (MPP and SCD), wall builder (MPP), note takers (JJW and research assistants) and timekeeper (JJW). A summary of the program of session 2 can be found in Supplementary file 1.

Action implementation meeting and webinar

During the one-year follow-up there were two contact moments to support the implementation of actions within the healthcare institutions. The first moment was between September and December 2022, where each healthcare institution was visited (approximately 60 min) by the first author (JJW) and a representative of the Nutrition & Healthcare Alliance. The aim was to discuss the successes and bottlenecks they experienced in the past months with respect to the implementation of actions and additional efforts to improve the food environment. Additionally, each healthcare institution was provided with tools and help of the Nutrition & Healthcare Alliance to overcome potential bottlenecks. During the second contact moment (February 2023), representatives of four of the five healthcare institutions attended a generic national network webinar (75 min with n = 23 healthcare institutions) organized by the Nutrition & Healthcare Alliance aimed at inspiration, sharing experiences and asking questions about the realization of a healthy food environment. Also, a representative of a hospital that had already made substantial improvements to the food environment shared their insights and business case.

Closing session

A closing session (T2) was organized by the researchers in collaboration with the Nutrition & Healthcare Alliance to gain insight into the implementation progress made during the one-year follow-up period and to identify additional needs required for further realization of a healthy and sustainable food environment. During this session the 'time-line wall' method was used (Fig. 2) which aimed to evaluate a process and visualize activities in time [26, 28]. For the construction of the time-line wall two central questions were asked to participants. First, what has been realized over a one-year period, i.e. which steps have been taken towards the improvement of the food environment in your healthcare institution? Second, what is needed to realize a healthy and sustainable food environment in your healthcare institution by 2030? For the second question participants had to formulate three important breakthroughs to come to a healthy and sustainable food environment by 2030. Participants first reflected individually upon the questions, before discussing their thoughts with their colleagues. Participants wrote their input on post-its and placed them on a wall where a time-line was visualized (please see Fig. 2 for an impression). Findings were shared in a plenary discussion with participants standing in front of the time-line wall.

Fig. 2 Time-line wall input during the closing session

Study procedure and measures

Evaluation of the GMB sessions

At the end of both GMB sessions, a questionnaire was used to measure participant involvement (i.e. *'I felt involved in making the CLD'* (session 1) *and 'I felt involved in identifying actions'* (session 2)), the degree of systems thinking (i.e. *'The session gave me insight into factors and connections influencing the food environment'* (session 1) and the degree of action awareness (i.e. *'The session gave me insight into actions that could influence the food environment'* (session 2)), that could be answered on a 5-point Likert scale, ranging from 1, fully disagree to 5, fully agree. Two open-ended questions were included about which harvest of the session the participants would share within their institution and what would be required to implement the identified actions. The questionnaire was based on a survey used in another study that evaluated system mapping [29].

Evaluation of the leverage points

In GMB session 2, participants were asked to individually score each leverage point on changeability (i.e., how easy or difficult is it to change this within their healthcare institution) and impact (i.e., the impact on improving the food environment) on a scale from 0 to 10, with 0 being least changeable or impactful and 10 being most changeable and impactful.

Evaluation of the system levels of the actions

To facilitate the identification of actions that can reorientate the system, the Action Scales Model (ASM) tool of Nobles [16] was used. The tool describes four levels (events, structures, goals and beliefs) with deeper levels yielding increased potential for changing the system. The actions were appraised by the research team according to the four levels of the ASM tool to evaluate the potential leverage impact on the system.

Evaluation of GMB process and progress towards action implementation

Six (T1) and twelve (T2) months after the GMB sessions, online semi-structured interviews (via Microsoft Teams) were conducted with the key contacts representing the five participating healthcare institutions. Topics central to the interview were looking back on the study trajectory, facilitators and barriers and goals and ambitions for transitioning towards a healthy and sustainable food environment. The interview guide was created for this study, topic details, prompts and the full interview guide (translated from Dutch to English) can be found in Supplementary file 2. The interviews were conducted in Dutch by one author (JJW), audio-recorded, and lasted between 29 and 42 min. The outcomes of the closing session (i.e., what has been realized and what is needed for improving the food environment) were included in the progress evaluation towards action implementation.

Data analyses

Creating the CLD was an iterative process. After the first GMB session the research team made a concept CLD, which was validated during the second GMB session using member checking. After this member check, the CLD was finalized by the research team. The CLD results were illustrated with quotes, derived from the notes taken during the sessions. These quotes were not necessarily fully literal, because the note takers in both sessions were unable to transcribe literally and to record who said what due to the speed of the conversations. The factors and mechanisms of the CLD were visualized via STICKE software (Version 3, Deakin University). Based on the visualization via STICKE the research team replicated the CLD and identified feedback loops using Vensim PLE 8.1.0, software to visualize feedback loops. Feedback loops are relationships between factors, where one factor leads to a change (growth, decline or stabilization) in another factor that again leads to a change in the original factor. A positive feedback loop generates a reinforcing change and can lead to growth or decline (i.e. reinforcing feedback) and a negative feedback loop generates a balancing change and can have a stabilizing effect (i.e. balancing feedback). The layout of the system map figures was created by an illustrator.

Changeability and impact of the leverage points and the questionnaires for stakeholder evaluation of the GMB sessions were analyzed using descriptive statistics in Microsoft Excel. The follow-up interviews at six and twelve months were anonymized and thematically summarized by the first author. The input on the time-line wall was collected from the closing session, and main themes were identified using thematic content analysis from the post-its on the wall and notes of the session. The results of the interviews and time-line wall were illustrated with quotes translated from Dutch to English.

3.3 Results

Causal loop diagram

The CLD as presented in Fig. 3 shows the system that shapes a healthy and sustainable food environment in healthcare institutions, formed by 30 factors, connections and mechanisms that influence the system. The arrows symbolize the connections between factors. An arrow with a plus symbol indicates that the relationship between the factors is positive (if the variable increases or decreases, the connected variable also increases or decreases correspondingly). An arrow with a minus symbol indicates that the relationship between the factors is negative (if the variables increases, the connected variable decreases, or if the variable decreases, the connected variable increases). Each color represents a subsystem, in which factors are clustered. The following four connected subsystems were identified: (1) the healthcare organization, (2) the patient, (3) purchasing,

procurement and budget and (4) national governance and policy. A total of six reinforcing feedback loops were identified, indicated by 'R' in the diagram. The identified leverage points are numbered and underlined.

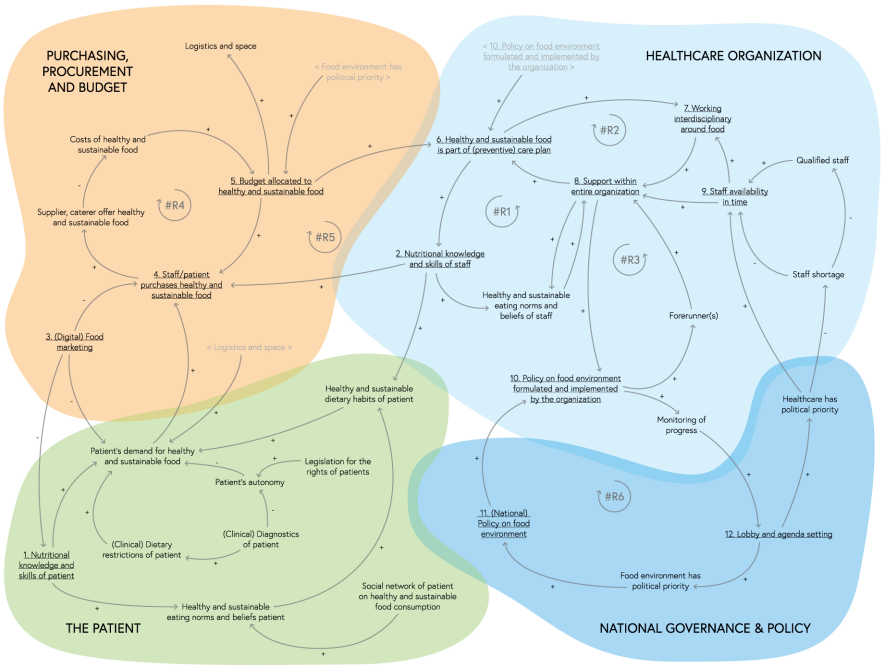


Fig. 3 Causal loop diagram shows the system that shapes the food environment in healthcare institutions. Each color represents a subsystem; feedback loops are indicated by an 'R' followed by a number; leverage points are underlined

Subsystem healthcare organization

Factors related to the healthcare organization are displayed in the light blue subsystem in Fig. 4. Most of the identified factors centre around support for a healthy and sustainable food environment within the *entire* organization. As illustrated by a participant: "*I think support within the organization is very important, that is where it starts*". Another participant noted: "*what really strikes me, is that the complexity [of the map] is within the healthcare organization part*". Three reinforcing feedback loops were identified within this subsystem. Feedback loop 1 indicates that broad support for healthy and sustainable food environments in the entire organization leads to the integration of healthy and sustainable foods in (preventive) care plans. This, in turn, increases nutritional knowledge and skills of staff, that positively shapes their norms and beliefs regarding healthy and sustainable eating, which fosters further support within the healthcare organization (R1,

Fig. 4). Feedback loop 2 shows that if healthy and sustainable food is part of a (preventive) care plan for patients, this will enhance interdisciplinary working around food within the organization. Interdisciplinarity can also broaden the support for the creation of a healthy and sustainable food environment within the entire healthcare organization and that will increase the likelihood that healthy and sustainable food will become part of a (preventive) care plan for patients (R2, Fig. 4). Feedback loop 3 shows that having a 'forerunner' who initiates or leads change in the transition towards a healthy and sustainable food environment, is beneficial for creating support towards a healthy and sustainable food environment in the entire organization. For example, a person on management or board level who disseminates the importance of healthy and sustainable food and the role of the food environment can increase support, which can accelerate the implementation of

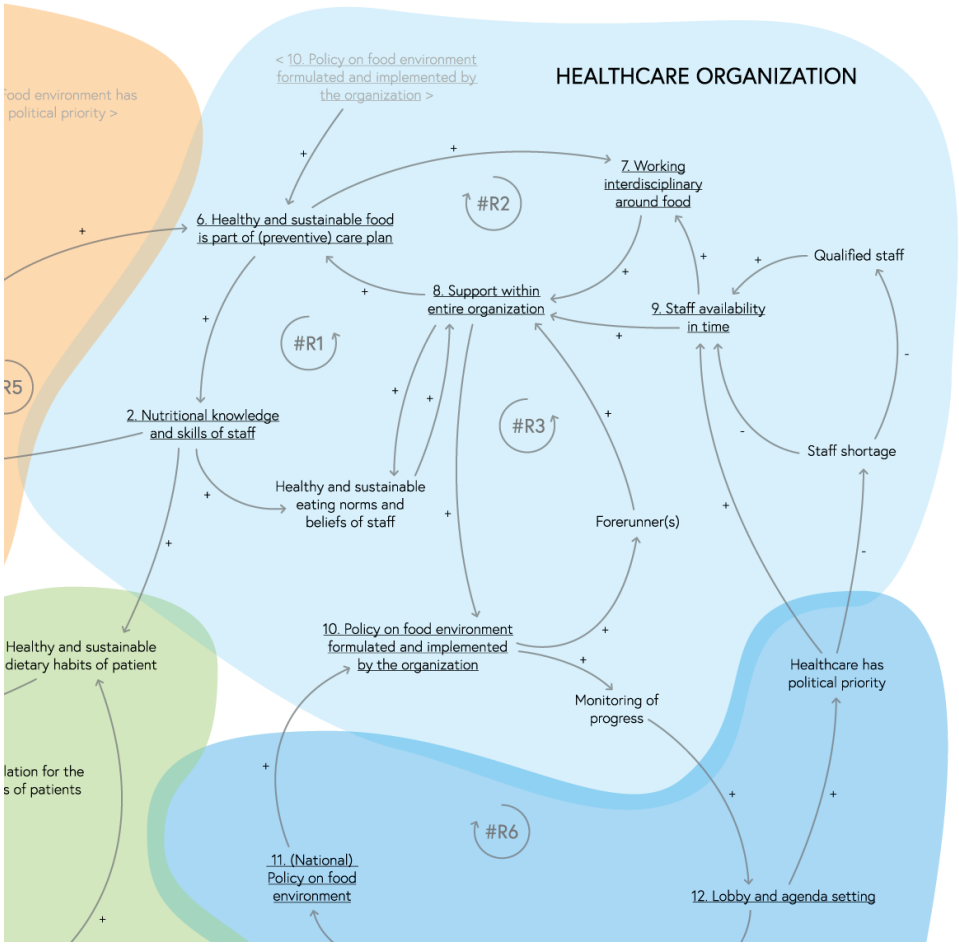


Fig. 4 Causal loop diagram subsystem healthcare organization

food environment policies. An implemented food environment policy is again helpful in attracting and guiding forerunners, the beginning of feedback loop 3 (R3, Fig. 4).

Subsystem the patient

Factors related to the role of the patient are displayed in the green subsystem (Fig. 5). No feedback loops were identified here. Most factors in this subsystem had a direct influence on the patient's demand for healthy and sustainable food, including nutritional knowledge and skills, (clinical) dietary restrictions, patient's autonomy, healthy and sustainable dietary habits and a more distal factor, namely the influence of (digital) food marketing. The patients' demand for healthy and sustainable foods influenced the food purchases of staff and patients, e.g. patients asking staff to prepare or buy healthy and sustainable foods. Indirect factors that influenced patients' demand for healthy and sustainable foods were the social network of patients, which in turn influenced the eating norms and beliefs of patients. The (clinical) diagnostics of patients and related (clinical) dietary restrictions affect the patients' demand for food within the healthcare institution. Participants

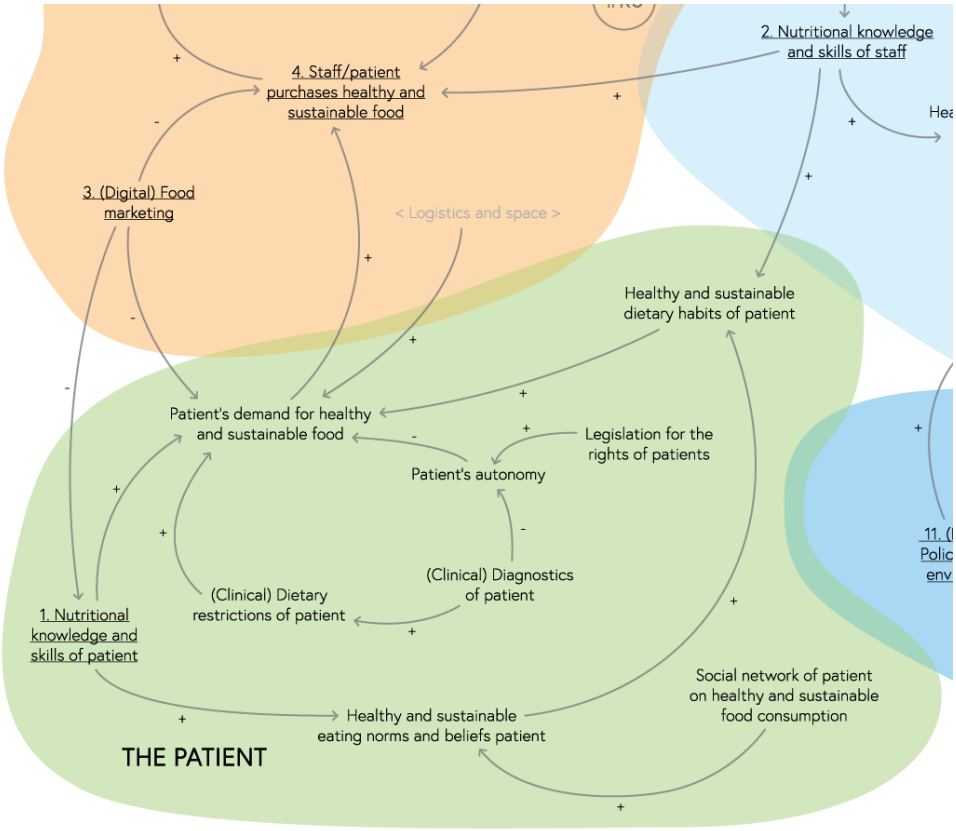


Fig. 5 Causal loop diagram subsystem the patient

discussed the influence of patients' autonomy and the influence of associated regulations on the demand for healthy and sustainable food. The autonomy and rights of individuals with intellectual disabilities or psychogeriatric conditions receiving involuntary care are protected and regulated in the Netherlands by the Care and Coercion Act (in Dutch: Wet Zorg en Dwang or Wzd 2020) [30], to ensure these individuals receive adequate care. Since diet and prevention are not part of this Act, it was indicated that patients often have full autonomy over their food choices, and the right to choose an unhealthy diet, illustrated by a participant: "*it is not allowed that a health care receiver crosses the road [e.g. a busy roadway], but that someone [figural] eats him or herself to death is allowed, as this does not happen overnight*".

Subsystem purchasing, procurement and budget

Factors related to food purchasing, procurement and budget available for healthy and sustainable food are displayed in the orange subsystem (Fig. 6). In many healthcare institutions, staff members are tasked with procuring the food that patients consume, yet in some healthcare institutions (e.g. mental healthcare, institutions for people with intellectual disabilities) patients take on the responsibility of obtaining their own meals. Reinforcing feedback loop 4 shows that an allocated food budget would increase the purchases of healthy and sustainable food by staff and patients, which will enhance the (external) suppliers' and caterers' offerings of healthy and sustainable foods (supply and demand), which, in turn, will lower the costs of healthy and sustainable foods. As a result, more budget can be allocated to healthy and sustainable foods which in turn leads to an increase of healthy and sustainable food purchases by staff and patients (reinforcing loop R4, Fig. 6). A participant elaborated on this: "*in theory there is budget, but in practice it is often not clear for what that budget is, for example, it is also for household products and then there is no budget left anymore for foods*" and another participant said "*there is no budget for healthy food, because it is more expensive than unhealthy food*". Feedback loop 4 can be extended to feedback loop 5, adding that more budget allocated to healthy and sustainable foods can increase the likelihood that healthy and sustainable food is part of a (preventive) care plan, which in turn can enhance the nutritional knowledge and skills of staff (subsystem the healthcare organization) and with that increases the purchases of healthy and sustainable foods by staff/patients (reinforcing loop R5, Fig. 6).

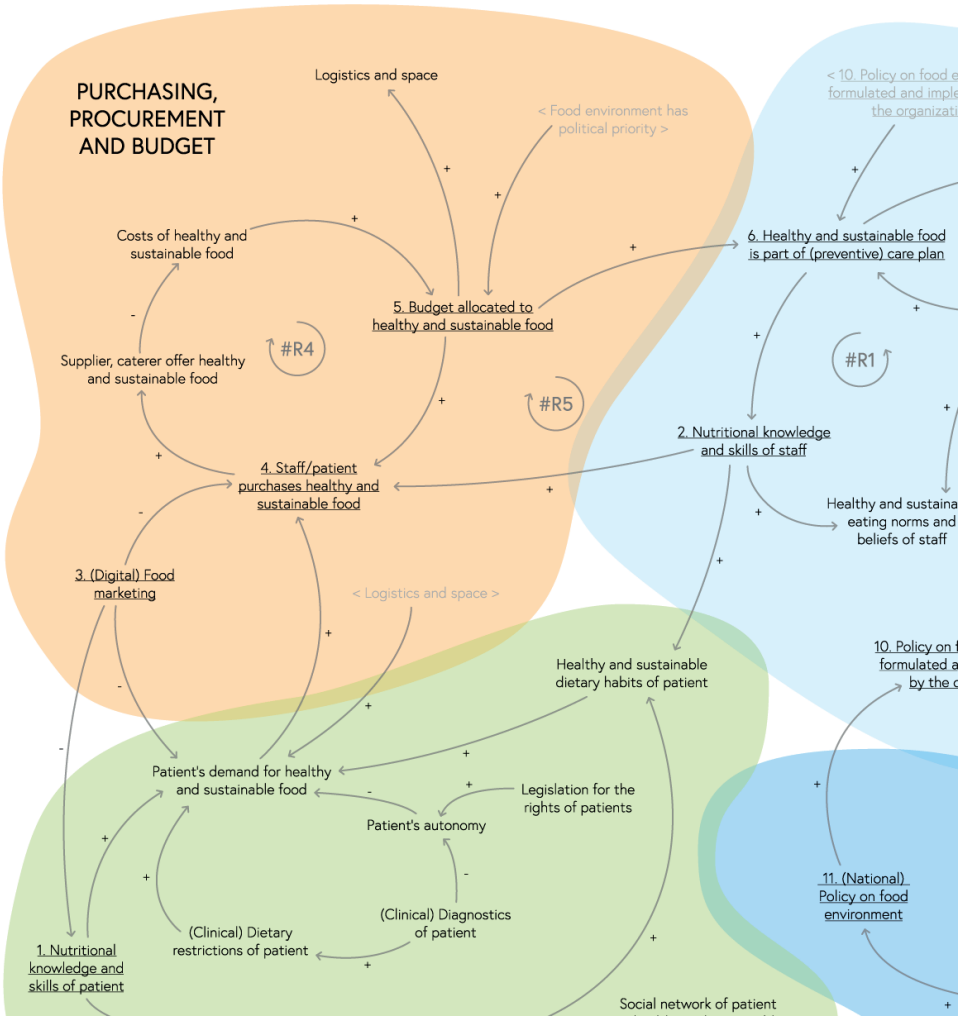


Fig. 6 Causal loop diagram subsystem purchasing, procurement and budget

Subsystem national governance and policy

The final subsystem, displayed in dark blue, illustrated how factors related to national governance and policy shape the healthcare institutions' food environment (Fig. 7). Reinforcing feedback loop 6 shows that lobby and agenda setting by e.g. civil society organizations can contribute to higher political priority and more (national) policy to create healthy and sustainable food environments, which in turn can enforce healthcare institutions to formulate and implement policies. Having a food environment policy within healthcare institutions can impose monitoring or evaluation of the food environment and this can help to empower the role of lobby and agenda setting, the start of feedback

loop 6 (R6, Fig. 7). Illustrated by a participant: *"Lobbying is important and trade associations have large influence, not only trade associations but also health insurers have an important position in this"*. Participants further discussed that the government is more focused on economic interests than health interests, which restricts budget allocated to healthy and sustainable foods, illustrated by: *"think of Value Added Taxes, the economic interests outweigh the health interests"*. Furthermore, participants mentioned that the lack of prioritization on the healthcare setting by the national government increases staff shortage and lowers available time staff has for health care receivers, which in the end negatively influences the support for realizing a healthy and sustainable food environment.

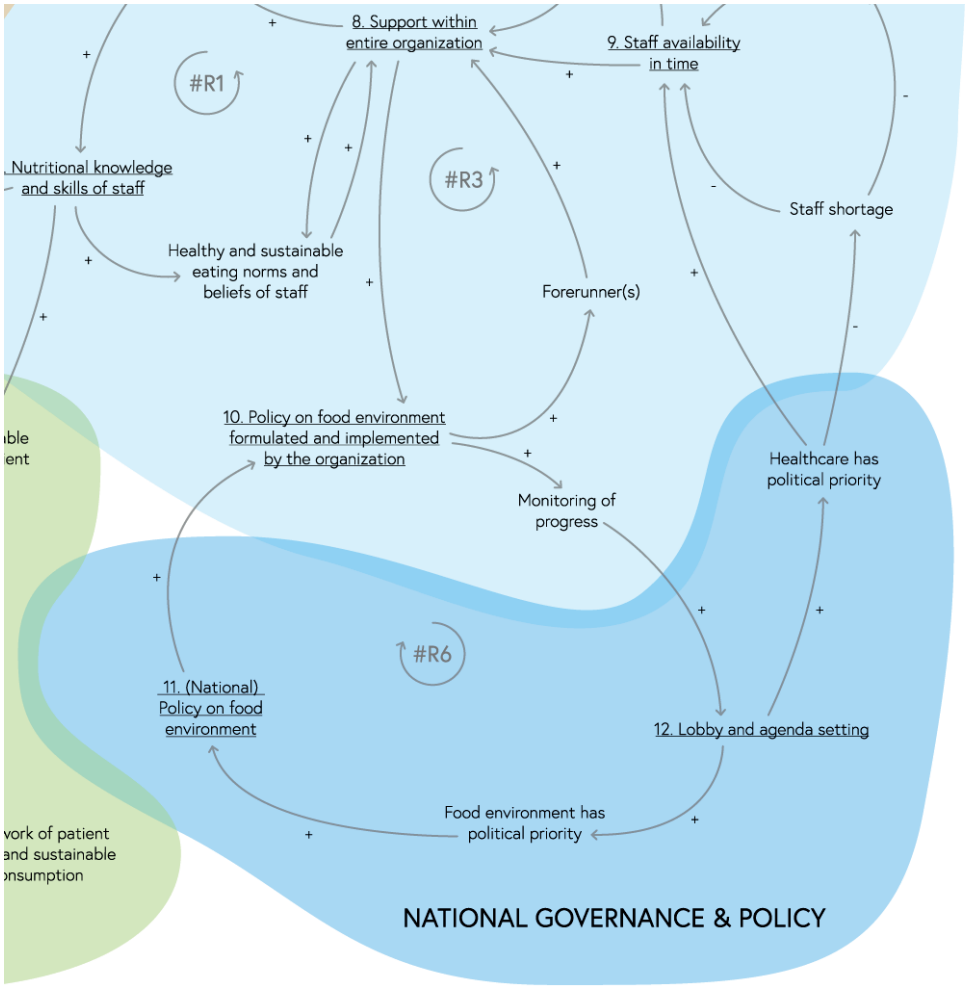


Fig. 7 Causal loop diagram subsystem national governance and policy

Changeability and impact of leverage points

Twelve leverage points were identified (all leverage points are underlined and numbered in the causal loop diagram, Fig. 3). On the 10-point scale the three leverage points that received the highest score combination of impact and changeability are: (2) nutritional knowledge and skills of staff (impact = 7.0, changeability = 6.1), (12) lobby and agenda setting (impact = 7.3, changeability = 5.7), and (6) healthy and sustainable food is part of (preventive) care plan (impact = 7.4, changeability = 5.4). The impact and changeability scores for all leverage points are plotted and available via Supplementary file 3.

Actions for transition of the food environment

During session 2, participants formulated 40 actions based on the leverage points in the CLD, of which 10 actions were appraised on the *events* level of the ASM model, 22 actions on the *structures* level, 3 actions corresponded to the *goals* level and 5 actions to the *beliefs* level. The actions can be found in Supplementary file 4.

Evaluation of both GMB sessions

Overall, the results of the questionnaires showed that participants felt involved in both sessions with a mean score of 4.4 (SD = 0.5). Participants indicated that they were encouraged in systems thinking after the first session (M = 4.1, SD = 0.6) and obtained action awareness after the second session (M = 4.1, SD = 0.6). The open-end questions predominantly elucidated that participants wanted to share the outcomes of the sessions within their organization and that they required support from management level to implement the identified actions.

Follow-up summary: interviews after six, twelve months and time-line wall

Determining the accomplishments over the follow-up year through the interviews and time-line wall, participants highlighted various, small advancements towards improvement of the food environment, facilitated by the GMB sessions. Participants noted that the GMB sessions and outcomes played a role in raising awareness on the importance of a healthy and sustainable food environment, agenda setting, and the formulation of concrete plans to start improving the food environment. In one healthcare institution the sessions helped to (re)start the conversation on this topic with the management level: *"But it helps to start the conversation with the management - and I do notice that after the conversation we had, they seem to think that it is all well-founded - then it seems like we are being taken more seriously - so that's also very nice." (P14).* Another participant highlighted that the study trajectory served as an important motivator for improving the food environment, acting as a catalyst for staying proactive. Some participants mentioned that the study activities emphasized the collaborative effort in improving the food environment, fostering a sense of unity rather than isolation, illustrated by: "*We do not act alone; there*

are several other healthcare institutions in the region who share similar intentions to undertake such endeavors." (P6).

However, participants also mentioned that the study activities did not *directly* contribute to the initiation of concrete actions or improvements in the food environment, illustrated by "*we have not done much in the meantime*" *(P1)* or participants did not link or recall any changes to the study activities. Four healthcare institutions already started to improve their food environments before the sessions began (for example writing a new vision or outsourcing patient food service to in-house management) and the GMB sessions and outcomes served as a complementary effort, as illustrated by participants: "*We are moving in a certain direction and we will also take the knowledge and information of the sessions with us*" *(P19)* and "*we already had the intention to make improvements when it comes to nutrition*" *(P6)*.

The main barriers for implementation of actions for improving the food environment that were mentioned by participants were: lack of time, lack of adequate budget or finances (e.g. because of inflation), no priority, no integration into daily tasks or daily health care, personnel changes (instable team), high workload, lack of communication and lack of support from management level or the entire organization or lack of having a forerunner to change the food environment As illustrated by a participant: "*It is so important that you have support, because then you also have the resources and manpower" (P14)* and "*Because we have a staff shortage and there are a lot of flexible workers at this moment nutrition is not the first thing to tackle" (P11).*

When participants were asked what they need in terms of resources to realize a healthy and sustainable food environment most participants indicated that they need (financial) support, people, forerunners, guidance (e.g. project leaders, tools for realizing a healthy and sustainable food environment, rules and policies within the healthcare institution but also from the government), peer support through learning from other healthcare institutions (e.g. by sharing best practices), and monitoring (e.g. by evaluation moments to assess the extent of change). Participants remarked the need of multidisciplinary collaboration and making integral decisions for the transition to a healthy and sustainable food environment. Also, having a vision and how to translate the vision to a plan were mentioned. One participant said: "*Besides policy at national level, there are also opportunities for policy at municipal level*" *(P13).* Another participant suggested that the role of the government in creating a healthy and sustainable food environment in healthcare institutions should be the same role the government takes in quitting smoking. Another participant stressed the importance of handling autonomy, especially when individuals may not fully grasp the consequences of unhealthy foods. In such cases, maintaining

autonomy is crucial, accompanied by the ability to provide guidance in decision-making, for instance providing a patient two healthy food options.

3.4 Discussion

This study obtained a comprehensive understanding of the system dynamics underlying the food environment in healthcare institutions. The collectively acknowledged systems map, included 30 factors, four subsystems including the patient, the healthcare organization, purchasing, procurement and budget and national governance and policy, and these subsystems included six feedback loops. Twelve leverage points for improving the healthcare food environment were identified with 'nutritional knowledge and skills of staff', 'lobby and agenda setting' and 'healthy and sustainable food is part of (preventive) care plan' perceived as most impactful and changeable. A total of 40 actions were formulated and appraised on the levels of the ASM, with most actions corresponding to the events and structures levels. The GMB sessions, outcomes and one-year follow-up trajectory did contribute to indirect actions that could lead to future system changes supportive of healthy food environments, including agenda setting and increased awareness of the need to improve the healthcare food environment. However, the study efforts did not directly contribute to action implementation that improved the food environment. To make further progress in the transition towards a healthy and sustainable food environment in long-term healthcare institutions, a longer time frame for follow-up and additional efforts towards the implementation of actions are required.

The study resulted in a systems map of the food environment in long-term healthcare institutions, which included four subsystems, each of which revealed several remarkable system dynamics. In the CLD subsystem 'the healthcare organization', most dynamics were found, with three feedback loops related to the factor 'support within the entire organization', indicating that organizational support, leadership and the presence of forerunners are crucial factors for realizing a healthy and sustainable food environment in the healthcare setting. This could be explained by delving into the deeper layers of the system, which encompass the beliefs and goals of the management, but also of the wider organization, as well as the norms and values around this topic that are essential for initiating food environment policies and budget allocations for these policies [16]. The importance of support and forerunners was also found in other studies, showing that support and strong leadership are integral for successful implementation of actions for system change, and for broader stakeholder engagement [14, 31]. Other studies, including a systematic review, have shown that the implementation of other (non-food related) complex interventions in long-term care settings, also found that leadership, management support and forerunners to be key factors influencing successful change

in healthcare settings [32, 33]. These findings indicate that it is important to start working on support and leadership for a healthy food environment on different levels within the healthcare organization before actually starting to change the food environment.

In the CLD subsystem 'the patient', the patients' demand for healthy and sustainable food occupies a central position with numerous factors influencing this demand (e.g. food marketing, patient's autonomy). This central position of the patient seems characterizing for the healthcare setting culture. The World Health Organization also defines healthcare quality as people-centred and organized to meet patients' needs [34]. The autonomy of patients is highly valued in healthcare contexts, providing patients with the right to self-determination and choice with regard to care, support and their treatment [35, 36]. For people with intellectual disabilities or psychogeriatric conditions receiving involuntary care the Dutch Act 'Wet Zorg en Dwang'[30] (Care and Coercion Act) describes and protects their rights, but also outlines that either care providers or client representatives can assist in making choices for them, when being unable to assess what is good for themselves. While this Act includes the administration of fluid, nutrition, medication and medical procedures, preventive measures (e.g., prohibit the overconsumption of unhealthy foods leading to weight gain) are not specified. A pivotal question that arises in these healthcare setting is whether health protection and preventive measures should be addressed, as not all patients are capable of making such health related choices themselves either [37].

The dynamics underlying the subsystem 'national governance & policy' showed that political priority is essential to formulate policies for establishing a healthy and sustainable food environment in the healthcare setting. To enhance priority, the influence of the lobby of civil society organizations was mentioned, a factor also found crucial in other studies for enhancing public health measures [38, 39]. However, civil society organizations have a much smaller sphere of influence and power and less resources for lobbying compared to commercial food industries [40, 41]. Improving the food environment in the healthcare setting has been given greater priority in recent years as the Dutch government did set specific goals for improving the food environment in hospitals in the National Prevention Agreement, however specific objectives for other healthcare institutions were lacking [42]. Yet, after the GMB sessions, an agreement was signed by the Dutch government (Ministry of Health, Welfare and Sports) and several other parties (e.g. healthcare insurers, trade associations) aimed at keeping healthcare accessible, of good quality and affordable, including the goal to improve food environments in healthcare institutions for patients by 2030 [43]. This may further strengthen the needed priority to make substantial improvements to the food environments of healthcare institutions, and potentially extend the allocation of budget and to implement policies for a healthy and sustainable food environment, identified as essential for change in our study. Also from

other studies it is known that sufficient financial resources and policies play a crucial role in realizing healthy and sustainable food environments [44, 45].

A myriad of actions were identified during the GMB sessions and this underlines the message that healthy and sustainable food environments in healthcare institutions cannot be created through single and isolated interventions. The actions were however predominantly developed at the lower levels of the system (events and structures levels) and to a lesser extent on the deeper levels of the system which provide greater potential for changing how the system functions (goals and beliefs levels). The results of our study indicated that, although we stimulated participants to think in systems, it was difficult for them to formulate actions that addressed deeper layers of the system and that it was easier to come up with actions that intervene in problems that are clearly visible. This is not surprisingly since people are often used to think in quick fixes and low hanging fruit actions within existing systems, as this is the common way and addresses actions that are often the easiest to implement. A potential explanation for the formulation of actions predominantly at the lower system levels could be that the duration of the GMB workshops in our study was too short for the devised methodologies of systems thinking. As people are not used to think in the deeper layers of systems, sufficient time should be allocated to support participants in this. Due to time constraints, certain components of the GMB scripts received less time than initially advised. A GMB study in New Zealand for improving fruit and vegetable intake in children, also explained that participants did not identify actions targeting the deeper levels of the systems, because the allowed time of 3-hour workshops was not enough for understanding system levers [22]. They recommended to add an additional phase to the GMB process for further identifying and implementing actions [22]. A study by Conway-Moore et al. on co-creating obesity prevention policies with youth from different countries yielded similar findings, as most action ideas were formulated on the lowest system level, relating to adolescents own lived experience [46], and no action ideas were formulated on the higher levels of the system shifting goals and beliefs. Participants in another GMB study, to improve obesity related behaviors in adolescents in the Netherlands, succeeded in the formulation of actions targeting higher system levels. However, in this study they formed separate action groups per action theme, that met regularly and there was more guidance on the application of systems thinking [47]. Another potential explanation for the formulation of actions predominantly at the lower system levels could be that we did not invite the right group of stakeholders, for example the system architects of healthcare institutions of which it is known that these people have mandate to enact change, e.g. directors, managers, policy makers. Our sample consisted mainly of participants fulfilling a rather executive role, where strategic thinking might not be the core aspect of their job. Furthermore, it is recommended to appropriately identify, approach and engage a very wide group of stakeholders (not only invite people who are responsible for food and beverages) for the

GMB workshops, including system architects such as governmental stakeholders (e.g. policy makers) and external parties (e.g. caterers, suppliers).

The GMB process in this study was successful in encouraging systems thinking, and using GMB to collaboratively understand the system was a valuable approach. However, advancing from action ideas to action implementation remained lagging in the one year follow-up. First of all, it could potentially be explained by the fact that the GMB sessions were held with a variety of healthcare institutions with only one or two participants per institution and probably an insufficient amount of forerunners and system architects, people needed for real action implementation [16, 48]. Furthermore, going from systems thinking (GMB approach) to actual systems acting requires recognition of the people in charge of making decisions and a clear guidance on how to implement system based changes [49, 50]. Yet, main barriers for progress identified were lack of priority, time, budget and support, showing that substantial efforts at this organizational level are required. Another likely explanation is that the time frame of our evaluation was too short, since action implementation for system change is a prolonged endeavor because systems change at a gradual pace, which can take up to several years, which was far beyond the reach of this study [38]. To illustrate, a recent review into GMB use in public health and healthcare settings, showed that more substantial system changes need time and were only observed after 5-years of follow-up [21]. The short term outcomes of GMB were associated with insights (individual level learning), consensus and strengthening relationships, which are in line with our outcomes after our one-year follow-up. Therefore, a long-term follow-up evaluation would be valuable to assess system changes in the food environment of healthcare institutions.

This study provides a novel contribution to the literature towards the application of a systems approach in a real-life setting to understand the system dynamics underlying the food environment in the healthcare setting. Strengths include the inclusion of participants from a wide range of healthcare institutions, serving a diversity of health care receivers, who were able to collaboratively create a shared understanding of the system underlying the food environment in healthcare institutions. The participants were all part of the system and spoke the same language and jargon and could comprehend and complement each other in discussions despite the differences in functions and type of healthcare institutions. This shows that the method is applicable across healthcare institutions and throughout the healthcare landscape. Another strength is the follow-up trajectory to evaluate the GMB process and progress towards action implementation, as a follow-up trajectory is often not included in GMB studies.

The present study also includes some limitations. First, the participants may not be representative for the entire healthcare institution and therefore we lack the view of all

actors involved that may have provided a different perspective on the system underlying the healthcare food system. Although we included a variety of stakeholders (e.g., facilities managers, dietitians), even a more diverse group including the system architects (e.g. management level, board level), would have been preferred. Second, the GMB method involved stakeholders from five different healthcare institutions, making the developed systems collectively acknowledged and applicable for multiple types of healthcare institutions. Yet, it could have been more useful to apply the GMB method and follow-up trajectory of action implementation within each separate healthcare institution because then it can be employed for that specific healthcare institution and ensure that a wide range of stakeholders from that institution is engaged during the trajectory. Moreover, we only conducted a one-year follow-up study while systems changes require a longer period of time [21]. However, due to budgetary, personnel and time constraints we were unable to prolong the follow-up period. Another limitation was the challenge for the facilitators and researcher of taking notes during the GMB sessions, therefore we recommend recording the sessions in the future. A final limitation was that the GMB process and study trajectory required a substantial time investment from the participants, resulting that not all participants were involved in all study activities.

The results of this study also yield implications for governmental policy formulation, e.g. specific for the food environment in the healthcare setting and tailored to different types of care. The progress evaluation towards action implementation can be used to strategically invest in resources to overcome barriers and to foster actual sustainable implementation of actions for transitioning the food environment in the healthcare setting. A recommendation for future research is to assess the generalizability of the outputs to see whether the created systems map and identified actions are representative for other healthcare institutions, or that the process of the creation of the systems map is unique and should be repeated in each setting. Another recommendation for future research is to explore how developing a CLD and creating action ideas could lead to long-lasting implementation of actions that can reorientate the system – from systems thinking to systems acting.

3.5 Conclusions

This study gained a comprehensive, collectively acknowledged understanding of the system dynamics underlying a healthy and sustainable food environment in healthcare institutions. The results underscore the importance of crafting a coherent set of actions that addresses various factors and underlying mechanisms to initiate systemic change, with due attention given to action implementation. The one-year evaluation showed that actual action implementation and system change remained challenging. The potential of

systems-based solutions should be identified collectively with all stakeholders (system architects and users, e.g. policy makers, health care staff, suppliers) and future research should ascertain if it fosters impactful change in the food environment in healthcare settings. Long-term follow-up research is needed to explore how to come from action ideas to implementation for improvement of the food environment in healthcare institutions.

References Chapter 3

1. Sloane PD, Ivey J, Helton M, Barrick AL, Cerna A. Nutritional issues in Long-Term Care. J Am Med Dir Assoc. 2008;9:476–85.
2. Thibault R, Abbasoglu O, Ioannou E, Meija L, Ottens-Oussoren K, Pichard C, et al. ESPEN guideline on hospital nutrition. Clin Nutr. 2021;40:5684–709.
3. Larson N, Story M. A review of Environmental influences on Food choices. Ann Behav Med. 2009;38:56–73.
4. Caspi CE, Sorensen G, Subramanian SV, Kawachi I. The local food environment and diet: a systematic review. Health Place. 2012;18:1172–87.
5. Giskes K, van Lenthe F, Avendano-Pabon M, Brug J. A systematic review of environmental factors and obesogenic dietary intakes among adults: are we getting closer to understanding obesogenic environments? Obes Rev. 2011;12:e95–106.
6. Swinburn B, Sacks G, Vandevijvere S, Kumanyika S, Lobstein T, Neal B, et al. INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. Obes Rev. 2013;14:1–12.
7. Wierda JJ, de Vet E, Troost E, Poelman MP. Characterizing food environments of hospitals and long-term care facilities in the Netherlands: a mixed methods approach. BMC Health Serv Res. 2024;24:31.
8. Hoefnagels FA, Patijn ON, Meeusen MJG, Battjes-Fries MCE. The perceptions of food service staff in a nursing home on an upcoming transition towards a healthy and sustainable food environment: a qualitative study. BMC Geriatr. 2023;23:784.
9. Horton Dias CE, Dawson RM, Harris DM, Wirth MD, Abshire DA. Foods and beverages available to nurses in Hospital cafeterias, Vending machines, and gift shops. Am J Health Promotion. 2022;36:1133–41.
10. Champ CE, Iarrobino NA, Haskins CP. Hospitals lead by poor example: an assessment of snacks, soda, and junk food availability in Veterans affairs hospitals. Nutrition. 2019;60:70–3.
11. Winston CP, Sallis JF, Swartz MD, Hoelscher DM, Peskin MF. Consumer Nutrition Environments of Hospitals: An Exploratory Analysis Using the Hospital Nutrition Environment Scan for Cafeterias, Vending Machines, and Gift Shops, 2012. Prev Chronic Dis. 2013;10:120335.
12. Waterlander WE, Singh A, Altenburg T, Dijkstra C, Luna Pinzon A, Anselma M et al. Understanding obesity-related behaviors in youth from a systems dynamics perspective: the use of causal loop diagrams. Obes Rev. 2021;22.
13. Li B, Alharbi M, Allender S, Swinburn B, Peters R, Foster C. Comprehensive application of a systems approach to obesity prevention: a scoping review of empirical evidence. Front Public Health. 2023;11:1015492.
14. Bagnall A-M, Radley D, Jones R, Gately P, Nobles J, Van Dijk M, et al. Whole systems approaches to obesity and other complex public health challenges: a systematic review. BMC Public Health. 2019;19:8.
15. Rutter H, Savona N, Glonti K, Bibby J, Cummins S, Finegood DT, et al. The need for a complex systems model of evidence for public health. Lancet. 2017;390:2602–4.
16. Nobles JD, Radley D, Mytton OT. The Action scales Model: a conceptual tool to identify key points for action within complex adaptive systems. Perspect Public Health. 2022;142:328–37.
17. Richardson GP. Reflections on the foundations of system dynamics. Syst Dyn Rev. 2011;27:219–43.

18. Waterlander WE, Ni Mhurchu C, Eyles H, Vandevijvere S, Cleghorn C, Scarborough P, et al. Food futures: developing effective food systems interventions to improve public health nutrition. Agric Syst. 2018;160:124–31.
19. Carey G, Malbon E, Carey N, Joyce A, Crammond B, Carey A. Systems science and systems thinking for public health: a systematic review of the field. BMJ Open. 2015;5:e009002.
20. Hovmand PS. Community Based System dynamics. New York, NY: Springer New York; 2014.
21. Estrada-Magbanua WM, Huang TT-K, Lounsbury DW, Zito P, Iftikhar P, El-Bassel N, et al. Application of group model building in implementation research: a systematic review of the public health and healthcare literature. PLoS ONE. 2023;18:e0284765.
22. Gerritsen S, Renker-Darby A, Harré S, Rees D, Raroa DA, Eickstaedt M, et al. Improving low fruit and vegetable intake in children: findings from a system dynamics, community group model building study. PLoS ONE. 2019;14:e0221107.
23. Guariguata L, Rouwette EA, Murphy MM, Saint Ville A, Dunn LL, Hickey GM, et al. Using Group Model Building to describe the system driving unhealthy eating and identify intervention points: a participatory, Stakeholder Engagement Approach in the Caribbean. Nutrients. 2020;12:384.
24. Mui Y, Ballard E, Lopatin E, Thornton RLJ, Pollack Porter KM, Gittelsohn J. A community-based system dynamics approach suggests solutions for improving healthy food access in a low-income urban environment. PLoS ONE. 2019;14:e0216985.
25. Website of The Nutrition. & Healthcare Alliance. https://www.alliantievoeding.nl/en
26. Van der Zouwen A. Co-creatie in werkbijeenkomsten. Het onzichtbare zichtbaar maken. Heart Media; 2023.
27. Hovmand P, Rouwette EAJA, Andersen D, Richardson G, Calhoun A, Rux K et al. Scriptapedia: a handbook of scripts for developing structured group model building sessions. System Dynamics Conference. 2011;:1476–91.
28. Weisbord MR, Janoff S. Future Search: An action Guide to Finding Common Ground in Organisations and Communities. Third edition. Berrett-Koehler Publishers; 2010.
29. Chavez-Ugalde Y, Toumpakari Z, White M, De Vocht F, Jago R. Using group model building to frame the commercial determinants of dietary behaviour in adolescence – proposed methods for online system mapping workshops. BMC Med Res Methodol. 2022;22:84.
30. Ministerie van Volksgezondheid Welzijn en Sport. Wet Zorg en dwang (wzd). https://www.dwangindezorg.nl/wzd. Accessed 10 Mar 2024.
31. Public Health England. Whole systems approach to obesity. A guide to support local approaches to promoting a healthy weight. 2019.
32. Groot Kormelinck CM, Janus SIM, Smalbrugge M, Gerritsen DL, Zuidema SU. Systematic review on barriers and facilitators of complex interventions for residents with dementia in long-term care. Int Psychogeriatr. 2021;33:873–89.
33. Al-Hussami M, Hammad S, Alsoleihat F. The influence of leadership behavior, organizational commitment, organizational support, subjective career success on organizational readiness for change in healthcare organizations. Leadersh Health Serv. 2018;31:354–70.
34. World Health Organization, OECD, International Bank for Reconstruction and Development/ The World Bank. Delivering quality health services: a global imperative for universal health coverage. Geneva; 2019.
35. Entwistle VA, Carter SM, Cribb A, McCaffery K. Supporting patient autonomy: the importance of clinician-patient relationships. J Gen Intern Med. 2010;25:741–5.
36. Greaney A-M, O'Mathúna DP. Patient autonomy in nursing and Healthcare contexts. Key concepts and issues in nursing Ethics. Cham: Springer International Publishing; 2017. pp. 83–99.

37. Badger JM, Ladd RE, Adler P. Respecting patient autonomy Versus protecting the patient's health. JONAS Healthc Law Ethics Regul. 2009;11:120–4.
38. Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, Bogard JR, et al. The global syndemic of obesity, Undernutrition, and Climate Change: the Lancet Commission report. Lancet. 2019;393:791–846.
39. Swinburn B. Power Dynamics in 21st-Century Food systems. Nutrients. 2019;11:2544.
40. Lelieveldt H. Food industry influence in collaborative governance: the case of the Dutch prevention agreement on overweight. Food Policy. 2023;114:102380.
41. Mozaffarian D, Angell SY, Lang T, Rivera JA. Role of government policy in nutrition—barriers to and opportunities for healthier eating. BMJ. 2018;361:k2426.
42. Ministerie van Volksgezondheid Welzijn en Sport. Nationaal Preventieakkoord. Een gezonder Nederland. 2018.
43. Ministerie van Volksgezondheid Welzijn en Sport. Integraal Zorgakkoord (IZA): Samen werken aan gezonde zorg. 2022.
44. Swinburn B, Vandevijvere S, Kraak V, Sacks G, Snowdon W, Hawkes C, et al. Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: a proposed government healthy food Environment Policy Index. Obes Rev. 2013;14:24–37.
45. Djojosoeparto SK, Kamphuis CBM, Vandevijvere S, Murrin C, Stanley I, Romaniuk P, et al. Strength of EU-level food environment policies and priority recommendations to create healthy food environments. Eur J Public Health. 2022;32:504–11.
46. Conway-Moore K, Knai C, Finegood D, Johnston L, Brinsden H, Aguiar A et al. Co-creating obesity prevention policies with youth: policy ideas generated through the CO-CREATE project. Obes Rev. 2023;24.
47. Luna Pinzon A, Waterlander W, de Pooter N, Altenburg T, Dijkstra C, Emke H, et al. Development of an action programme tackling obesity-related behaviours in adolescents: a participatory system dynamics approach. Health Res Policy Syst. 2024;22:30.
48. Foster-Fishman PG, Nowell B, Yang H. Putting the system back into systems change: a framework for understanding and changing organizational and community systems. Am J Community Psychol. 2007;39:197–215.
49. Sautkina E, Goodwin D, Jones A, Ogilvie D, Petticrew M, White M, et al. Lost in translation? Theory, policy and practice in systems-based environmental approaches to obesity prevention in the healthy towns programme in England. Health Place. 2014;29:60–6.
50. Srivastava S, Nambiar D. Pivoting from systems thinking to systems doing in health systems—documenting stakeholder perspectives from Southeast Asia. Front Public Health. 2022;10.
51. Regional Deal Foodvalley. Regio Deal Foodvalley. https://www.regiofoodvalley.nl/programma/regio-deal/
52. World Medical Association. World Medical Association Declaration of Helsinki. JAMA. 2013;310:2191.

CHAPTER

4

Which factors influence the transition towards a healthy and sustainable food environment in Dutch hospitals? A qualitative view from stakeholders

Authors:
Joline J. Wierda, Femke van Nassau, Sanne K. Djojosoeparto & Maartje P. Poelman

Published as:
Wierda, J. J., van Nassau, F., Djojosoeparto, S. K., & Poelman, M. P. (2025). Which factors influence the transition towards a healthy and sustainable food environment in Dutch hospitals? A qualitative view from stakeholders. *BMC medicine*, *23*(1), 45.

https://doi.org/10.1186/s12916-025-03872-y

Abstract

Background: Hospitals fulfill an important exemplary role in promoting health and well-being. It is therefore crucial to have a supportive food environment that stimulates healthy and sustainable food choices of patients, staff, and visitors. This qualitative study aimed to identify factors influencing the implementation of long-lasting actions to enhance the healthiness and sustainability of the food environment in the hospital setting in the Netherlands, from the perspective of different stakeholders.

Methods: Semi-structured interviews were conducted in hospitals realizing a healthy and sustainable food environment. Verbatim transcripts were thematically analyzed, guided by the Consolidated Framework for Implementation Research. Data were organized and interpreted per theme as well as stakeholder group.

Results: In three hospitals, 29 semi-structured interviews were conducted with 30 stakeholders from a wide spectrum of stakeholder groups (i.e., facility professionals, healthcare professionals, project coordinators, and board of directors). Identified themes and subthemes were: 1 the outer setting, with momentum for change, government-established policies and guidelines, collaboration and networks outside the hospital, and caterers' and suppliers' food offerings, interests, and contracts; 2 the innovation domain, with familiarity and compliance with the TEH program; 3 support at all levels, achieving organizational buy-in with communication as a strategy, and end user interests; 4 the inner setting, with key priority in policy and having a vision, available resources, infrastructure within the hospital, ambassadors, and gradual process with continuous effort; and 5 the individual domain with personal drive.

Conclusions: The results revealed an interplay of perceived factors that influence the enhancement of a healthy and sustainable food environment and underscored the importance of addressing various facilitators and barriers across multiple domains within and outside the hospital setting. To ensure successful integration of a healthy and sustainable food environment in hospitals, throughout the entire organization it is crucial to engage diverse stakeholders at all levels and address their barriers with tailored implementation strategies. We suggest verification of our findings in more hospitals.

4.1 Background

Our food choices are strongly influenced by the food environment, which currently stimulates unhealthy and unsustainable rather than healthy and sustainable food choices [1, 2]. The food environment can be defined as the collective physical (availability, quality, promotion), economic (costs), policy (rules), and socio-cultural (norms, beliefs) surroundings, opportunities, and conditions that influence food choices and nutritional status [3]. Unhealthy diets are major contributors to overweight, obesity, and non-communicable diseases (NCDs), such as type 2 diabetes and cardiovascular diseases [4, 5] and unsustainable diets such as the high consumption of animal-based foods have a negative impact on environmental sustainability [6]. A healthy and sustainable diet contains high-nutrient foods including a diversity of fruits, vegetables, legumes, unsalted nuts and unsaturated oils, whole grain products, and is low in animal-source foods, saturated and trans fats, refined grains, highly processed foods, and added sugars [6]. Implementing a healthy and sustainable food environment supporting healthy and sustainable food choices may have significant beneficial implications for both human and planetary health, also in terms of increased health equity, growth of sustainable food systems, and ultimately reducing healthcare costs [6, 7]. For example, a healthy and sustainable food environment is one where nutritious and environmentally friendly food options are the default. These options are affordable, widely available, and actively promoted, making it easy and appealing for individuals to make healthier and sustainable food choices.

Hospitals have an exemplary role to play in promoting health and well-being and it is therefore important that hospitals implement a healthy and sustainable food environment that guides patients, staff, and visitors towards healthy and sustainable food choices [8, 9]. The hospital setting can promote health for patients, as research has shown that nutrition plays a critical role in recovery, enhancing patient outcomes and preventing diseases [10, 11]. A healthy and sustainable food environment in hospitals must accommodate the nutritional requirements of all individuals, both those with specific clinical dietary needs and those without. For example, hospitalized patients often face a higher risk of malnutrition or require elevated protein intake [12], while others, including staff and visitors, benefit from adhering to general dietary guidelines [13]. Moreover, the hospital setting includes a large number of employees, which provides the opportunity for hospitals to promote a healthy and sustainable work environment and to keep employees healthy by providing healthy foods during their working hours [14]. Additionally, hospitals receive a significant number of visitors for whom this setting can fulfill an exemplary role when it comes to health [15].

The current literature on the hospital food environment showed that the foods available and offered are primarily unhealthy and unsustainable [16,17,18,19,20]. In recent years,

there has been growing awareness for the need of healthy and sustainable food environments in general as well as specifically in hospitals. For example, the Dutch government has set the ambition that in 2025, 50% of hospitals offer healthy foods to patients, visitors, and staff, and in 2030 all hospitals should reach this goal [21]. To support the hospital ambition of the government, the Dutch Ministry of Public Health, Welfare and Sports commissioned a national program in 2018, called "A Taste of Excellent Healthcare" (TEH) (in Dutch: Goede Zorg Proef Je) [22]. The TEH program aims to support and help hospitals improving the food environment for patients, staff, and visitors, and is executed and led by the Dutch Nutrition & Healthcare Alliance (a national expertise center in nutrition and healthcare) [23]. The scientific bases for the TEH program are the 2015 Dutch food-based dietary guidelines [13] and the ESPEN guidelines for hospital nutrition [12] for patients, and the Guidelines Eating Environments of the Dutch Nutrition Centre [24] for staff and visitors. Across the globe, several other initiatives show promising efforts for a transition of the hospital food environment. For example, in New York City, many hospitals joined a program that led to improvements of the hospital food environment [25]. In Australia, a state-wide policy was introduced for a healthy food environment in all healthcare facilities, including hospitals [8, 26].

It has been recognized that changing the food environment in the hospital setting is a complex transition, which requires a systemic approach for a drastic shift in the entire hospital organization [18]. It involves changes at various levels of the organization, with a variety of stakeholders who have different roles and distinct spheres of influence. So far, previous studies evaluating implementation of healthy food initiatives in hospital or healthcare settings have already identified that resources, support, and communication are essential factors influencing implementation of strategies to improve food environments [27, 28]. Known barriers for implementing change in hospital food environments are, e.g., budget constraints, logistical barriers, lack of resources, time constraints, customer complaints, resistance, and lack of support [18, 28, 29].

To the best of our knowledge, there are currently no studies examining how a healthy and sustainable food environment through the entire hospital organization can be realized. Only specific aspects of the food environment have been examined, for example, the evaluation of the implementation of healthier foodservice guidelines in hospital cafeterias [28] or adopting sustainable food service practices [29]. Furthermore, the perspectives of all stakeholders across all levels of the hospital organization are not often analyzed in one study. Often, only a specific group of stakeholders was considered, for example, only the perspectives of hospital food outlet retailers concerning the implementation of healthy food procurement policy [30]. To achieve a sustained transition of the entire hospital food environment for patients, staff, and visitors towards a healthy and sustainable food environment, it is important to study this in a more holistic way,

incorporating both the full food environment and a variety of stakeholders in all levels of the hospital.

Therefore, the aim of this study was to gain insight into the factors that influence the implementation of actions to enhance the healthiness and sustainability of the food environment in the hospital setting in the Netherlands, from the perspective of different stakeholders in this setting.

4.2 Methods

Context

This study was part of a project that was financially supported by a grant (grant number 162135) from the Regio Deal Foodvalley, a collaboration between the Dutch government and different regional governments, entrepreneurs, education, and knowledge institutions, including the Nutrition & Healthcare Alliance, a national expertise center that aims to realize health benefits by applying scientific findings on nutrition and exercise in prevention and healthcare. The TEH program is funded and supported by the Dutch government, following the National Prevention Agreement of 2018, which is an agreement aiming to achieve a healthier Netherlands, signed by the Dutch government and several public and private organizations [21]. One goal in the agreement focuses on the food environment in hospitals and states that by 2025, 50% of hospitals are expected to offer healthy foods to patients, staff, and visitors, with the goal of reaching full implementation in all hospitals in the Netherlands by 2030. The Nutrition & Healthcare Alliance and the TEH program started a learning network with 20 hospitals that committed to accelerating achieving the goal in the agreement: realizing a healthy hospital food environment by 2022. This group of 20 hospitals is called the frontrunner hospitals [31, 32]. A prerequisite to be a frontrunner hospital was to have a vision on healthy food for patients.

Study design

This qualitative study aimed to identify factors influencing the transition towards a healthy and sustainable food environment in frontrunner hospitals in the Foodvalley region in the Netherlands. Our study adopts an interpretivist design rationale, as it explores a complex reality from subjective experiences and perspectives of different stakeholders [33]. Results were reported guided by the Consolidated criteria for reporting qualitative research (COREQ), please see Supplementary file 1 [34].

Ethics

Prior to the interview, participants received information about the study via email, including the goal and purpose of the interview and study. All participants provided informed consent. The Social Sciences Ethics Committee of Wageningen University & Research approved this study (reference number 2021-38-Wierda) and it complies with the Netherlands Code of Conduct for Research Integrity.

Participant recruitment

The hospitals were chosen based on their location in the Foodvalley region in the Netherlands, as this was the study area of the overall research project this study was part of. Four frontrunner hospitals were identified and were approached for participation in this study, of which one hospital was unwilling to participate due to their self reported time constraints. In 2022, semi-structured interviews were conducted in three hospitals (an academic, top-clinical, and general hospital). The participants were recruited with support of the network of the Nutrition & Healthcare Alliance, who had contacts within these hospitals, as these hospitals were part of the TEH program. Either an email address was provided and the first author (JJW) made the initial contact, or the Nutrition & Healthcare Alliance introduced the participants via email. Additionally, we asked participants if they could suggest a colleague that fulfilled the inclusion criteria and whom we should also interview. Hospital staff were eligible to participate if they were professionally engaged with the food environment or had a significant role in shaping its structure within the hospital food system. We recruited participants among four stakeholders groups within each hospital: facility professionals, project coordinators, healthcare professionals, and board of directors. The target number of participants for this study was based upon the stakeholders that were identified by the three hospitals (i.e., a convenience sample), spanning all organizational levels from facility staff to board directors, ensuring representation of each stakeholder group.

Interview guide

We used the Consolidated Framework for Implementation Research (CFIR) to guide the interviews [35]. CFIR consists of constructs across five domains, the innovation, the outer setting, the inner setting, the individuals, and the implementation process domain. We were guided by the CFIR framework in this study, although not all CFIR components were included. The interview guide helped to explore the various factors that influence the implementation of a healthy and sustainable food environment in the hospital setting. Topics that were asked were, for example, commitment of management level, vision and goals for the hospital food environment, motivation for the transition, and available resources (see Supplementary file 2 for the interview guide). We developed the questions for the semi-structured interviews guided by the CFIR framework, relevant literature, our previous study where we characterized the food environment [18], and team discussions

to ensure alignment with the research objectives. We tailored the topic list to the specific role of the interviewee in the implementation process. For example, in interviews with management, we placed less emphasis on questions regarding practical implementation, whereas in interviews with operational staff, we de-emphasized questions related to allocated financial resources. This approach provided flexibility, but may have introduced some variability in the data collected across the different roles of the participants. Prompts and probes were used to encourage deeper responses or to clarify participants' answers when necessary.

Data analysis

Interviews were conducted in Dutch by the first author (JJW). In general she was not involved with the participants beforehand, except that she had interviewed one participant previously for a different study [18]. The interviews were transcribed verbatim by an external company (Transcript online) [36]. Participants did not comment on the transcripts or the findings. All verbatim transcripts were anonymized and thematically analyzed. The data analysis was guided by several phases including all authors, JJW (PhD candidate at time of the study, female) and FvN, SKD, MPP (PhDs, females, experienced qualitative researchers). First, three of the four authors (JJW, FvN, and MPP) each independently read a selected different transcript, each from a different stakeholder group and a different hospital to capture diversity, and open coded that interview. Then, these three authors met in person to discuss and organize all codes under each CFIR domain. The three authors combined their individual codes into a single set, and then collaboratively organized these codes into the CFIR domains. Some codes were merged, because they represented the same concept, thereby excluding some initial codes, while other codes remained distinct. The first author then reviewed and refined these codes, consolidating duplicates and adjusting certain terms to better capture the nuances of the data. The final codebook was discussed and agreed upon by the entire research team (please see Supplementary file 3 for the code book). Then, two authors (JJW and SKD) coded separately the same interview with this code book to create consensus. The two authors discussed their codes for the specific interview, reviewed all the codes, and no major differences emerged. There was consistency in coding by both authors, and after discussing a few nuanced differences, consensus was reached. The code book was used by the first author (JJW) to code all interviews via the analysis software ATLAS.ti (version 22) [37]. In consultation and discussion with all authors for organization of the data, codes were reviewed for similarities, redundant codes were merged, and relating codes were grouped into themes, with the CFIR as guiding framework for grouping the codes into themes. Data were also organized and interpreted per stakeholder group. The findings comprehensively aligned with the data. Quotes from participants were used to illustrate the presented findings including an identification of the participant. The quotes were selected based on their

relevance and suitability to best illustrate the themes discussed and align with the study's objective. Illustrative quotes were translated from Dutch to English.

4.3 Results

Interview procedure and participant characteristics

The interviews were conducted between May and November 2022. In total, 29 interviews were conducted with 30 participants (one duo interview), of which 12 interviews in hospital one, 10 interviews in hospital two, and 7 in hospital three. A total of 18 interviews were conducted online via Microsoft Teams or by telephone and 11 interviews in person in the hospital. The interviews were audio-recorded and lasted between 24 and 70 min. A description of the characteristics of the participants can be found in Supplementary file 4. Some participants fulfilled a position that could be classified in multiple stakeholder groups: 11 participants were categorized in the facility stakeholder group (e.g., chef, team leader of the nutrition and hospitality department), 9 participants as project coordinators (e.g., department manager of hospitality services), 9 participants as healthcare professional (e.g., dietitian, gastroenterologist), and 3 in the board of directors (e.g., chairperson of the board of directors, management team). All three hospitals included representation from each stakeholder group, except in one hospital no one from the board of directors was willing to participate in this study.

Key factors that influence the transition towards a healthy and sustainable hospital food environment

Table 1 describes an overview of the factors influencing a transition towards a healthy and sustainable hospital food environment.

THE OUTER SETTING

Factors within the outer setting that affected the realization of a healthier and more sustainable food environment in hospitals were momentum for change, government-established policies and guidelines, collaboration and networks outside the hospital, and caterers' and suppliers' food offerings, interests, and contracts.

Table 1 Factors influencing a transition towards a healthy and sustainable hospital food environment

Main theme	Subtheme
The outer setting This theme includes several factors and societal developments outside the hospital boundaries that affect the realization of a healthier and more sustainable food environment within hospitals	Momentum for change Government-established policies and guidelines Collaboration and networks outside the hospital Caterers' and suppliers' food offerings, interests, and contracts
Innovation domain This theme describes factors concerning the implementation of a healthy and sustainable food environment, supported by the TEH program (A Taste of Excellent Healthcare)	Familiarity with the TEH program Compliance with the TEH program
Support at all levels This theme describes factors related to support for a healthy and sustainable food environment	Achieving organizational buy-in End user interests Communication as a strategy for gaining buy-in
Inner setting This theme describes factors related to the hospital setting in which a healthy and sustainable food environment is implemented	Key priority in policy and having a vision Available resources Infrastructure within the hospital Ambassadors Gradual process with continuous effort
Individual domain This theme describes influences and roles of individuals involved in the implementation of a healthy and sustainable food environment in hospitals	Personal drive

Momentum for change

Some participants mentioned that there was increased attention and awareness for prevention and a healthy lifestyle in society in general. This created momentum for change to healthier and more sustainable food environments in their hospital and enhanced the awareness among the entire population. Additionally, a few participants mentioned that recent experiences with the COVID-19 pandemic reinforced this momentum for a healthier environment. However, these participants indicated at the same time that the COVID-19 pandemic had delayed the realization of a healthy and sustainable food environment in hospitals, for example, because of staff shortages and a deteriorated financial situation of caterers and suppliers, causing less emphasis on development and innovation of healthy and sustainable food products. Yet, a shift towards a healthier environment is still needed, emphasized by a healthcare professional: "*Before a hospital truly embraces nutrition, prevention, health promotion, that requires a significant shift, especially if you always focused solely on illness.*" P21, healthcare professional/project coordinator.

Government-established policies and guidelines

As a helpful guidance in achieving a healthy and sustainable food environment, participants often mentioned that the clear goals and targets set by the National Prevention Agreement [21] provided them the urgency to change: "*[…] And we just have to achieve that goal, because we signed the [NPA] agreement.*" P2, facility professional. In addition, many participants indicated that the tools and guidelines of the National Nutrition Centre with respect to healthy and sustainable diets and food environments are supportive in achieving this goal. However, a participant also illustrated: "…*hospital patients often require more protein and energy, more frequent eating moments, and sometimes more compact foods with higher energy density. As a result, it may not always fully align with the [Dutch] Dietary Guidelines.*" P8, healthcare professional.

Collaboration and networks outside the hospital

All three participating hospitals were located near a university that facilitated collaborations with academics and provided them with knowledge and skills that supported the transition towards a healthy and sustainable food environment. Furthermore, all three hospitals acknowledged that the national learning network of hospitals set up by the TEH program of the Nutrition and Healthcare Alliance supported them in various ways, such as sharing best practices, learning from each other, and benchmarking their performance against other hospitals, as illustrated by: "*What we have particularly benefited from is the motivation it [the TEH network] gave and the contacts with other hospitals that emerged there. So doing it together with [hospitals] in the entire country.*" P19, healthcare professional.

Caterers' and suppliers' food offerings, interests, and contracts

Participants indicated that in each hospital a cooperative and committed food supplier and/or caterer was essential in the transition towards a healthy and sustainable food environment. Illustrated by: "*[…] it depends to some extent on the willingness of the caterer to move forward. And we might be lucky with that, that it went smoothly.*" P23, project coordinator. However, some issues with caterers and suppliers were not in favor of the transition. First, facility professionals, project coordinators, and board of directors participants indicated that caterers and suppliers were generally willing to cooperate and to innovate, but emphasized that commercial and financial interests took precedence and sometimes hindered the preferred transition. Moreover, some participants mentioned that caterers' profit was mainly obtained from the sale of unhealthy products: "*Next to a cappuccino, the second best-selling product is a sausage roll and then a croquette [fried meat snack]. That's just profit.*" P3, facility professional. Second, mostly facility and project coordinator participants mentioned that the product range of the caterer or supplier was not always sufficient to achieve a healthy and sustainable food environment. Finding alternative products was mentioned to be challenging and the market did not always

seem ready for it: "*For example, finding alternatives to meat products was very difficult.*" P23, project coordinator. Furthermore, some healthcare professionals mentioned that clinical dietary requirements, for example, that of patients with increased protein needs, must be assured, especially in the transition towards sustainable food environments. As illustrated by a participant: "*Of course, we now also have a much stronger focus on plant-based foods, which is quite more complicated for patients, because we say – it [a more plant-based diet] should not come at the expense of patients' protein needs.*" P7, project coordinator. Finally, the long-term contracts without an emphasis on health and sustainability targets were observed as an obstacle for creating a healthy and sustainable food environment in the short term. Participants indicated that because of such contracts they were, for example, not always in charge of what was offered, or that they were dependent on fixed menus provided by the external party or were only able to use fixed order lists (e.g., with pre-defined products). Moreover, those with in-house management of food provision expressed the greater flexibility for changing foods and meals offered: "*Of course, we [the restaurant] are managed in-house, which really makes a big difference. So we are not tied to fixed recipes or fixed order lists.*" P5, facility professional. What worked in some hospitals were negotiations: "*So I put pressure on the suppliers, I negotiate with them to renew and improve their food offerings. And that's exactly what happened.*" P13, board of director. Including healthy and sustainable foods in a Statement of Requirements (i.e., document with requirements, criteria, and conditions that a potential product or service must meet to be purchased in, for example, a procurement process) for suppliers was also regarded as facilitating: "*This was clearly stated as a requirement in our tender to all external suppliers. Naturally, they have to be able to comply with that.*" P5, facility professional. Uniting as hospitals towards producers and suppliers, the power of the collective, was put forward by participants as a solution to increase the demand for more healthy and sustainable products.

INNOVATION DOMAIN

Factors within the innovation domain that affected the realization of a healthier and more sustainable food environment in hospitals were familiarity and compliance with the TEH program.

Familiarity with the TEH program

Many of the participants were not familiar with the TEH program; only a small part of the participants recognized the name and knew the program, especially the facility and project coordinators. Illustrated by a project coordinator: "*… people sometimes really don't know the TEH. But they don't know the National Prevention Agreement either, so- And that, I think, is the biggest challenge for all of us. Like, how do you get it to people on the floor?*" P7, project coordinator. Healthcare professionals also often knew little about TEH: "*Because they approached me quite at a final phase as a medical specialist.*" P21, healthcare profes-

sional/project coordinator. A participant from the board of directors described it as follows:

> *And I don't know whether TEH is widely known in the hospital, but its effects are widely known in the hospital. […] if you randomly ask a nurse here about TEH, that person may not be able to place it, but at least knows that we are working on nutrition.* P11, board of director, May 24, 2022

The hospitals incorporated TEH into their own projects, in which the objectives of TEH were reflected: "*We don't call it TEH, but we call it [unique name of project in hospital]. But actually, it's the same thing.*" P17, project coordinator.

Compliance with the TEH program

Most participants familiar with TEH mentioned that the program served as a driving force to accelerate the transition by providing them guidance and serving as a strong incentive. Hospitals wanted to comply with the requirements. Moreover, participants stated that the TEH program was a key incentive for participation, because it involved all hospitals and other healthcare institutions in the Netherlands to work towards the same goal.

Participants mentioned that within the TEH frame there was freedom how to implement the transition. A project coordinator expressed that the degree of freedom should be limited in implementation and deviation from agreements on realizing a healthy and sustainable hospital food environment: "*But hospitals evaluate their own food environment. And my experience is that everyone interprets it differently and that the criteria that are set are therefore not always implemented in the same way.*" P23, project coordinator. Additionally, a few participants mentioned that consensus was lacking about when you succeeded with the TEH program. The facility and project coordinator stakeholders described the criteria for what constitutes a healthy and sustainable food environment mainly at product level, while other participants mentioned the "TEH criteria" and the NPA as the ultimate goal.

Support at all levels

Factors within the theme support at all levels that affected the realization of a healthier and more sustainable food environment in hospitals were achieving organizational buy-in, end user interests, and communication as a strategy for gaining buy-in.

Achieving organizational buy-in

Having support of colleagues throughout the entire hospital organization was mentioned by many participants from all stakeholder groups as a key facilitator for implementing a healthy and sustainable food environment in their hospital. Improving food environments needs endorsement throughout the entire hospital organization: "*I believe the real*

difference lies in having a shared direction and actively working on it." P8, healthcare professional, and "*What I think is also a very important one is that you really have to include all levels.*" P19, healthcare professional. Participants with a management position stated the following: "*It is essential to realize that when management and middle management do not fully support the initiatives, expecting support from the executive people becomes unrealistic.*" P12, healthcare professional/board of director.

Participants from the board of directors also mentioned that they tried to provide managerial support, e.g., by providing resources and sharing the vision for the transition, to implement a healthy and sustainable food environment and they indicated that this support was necessary. Participants from the other stakeholder groups also perceived the managerial support as positive; it was considered necessary that the board of directors took a firm stance on the transition. Illustrated by a project coordinator: "*You are highly dependent on visionary leaders for your innovative capacity*," P30, project coordinator. Some facility stakeholders perceived the managerial support as being more distant: "*Sometimes it feels as if we need to push it up from the lower levels, whereas ideally, it should be more like a blanket covering the entire organization.*" P5, facility professional.

End user interests

The interviews revealed that the attitude of the end user, i.e., patients, staff, and visitors, towards a healthy and sustainable food environment in the hospital often varied and were perceived differently by the various stakeholder groups interviewed. Especially facility stakeholders elaborated on the resistance topic and mentioned that often patients found a healthy and sustainable food offering acceptable, however most of the resistance towards a healthy and sustainable food environment came from hospital staff, as illustrated by: "*And the staff of the hospital also have to get used to it. When they come to us, they are always more critical than the guests, the visitors, for example.*" P3, facility professional, and "*The biggest complainers are the staff.*" P25, facility professional. One hospital practiced with role plays how facility stakeholders could react to guests who showed resistance to overcome this barrier. Participants from the facilities stakeholder group also believed that especially the staff, including medical staff, had to set the right example: "*If I have to engage in a discussion with a physician, something seems to go wrong in my perception, as you expect that especially from the core of the hospital, the (medical) specialists, should know what healthy food is.*" P5, facility professional. It was mentioned multiple times from the facility stakeholder group that it sometimes felt like the transition was coming from them, as if they were the ones that determined what someone can and cannot eat, because the facility staff received first hand feedback. A few healthcare professionals echoed this; they also mentioned that the criticism was greater among staff than among patients and that staff felt patronized more often. As illustrated by: "*Staff – there is really huge criticism that there is now more plant-based food in the restaurant and then you really hear people*

grumble like I should be able to choose what I want." P21, healthcare professional/project coordinator. In all stakeholder groups, participants mentioned that resistance and criticism from patients, staff, and visitors are inevitable during a transition, but emphasized the importance of persevering with the change, dealing with resistance, and giving it time: "*Then I think, you are not yet the early adaptor or the innovator, you are a laggard. Time will take care of it […], I am trying to focus mainly on the people who are naturally involved in this.*" P27, project coordinator.

Generally, it was stated in all stakeholder groups that a healthy and sustainable food environment is inherent to a hospital and that a hospital has a role model function and a unique position towards healthy nutrition for patients, but also for its staff. It was also mentioned by project coordinators that those few hospital days can make a difference in ensuring that someone is well-nourished. There was also some countervailing opinion: "*However, when examining where the actual problems lie, they are often more related to lifestyle, living environment and individual behaviors at home. And in that context, what you offer in hospitals is honestly speaking just a drop in the ocean*," P30, project coordinator. A healthcare professional outlined some conflicting interests occasionally heard among medical specialist regarding the role of the hospital:

> *Why focus on prevention? On health promotion? We are a hospital. We are dealing with sick individuals; that should not be part of this. All of that needs to be addressed in primary care, or even zero-line care (care provided outside formal healthcare)*. P21, healthcare professional/project coordinator, July 14, 2022

A healthcare professional also stated: "[…], *the core business, so to speak, is essentially just running the hospital*," P1.

Communication as a strategy for gaining buy-in

Communication about the transition towards a healthy and sustainable food environment was mentioned multiple times by several participants from all stakeholder groups as a crucial strategy to gain support and overcome resistance. In particular to explain "the why" and the reasons for the transition and take people along the journey, articulate the importance across the entire hospital, continuously involve and enthuse people in a positive way, and maintain continuous and timely communication: "*I believe that is key, […], timely communication and thoroughly explaining why you are implementing particular actions.*" P24, project coordinator.

Several participants emphasized the importance of collaborating with colleagues of the communication department from the start of the transition. Examples of effective communication strategies included engaging in conversations with employees, organizing

lunch sessions, face-to-face conversations, and offering tastings: "*Continuing the dialogue with employees and letting them taste the changes. Involve them in the transformation. That is truly change management*." P17, project coordinator. A facility stakeholder mentioned that they did not explicitly communicate changes and had few negative reactions: "*But we also did not publicize it widely. We did not say, from Monday we will replace three types of [name of sweetened carbonated soft drink] for one and we also put water flavorings next to them.*" P5, facility professional.

Important in the communication was tailoring information on the food environment transition to different target groups. Facility stakeholders mentioned that they aimed to encourage people to make healthy choices rather than prohibiting unhealthy ones: "*It remains quite challenging to engage everyone without becoming patronizing. […], you have got to give it a bit of a nice twist and you have got to keep it fun.*" P10, facility professional. Several participants mentioned that the main part lies in healthy food, but that there should also be room for unhealthy food. Healthcare stakeholders primarily discussed the importance of communicating with their patients. Participants also stressed the importance that "the how and why" of a food environment transition should also be effectively communicated to the service assistants, who distribute food and drinks to patients: "*You have to turn all the radars, and the radar of the service assistants is of course also extremely important in this.*" P17, project coordinator.

INNER SETTING

Factors within the inner setting that affected the realization of a healthier and more sustainable food environment in hospitals were key priority in policy and having a vision, available resources, infrastructure within the hospital, ambassadors, and gradual process with continuous effort.

Key priority in policy and having a vision

All stakeholder groups noted that having a written document, often a policy or vision document with, e.g., goals, served as a reference and guidance for the entire hospital organization and facilitated the realization of a healthy and sustainable food environment. Specifically project coordinators mentioned the importance of including the goals to improve the hospital food environment in a vision and policy document: "*It is so deeply embedded in the vision of the [name of the hospital], making it also embedded in the entire food concept for all three target groups [patients, staff, visitors]*," P7, project coordinator. Another participant gave the example of having a contract or Key Performance Indicators (metrics to evaluate organizational performance): "*Ensure that things are documented. […] This way, you can keep holding each other accountable for the goals you have set together*," P23, project coordinator.

Available resources

The majority of participants indicated that enough available resources, manifested in time, budget, and personnel facilitated the transition towards a healthy and sustainable food environment. They explained that the transition was accompanied with enhanced procurement costs and often required extra time of staff. However, most participants mentioned that they regarded working on the transition as part of their day to day work: "*All the time I spend on this falls within my regular hours*," P1, healthcare professional. They indicated that the implementation phase took more time but that eventually it should be integrated into their regular tasks. They experienced the given freedom by the hospitals as facilitating and it helped them to be creative and try new things in order to achieve a healthy and sustainable food environment: "*… you can just do what you want to do, you don't have to ask for permission for everything from above.*" P10, facility professional. Some participants of the board of directors, project coordinators, and some facility professionals mentioned that resources had been expanded, for example, in the form of hiring external project managers and the allocation of budget. Participants from the healthcare professionals, project coordinators, and facility staff all mentioned that staff shortages and a lack of qualified personnel were factors that hindered the transition to a healthy and sustainable food environment.

Infrastructure within the hospital

Participants from all stakeholder groups noted that there was an infrastructure present within the hospital that supported the implementation of a healthy and sustainable food environment. Participants said that extensive use was made of project groups, work groups, steering groups, and advisory boards, which facilitated and were crucial for collaboration, coordination, and taking decisions. Often these infrastructures were already existing structures related to nutrition and sometimes specifically established for this purpose: "*A project team has been established for that [the transition] purpose, and a project coordinator is also assigned to it.*" P4, project coordinator. Participants also said that these project groups were important for progress and decision-making: "*… Otherwise, progress would be hindered […] Because everyone has an opinion about food and drinks.*" P17, project coordinator. In those project groups, many disciplines, perspectives, and departments were represented, as a participant illustrated that this contributed to generating support and ownership: "*because almost all departments are represented, this prevents any single department from questioning, 'how could you have done that?'*," P7, project coordinator. Participants also noted that it was important to represent and involve everyone: "*People need a medical specialist or a nurse, someone from facility, someone from procurement. Only when all those parts come together, it will succeed*," P12, healthcare professional/board of directors.

Ambassadors

Ambassadors for realizing a healthy and sustainable food environment in the hospital were seen as key by participants to engage, enthuse, and motivate people for a healthy and sustainable food environment: "*You also need true champions at all levels, so among the paramedics, the nursing staff, medical specialists, support staff, facility staff, of course, and among kitchen personnel.*" P12, healthcare professional/board of directors. Project coordinators from one hospital mentioned that they specifically designated ambassadors to tell the story about their project translation of TEH across the hospital. In fact, most of the participants had taken on the ambassador role themselves: "*I think that we […] have taken the lead with the three of us to advance to this stage*," P24, project coordinator.

Gradual process with continuous effort

Participants from all stakeholder groups mentioned that the transition towards a healthy and sustainable food environment requires time and is a slow and not always easy process; it is a process that is continually evolving. Participants from the board of directors mentioned that continuous investments are needed and that requires several years before a hospital truly embodies it: "*And then, still, I mean, it is not a project, it is truly akin to a form of DNA or a mindset that you have to adopt on all fronts.*" P11, board of director. It was in particular mentioned that changes were implemented gradually, in phases and with a learning approach, illustrated by: "*We did not start everything we wanted at once. So we are implementing it in phases.*" P22, healthcare professional. Almost all participants indicated that the ongoing transition was likely to proceed: "*These changes are irreversible, figuratively speaking. They initiated it, it is in motion, and it is unlikely that we will reverse it quickly.*" P6, project coordinator. In addition, participants emphasized the importance of monitoring changes and ensuring that efforts continue, for example, via patient and customer satisfaction surveys, monitoring product procurement changes via systems of caterers and suppliers and monitoring the Key Performance Indicators (metrics to evaluate organizational performance) that were established during the procurement process.

INDIVIDUAL DOMAIN

A factor within the individual domain that affected the realization of a healthier and more sustainable food environment in hospitals was personal drive.

Personal drive

The majority of participants saw it as their responsibility to contribute to the transition, either from their professional position or from their own intrinsic motivation. Participants considered it an important topic to work on and aimed to improve the food environment: "*We strive to provide people healthy food that contributes to quick recovery*," P2, facility professional. Some healthcare stakeholders said that they had to give the right example and "the white coat effect" also helped. One participant illustrated this by referring to chang-

ing the food environment in the hospital as personal mission: "*In general, it is my mission to improve that health is a standard part of medical treatment.*" P27, project coordinator.

4.4 Discussion

This qualitative study identified various factors influencing the implementation of a healthy and sustainable food environment in hospitals, as perceived by different stakeholder groups throughout the hospital. We found several important insights. First, this study identified multiple influencing factors in various domains within and outside the hospital as perceived by the stakeholders, ranging from internally available resources to external government established guidelines and from the personal drive of key stakeholders to societal momentum for change. Second, participants from all stakeholder groups encountered unique challenges and opportunities that affect the implementation of a healthy and sustainable food environment. These outcomes highlight the importance of engaging a diverse array of stakeholders at all levels of the organization in this process, along with tailored implementation strategies.

One of the main facilitators identified by all stakeholder groups for enhancing a healthy and sustainable food environment in the hospital setting was having support and motivation at all levels in the hospital. Lack of support or motivation was at the same time perceived as a strong barrier for improving hospital food environments. To gain support from each stakeholder group, tailored strategies and customized communication approaches were mentioned as helpful strategies, for example, doing role plays how to deal with resistance instead of emailing such information. The need for support and motivation observed in our study are factors that are consistent with previous research in the hospital setting. A prior study of barriers and facilitators when implementing the protein transition—shifting dietary patterns from animal-based proteins towards the use of plant-based and alternative protein sources [6, 38]—in public food procurement, including hospitals, noted support and motivation as one of the five main themes for successful adoption [38]. A scoping review to understand implementation of local food procurement in healthcare foodservices mentioned organizational support, passionate leaders, and step-by-step changes as enablers [39]. This study adds to these insights and showed that the support or motivation for the implementation of a healthy and sustainable food environment was perceived different by each stakeholder group. Healthcare professionals expressed support in particular for a healthy food environment to cure their patients, compared to, for example, project coordinator stakeholders who were motivated to create a healthy and sustainable food environment for all their guests—hospital patients, staff, and visitors. Commitment and support from management was seen as crucial by participants for the transition to a healthy and sustainable food environment. This is in

line with other studies that mentioned those aspects as essential for disseminating the innovation through an organization [40, 41]. A review analyzing policy implementation processes of healthy hospital retail policies in Australia found similar factors for successful implementation [42]. They mentioned among others support and acceptability from all stakeholders in the hospital including management, retailers, staff, and visitors. The three frontrunner hospitals in our study already had commitment from management level at the moment they signed a declaration for participation in the TEH program and intention to change the food environment. This might have helped in the realization of a healthy and sustainable food environment. A systematic review exploring factors that influence sustained implementation of hospital-based interventions also mentioned that having the management team on board was a frequently reported facilitator [43]. However, some stakeholders emphasized the importance of being vigilant to ensure that commitment to such a national program aimed at improving the food environment is genuine rather than merely symbolic.

Another observation from our study was the perceived existence of resistance for a healthy and sustainable food environment among stakeholders, particularly among hospital staff. A few participants of the healthcare stakeholder group experienced that not all medical specialists did perceive prevention as the responsibility of the hospital setting and that a hospital should be focused on cure, and prevention is something that should be addressed earlier in the care pathway. Staff resistance was also a challenge found in a study to identify the drivers of sustainable hospital food services [44]. A possible explanation for the resistance of staff could be that staff might express more concerns, since they encounter the food environment in the healthcare setting on a daily basis, whereas patients and visitors typically have shorter interactions. Another explanation for resistance of stakeholders (including staff) could be that people do not want to be patronized when it comes to food choices, or people see it as individual responsibilities of consumers, while the focus should be shifted from the individual to strategies focused on improving the (food) environment, thereby improving public health [45]. These particular results illustrate barriers for adoption, which is in line with the diffusion of innovation theory of Rogers that shows that it is common that not everyone is instantly receptive to change [40]. Innovators and early adopters start implementing, yet the late majority and laggards need more to be convinced and only accept an innovation when it is widespread and broadly accepted and adopted by a majority of stakeholders of a hospital organization. Therefore, it is important to have tailored implementation strategies in place that include among others having ambassadors, positive communication, and explaining the why, as also appeared from our study, to address these perceived barriers of non-adopting individuals [46].

Interests and experiences of participants from all stakeholder groups in the hospital organization varied regarding the implementation of a healthy and sustainable food environment, which has been observed in other studies as well. To illustrate, a study on the transition of the food environment in nursing homes found that staff members' attitudes differed when the transition impacts their workflow (e.g., kitchen staff was the most resistant to change) versus when they gain from the change (e.g., management) [47]. In our study, for example, facility stakeholders had their main focus on improving the product assortment, while healthcare staff mainly focused on optimizing the food environment to enhance patient satisfaction and health. Furthermore, it is important that the food environment can be tailored to the nutritional needs of hospitalized patients (e.g., diet high in energy and protein). Providing more plant-based foods is often more challenging for specific groups such as patients, as compared to animal proteins, plant-based foods generally provide less complete protein nutrition due to differences in essential amino acids and digestibility [48]. As a result, a larger volume of plant-based foods is often required to achieve an adequate protein intake of sufficient quality, which can be challenging for patients, particularly those with poor appetite or early satiation [49]. The diverse stakeholder interests and experiences confirm again that changing the food environment in the hospital setting is complex, showing that it is important to ensure that all stakeholders are motivated and aligned when it comes to the realization of a healthy and sustainable food environment.

A strength of the study was that the realization of a healthy and sustainable food environment for patients, staff, and visitors was explored from a broad variety of different perspectives through the entire hospital system. Stakeholders through the entire hospital were incorporated in this study, from facility (e.g., nutrition assistant, kitchen staff member), management (director), healthcare (e.g., dietitian, physician), and project coordinator (e.g., project leader nutrition) levels. The process towards the realization of a healthy and sustainable food environment in the hospital setting was robustly explored in a systematic way guided by the CFIR framework, thereby creating a deep understanding of the factors underlying and influencing the implementation. Three diverse hospital settings (academic, top clinical, general) were followed during their ongoing process of enhancing the food environment which contributed to the generalizability of the results, providing real world insights into their implementation processes. However, when considering generalizability, there are also a few limitations. First, the three hospitals were frontrunner hospitals in the transition towards a healthy and sustainable food environment. One could argue that these hospitals are more likely the "believer" hospitals who are actively pursuing the transition ambition. It is also important to note that we did not independently verify the extent to which they had actually changed their hospital food environment into a healthy and sustainable one; we relied solely on the fact they committed to be frontrunner hospitals and the accelerated attainment of the NPA ambition. It would also be interesting to study how hospitals not affiliated to TEH would implement

such a transition. Another limitation is that we did not include the end user, the patient or hospital visitor, and external catering companies or supply companies. Therefore, future research should focus on assessing the generalizability of the outcomes by validating them in different hospitals as well as with other stakeholders (e.g., patients, end users, government, suppliers). An additional limitation may be that no explicit definition of a healthy and sustainable food environment was provided for participants and they had to rely on their own definitions. We did explain that the interview focused on the food environment for patients, staff, and visitors.

The results of this study can be used to provide all hospital stakeholders and policy makers with insights into the factors influencing the implementation of a healthy and sustainable food environment thereby highlighting potential areas and issues to address. It is important to address multiple themes on which facilitators and barriers may occur: the outer setting, with momentum for change, government-established policies and guidelines, collaboration and networks outside the hospital, and caterers' and suppliers' food offerings, interests, and contracts; the innovation domain, with familiarity and compliance with the TEH program; support at all levels, achieving organizational buy-in with communication as a strategy, and end user interests; the inner setting, with key priority in policy and having a vision, available resources, infrastructure within the hospital, ambassadors, and gradual process with continuous effort; and the individual domain with personal drive. Furthermore, it indicates that compliance with national policy and ambitions does not occur automatically - continuous and long-term efforts are needed. The insights of this study provide potential starting points and strategies for practice, policy and scientific research, how to formulate, tailor, implement, and evaluate policy for enhancing and sustaining the healthiness and sustainability of the food environment in the hospital setting.

4.5 Conclusions

This qualitative research highlights that various factors are perceived to affect the food environment transition in hospitals and it is important to address these factors on which facilitators and barriers may occur, ranging from, i.e., internal resources, support, and communication to external guidelines, policies, interests, and societal momentum for change. Different stakeholder groups encountered unique challenges and opportunities affecting the implementation of a healthy and sustainable food environment. To ensure successful integration of a healthy and sustainable food environment in hospitals, it is crucial to engage diverse stakeholders and address their barriers with tailored implementation strategies. Future research should focus on assessing the generalizability of the outcomes by validating them in different hospitals as well as with other stakeholders (e.g., patients, end users, government, suppliers).

References Chapter 4

1. Larson N, Story M. A review of environmental influences on food choices. Ann Behav Med. 2009;38:56–73.
2. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: shaped by global drivers and local environments. The Lancet. 2011;378:804–14.
3. Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. Prev Med (Baltim). 1999;29:563–70.
4. Branca F, Lartey A, Oenema S, Aguayo V, Stordalen GA, Richardson R, et al. Transforming the food system to fight non-communicable diseases. BMJ. 2019;364:l296.
5. World Health Organization. *WHO European Regional Obesity Report 2022*. Copenhagen: WHO Regional Office for Europe; 2022. Licence: CC BY-NC-SA 3.0 IGO.
6. Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet. 2019;393:447–92.
7. Giskes K, van Lenthe F, Avendano-Pabon M, Brug J. A systematic review of environmental factors and obesogenic dietary intakes among adults: are we getting closer to understanding obesogenic environments? Obes Rev. 2011;12:e95-106.
8. Cranney L, Thomas M, Shepherd L, Cobcroft M, O'Connell T, Munn L, et al. Towards healthier food choices for hospital staff and visitors: impacts of a healthy food and drink policy implemented at scale in Australia. Public Health Nutr. 2021;24:5877–84.
9. Pelikan JM, Krajic K, Dietscher C. The health promoting hospital (HPH): concept and development. Patient Educ Couns. 2001;45:239–43.
10. World Health Organization. *Diet, nutrition and the prevention of chronic diseases: report of a joint WHO/FAO expert consultation*. World Health Organization; 2003;916.
11. Jayedi A, Soltani S, Abdolshahi A, Shab-Bidar S. Healthy and unhealthy dietary patterns and the risk of chronic disease: an umbrella review of meta-analyses of prospective cohort studies. Br J Nutr. 2020;124:1133–44.
12. Thibault R, Abbasoglu O, Ioannou E, Meija L, Ottens-Oussoren K, Pichard C, et al. ESPEN guideline on hospital nutrition. Clin Nutr. 2021;40:5684–709.
13. Kromhout D, Spaaij CJK, de Goede J, Weggemans RM. The 2015 Dutch food-based dietary guidelines. Eur J Clin Nutr. 2016;70:869–78.
14. Witkoski A, Dickson VV. Hospital staff nurses' work hours, meal periods, and rest breaks. AAOHN J. 2010;58:489–97.
15. Whitehead D. Health promoting hospitals: the role and function of nursing. J Clin Nurs. 2005;14:20–7.
16. Horton Dias CE, Dawson RM, Harris DM, Wirth MD, Abshire DA. Foods and beverages available to nurses in hospital cafeterias, vending machines, and gift shops. Am J Health Promot. 2022;36:1133–41.
17. Champ CE, Iarrobino NA, Haskins CP. Hospitals lead by poor example: an assessment of snacks, soda, and junk food availability in Veterans Affairs hospitals. Nutrition. 2019;60:70–3.
18. Wierda JJ, de Vet E, Troost E, Poelman MP. Characterizing food environments of hospitals and long-term care facilities in the Netherlands: a mixed methods approach. BMC Health Serv Res. 2024;24:31.

19. Tsai C, Svensen E, Flood VM, Probst Y, Reilly K, Corbett S, et al. Healthiness of food and beverages for sale at two public hospitals in New South Wales. Australia Nutrients. 2018;10:216.
20. Moran A, Lederer A, Johnson CC. Use of nutrition standards to improve nutritional quality of hospital patient meals: findings from New York City's Healthy Hospital Food Initiative. J Acad Nutr Diet. 2015;115:1847–54.
21. Ministerie van Volksgezondheid, Welzijn en Sport. Nationaal Preventieakkoord: Naar een gezonder Nederland. 2018. https://www.rijksoverheid.nl/documenten/convenanten/2018/11/23/nationaal-preventieakkoord
22. Alliantie Voeding in de Zorg. Goede zorg proef je. https://goedezorgproefje.nl/.
23. Alliantie Voeding in de Zorg. https://www.alliantievoeding.nl/nl/wie-we-zijn.
24. Voedingscentrum. Richtlijn Eetomgevingen. https://www.voedingscentrum.nl/professionals/gezonde-eetomgeving/de-richtlijn-gezondere-eetomgevingen.aspx.
25. Moran A, Krepp EM, Johnson Curtis C, Lederer A. An intervention to increase availability of healthy foods and beverages in New York City hospitals: the Healthy Hospital Food Initiative, 2010–2014. Prev Chronic Dis. 2016;13: 150541.
26. Cranney L, Drayton B, Thomas M, Tang B, O'Connell T, Crino M, et al. Impact and acceptance of a state-wide policy to remove sugar-sweetened beverages in hospitals in New South Wales. Australia Health Promotion Journal of Australia. 2021;32:444–50.
27. Boelsen-Robinson T, Blake MR, Backholer K, Hettiarachchi J, Palermo C, Peeters A. Implementing healthy food policies in health services: a qualitative study. Nutr Diet. 2019;76:336–43.
28. Jilcott Pitts SB, Graham J, Mojica A, Stewart L, Walter M, Schille C, et al. Implementing healthier foodservice guidelines in hospital and federal worksite cafeterias: barriers, facilitators and keys to success. J Hum Nutr Diet. 2016;29:677–86.
29. Carino S, Collins J, Malekpour S, Porter J. Environmentally sustainable hospital foodservices: drawing on staff perspectives to guide change. Sustain Prod Consum. 2021;25:152–61.
30. Law KK, Pulker CE, Healy JD, Pollard CM. "Just so you know, it has been hard": food retailers' perspectives of implementing a food and nutrition policy in public healthcare settings. Nutrients. 2021;13:2053.
31. Pot GK, Winkels RM, van Loenhout T. Letter to the editor: an omission in guidelines. Cardiovascular disease prevention should also focus on dietary policies for healthcare facilities. Clinical Nutrition. 2023;42:1240–2.
32. Goede zorg proef je. Wie doen er al mee? . https://goedezorgproefje.nl/wie-doen-er-al-mee/.
33. Guba E, Lincoln Y. Competing paradigms in qualitative research. In: Denzin N, Lincoln Y, editors. The handbook of qualitative research. 1st ed. Sage; 1994. p. 105–17.
34. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19:349–57.
35. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci. 2009;4:50.
36. Transcript online. https://transcriptonline.nl/.
37. Scientific Software Development GmbH. ATLAS.ti . 2023.
38. Djojosoeparto SK, Verain MCD, Schebesta H, Biesbroek S, Poelman MP, Candel JJL. Harnessing the potential of public procurement for the protein transition – perceived barriers and facilitators. Agric Human Values. 2024.
39. Faulkner K, Collins J, Gilbertson HR, Porter J. Local food procurement by hospitals: a scoping review. J Hum Nutr Diet. 2023;36:2219–33.
40. Rogers EM. Diffusion of innovations. New York: The Free Press; 1995.

41. Cranney L, Thomas M, O'Connell T, Moreton R, Corbett L, Bauman A, et al. Creating healthy hospital retail food environments: multiple pathways to successful at scale policy implementation in Australia. J Health Serv Res Policy. 2023;28:100–8.
42. Tran HNQ, Krattli S, Ward N, Ananthapavan J. Australian healthy retail policies in hospital settings – a policy analysis and scoping review of potential impacts on dietary behaviours. Public Health Res Pract. 2024;34(1):3412406.
43. Cowie J, Nicoll A, Dimova ED, Campbell P, Duncan EA. The barriers and facilitators influencing the sustainability of hospital-based interventions: a systematic review. BMC Health Serv Res. 2020;20:588.
44. Carino S, Malekpour S, Porter J, Collins J. The drivers of environmentally sustainable hospital foodservices. Front Nutr. 2021;8:740376.
45. Hagenaars L, Waterlander W, den Hertog K, Stronks K. Een veerkrachtige publieke gezondheid in 2030: #hoedan? TSG. 2022;100:119–23.
46. Powell BJ, McMillen JC, Proctor EK, Carpenter CR, Griffey RT, Bunger AC, et al. A compilation of strategies for implementing clinical innovations in health and mental health. Med Care Res Rev. 2012;69:123–57.
47. Hoefnagels FA, Patijn ON, Meeusen MJG, Battjes-Fries MCE. The perceptions of food service staff in a nursing home on an upcoming transition towards a healthy and sustainable food environment: a qualitative study. BMC Geriatr. 2023;23:784.
48. Day L, Cakebread JA, Loveday SM. Food proteins from animals and plants: differences in the nutritional and functional properties. Trends Food Sci Technol. 2022;119:428–42.
49. Health Council of the Netherlands. A healthy protein transition. The Hague: Health Council of the Netherlands; 2023.
50. Regional Deal Foodvalley. Regio Deal Foodvalley. https://www.regiofoodvalley.nl/programma/regio-deal/.
51. Website of the Nutrition & Healthcare Alliance. https://www.alliantievoeding.nl/en.

CHAPTER

5

Implementing the Dutch national program 'A Taste of Excellent Healthcare' for shifting towards a healthier and more sustainable food environment in healthcare settings: monitoring results after one-year follow-up

Authors:
Joline J. Wierda, Gerda K. Pot, Sanne K. Djojosoeparto, Iris de Koning, Emely de Vet & Maartje P. Poelman

Under review (2025)

Abstract

Background: The food environment in healthcare settings is an important leverage point for promoting healthy food consumption among patients, staff, and visitors. The national Dutch program, 'A Taste of Excellent Healthcare' (TEH), supports hospitals and healthcare institutions implementing healthy and sustainable food environments via a learning network and toolkit including a step-by-step plan. This study examines the implementation of actions for a healthy and sustainable food environment in diverse hospitals and healthcare institutions one-year after their commitment to TEH.

Methods: A total of 18 hospitals and 8 healthcare organizations were included. The degree to which food policies were implemented and food offerings for patients, staff, and visitors were considered healthy and sustainable were measured using 28 items, by means of self-auditing at the start (T0) and one year after commitment to TEH (T1). Participants were asked to complete the monitoring checklist to indicate the level of action achievement using a traffic light system. Descriptive statistics were used to examine implementation progress of actions for a healthy and sustainable food environment at T0 and T1.

Results: More organizations developed a vision regarding a healthy food offering for patients, staff, and visitors, e.g. food vision for patients in hospitals 33% T0 vs. 78% at T1. Little action implementation was observed in the actual food offering after one-year follow-up, e.g. patients food service meeting the Dutch food-based dietary guidelines in healthcare institutions, 33% at T0, 50% at T1, and the food offering for staff and visitors including food prices and promotions, e.g. lower price for healthy choices for hospital staff, 24% at both T0 and T1.

Conclusions: One year of action implementation monitoring showed that most implementation progress was observed for actions related to food policies and food offerings for patients, and less for staff and visitors. Most opportunities for further progress were observed in the implementation of actions that create healthier and more sustainable food offerings. At the end of 2025, monitoring will reveal whether the hospitals and healthcare institutions implemented food environment improvements as aspired, or that additional incentives are needed to fulfil ambitions, e.g. financial measures, and develop policies accordingly.

5.1 Background

A healthy and sustainable food environment in hospitals and healthcare institutions is essential for patients, staff, and visitors [1]. This may support healthy and sustainable dietary patterns in line with national nutritional guidelines [2]. A healthy and sustainable food environment in healthcare settings can contribute to the enhancement of patient recovery, the prevention of malnutrition and lifestyle-related diseases, and the promotion of quality of life and a healthy lifestyle [3]. Furthermore, a healthy and sustainable food environment enhances staff well-being and exposes visitors to a health-promoting environment [4]. Moreover, hospitals and healthcare institutions have an important exemplary role in stimulating healthy and sustainable food choices for patients, staff, and visitors, thereby contributing to population and planetary health [5, 6].

Effective strategies to improve food environments and public health are, for example, by increasing the availability of healthy products, e.g., offering (free or more) vegetables and fruits, lowering prices for healthy and sustainable foods compared to unhealthy and unsustainable foods, offering more whole-grain products and replacing sugar-sweetened beverages with unsweetened beverages [7, 8]. In 2018, the Dutch government, along with more than seventy public and private organizations, signed the National Prevention Agreement (NPA), which outlines (voluntary) ambitions and goals to enhance the health of the Dutch population [9]. One of the ambitions is to improve food environments in healthcare settings. The ambition states that in 2025 the food offering for patients, staff, and visitors will be healthy in 50% of the Dutch hospitals, and in 2030 it should be healthy in all Dutch hospitals; additionally, efforts are directed toward healthcare institutions [9].

The Dutch Ministry of Health, Welfare, and Sport commissioned the Nutrition & Healthcare Alliance, a national expertise centre in nutrition and healthcare, to implement a national strategy and support hospitals and healthcare institutions to accomplish the NPA ambition [10]. Subsequently, the Nutrition & Healthcare Alliance launched a national program 'A Taste of Excellent Healthcare' (TEH) in 2019: a voluntary ongoing learning network with hospitals and healthcare institutions offering support and a step-by-step approach with tools to achieve the ambition of having a healthy and sustainable food environment in all Dutch hospitals and healthcare institutions by 2030 [11]. To illustrate, the step-by-step approach guides hospitals and healthcare institutions from developing a vision on healthy and sustainable food (first step) to implementing a healthy and sustainable food offering. This process includes the following steps: determination of the project goal, description of the current situation, description of the desired situation, determination of the strategy and activities, outline of the budget, creation of a planning schedule, and evaluating and sustaining the results. Across the globe, TEH is one of the few (national) initiatives that supports implementing a healthy and sustainable food environment in the healthcare

setting. Examples of these initiatives are the voluntary National Healthy Food and Drink Policy in New Zealand [12], the Healthy Hospital Food Initiative in New York City [13], and a state-wide policy to change the retail drink environment in hospitals in Australia [4].

In addition to implementing policies and realizing agreement ambitions to improve the food environment, the World Health Organization (WHO) emphasized the importance of monitoring food environments and food environment policy implementation [14]. Vandevijvere and Tseng stated that a lack of monitoring of the food environment translates into a lack of action [15]. Monitoring the food environment is of ultimate importance, to assess progress in achieving goals, providing best practices, and benchmarking. Moreover, monitoring is important to evaluate the effectiveness and effects of measures and policies, contributing to evidence-based approaches and stimulating policy change and actions [16].

To date, the TEH program showed promising outcomes among a first group of participating hospitals that committed to TEH in 2020, the so-called '2022-TEH-hospitals', who committed to realize a healthy and sustainable food environments for patients, staff, and visitors by 2022 [17]. These '2022-TEH-hospitals' already had a food vision before commitment, as this was a requirement for their participation as '2022-TEH-hospital' in TEH. In the present study, we explored to what extent results are achieved when the TEH program is implemented in other hospitals and healthcare organizations. These so-called '2025-TEH-hospitals' and '2025-TEH-healthcare institutions' committed in 2022 and 2023 to TEH, with the aim to full-fill the food environment ambitions by 2025. However, it has yet to been determined what can be accomplished within one-year of commitment to TEH in the '2025-TEH-hospitals' and '2025-TEH-healthcare institutions' towards establishing a healthy and sustainable food environment. It is essential to measure the implementation already after one-year of follow-up, as this provides insight into interim progress and allows for timely adjustments where additional effort or support is needed. Furthermore, the ongoing monitoring allows for comparison with the 2025 data to evaluate whether the implementation has increased, decreased, or remained the same. Therefore, this study aims to examine the implementation of actions for a healthy and sustainable food environment in hospitals and healthcare institutions after one-year of commitment to the TEH program.

5.2 Methods

Study design

This study used a pre-test post-test study design, with a baseline measure at the start of hospitals' and healthcare institutions' commitment, which included an intention agreement to the TEH program, signed by the board of directors of the hospitals and healthcare institutions, and a one-year follow-up measure. Staff of hospitals and healthcare institutions self-audited the degree to which actions to improve food environments for patients, staff, and visitors were implemented within their organization by using a predefined monitoring checklist. The checklist was based on national and evidence-based guidelines [2, 3, 18, 19]. Hereafter, the term patients in this study refers to patients, clients and health care recipients.

Ethics

This study was approved by the Social Sciences Ethics Committee of Wageningen University & Research and complies with the Netherlands Code of Conduct for Research Integrity (reference number 2021-38-Wierda). This study was part of a project that was funded by the Regio Deal Foodvalley (grant number 162135), a collaboration between the Dutch government and different regional governments, entrepreneurs, education- and knowledge institutions, including the Nutrition & Healthcare Alliance. The TEH program was commissioned and funded by the Dutch Ministry of Health, Welfare and Sport (grant number 90002145). The monitoring data from the hospitals and healthcare institutions was used in this study with their informed consent.

Sample and study procedure

Hospitals and healthcare institutions that voluntarily committed to the program TEH of the Nutrition & Healthcare Alliance, specifically with the ambition to realize a healthy and sustainable food environment for patients, staff, and visitors in the year 2025, were included. These were the second group of hospitals that committed to the TEH program, referred to as the '2025-TEH-hospitals'. The healthcare institutions were the first group of healthcare institutions that committed to the TEH program, referred to as the '2025-TEH-healthcare institutions'. Only hospitals and healthcare institutions with signed commitment of the board of directors are monitored in TEH. The start with TEH was not necessarily simultaneous as these hospitals and healthcare institutions could start participating at different points in time. Once hospitals and healthcare institutions decided to participate in the TEH program, the commitment ambition was formalized by an intention agreement, signed by the board of directors of the hospitals and healthcare institutions. This was a requirement for participation in the TEH program. Thereafter, staff responsible for the food offerings were invited via e-mail and/or telephone to self-audit

the implementation of actions for a healthy and sustainable food environment in their hospital or healthcare institution – the monitoring starting point (baseline). A similar self-audit was conducted each half year. They were instructed by a project staff member of the Nutrition and Healthcare Alliance to complete the monitoring checklist within three weeks and received up to two reminders to complete this. In this study, only the baseline (T0) and one-year follow-up (T1) monitoring were reported.

Measures

Self-auditing was conducted via an Excel monitoring checklist per hospital or healthcare institution. This monitoring checklist was based upon the 2015 Dutch food-based dietary guidelines [2], ESPEN guidelines for hospital nutrition [3] and success factors for meal systems [19] (for patients), and the Guidelines Eating Environments of the Dutch National Nutrition Centre [18] for staff and visitors. For this study, 28 actions regarding the healthiness and sustainability of the food environment were selected, with the condition that data for those actions were available at T0 and T1, that the phrasing of the action remained sufficiently consistent in scope over time and that data on actions were collected for the hospitals as well as the healthcare institutions. Using a traffic light system, participants were asked to complete the monitoring checklist to indicate the level of achievement. It was instructed to answer each particular action by completing an Excel cell with a traffic light color code, also presented in a legenda in the monitoring checklist, which encompassed: red (not fulfilled 0-50%), orange (work in progress 50-80%), green (fulfilled 80-100%) or grey (not applicable). In addition, for each action, a comment field was included, where participants could further explain their answers, if preferred.

The monitoring checklists underwent minor adaptations over time with small adjustments for hospitals and healthcare institutions due to changes in the Guidelines Eating Environments of the Dutch National Nutrition Centre [18], e.g. from the action formulation 'At (almost) all prominent places, only *healthier* choices are available' to 'At (almost) all prominent places, only *better* choices are available' and 'More than *half* of the food offering is healthy', to 'At least *60%* of the food offering is healthy'. Some hospitals' actions were adjusted to align with terminology used in healthcare institutions. Please see Supplementary file 1 for the monitoring checklist with actions used for this study at the monitoring moments for hospitals and healthcare institutions. Table 1 presents the 28 action items included in this study (the most recent version from the hospital setting is presented), including the abbreviations of each item. For presenting the results, we categorized seven actions as policy, e.g. having a food vision and interprofessional coordination regarding the food offering, actions that indirectly influence the food environment. We categorized 21 actions as food offering, e.g. stimulating better choices with lower prices and complying with the Dutch food-based guidelines, actions that directly influence the food environment (Table 1).

Table 1. Monitoring action description, abbreviated action description, and categorization into policy or food offering category and target group

#	Complete action description in monitoring checklist	Abbreviated action description in Results	Policy or food offering category and target group
1	There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for patients.	Vision healthy food offering for patients	Policy, patients
2	There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for visitors.	Vision healthy food offering for visitors	Policy, visitors
3	There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines for staff.	Vision healthy food offering for staff	Policy, staff
4	The healthcare institution maintains the dialogue with the caterer/supplier/kitchen regarding the food offering for patients, following the Dutch food-based guidelines.	Maintain dialogue with caterer/kitchen	Policy, patients
5	There is interprofessional coordination regarding the food offering, involving at least the departments of dietetics and facility management	Interprofessional coordination	Policy, patients
6	Attention is given to optimizing the nutrition skills, knowledge, and services of the nutrition assistant. The nutrition assistant = healthcare provider in the food provision process.	Optimize nutrition assistants' skills	Policy, patients
7	General waste and food waste are monitored and reduced when necessary	Monitor and reduce (food) waste	Policy, patients
8	Where possible and medically appropriate, the food service concept for patients complies with the Dutch food-based guidelines	Food service concept meets guidelines	Food offering, patients
9	Guidelines for the nutritional value of meals and snacks are applied	Nutritional guidelines applied for meals, snacks	Food offering, patients
10	There is an appropriate food offering for patients with (risk of) malnutrition (energy and protein enriched).	Appropriate food offering malnutrition	Food offering, patients
11	There is an appropriate food offering for patients with specific diets (e.g., low sodium, low potassium, fluid restriction, different consistencies, etc.).	Appropriate food offering for specific diets	Food offering, patients
12	There is transparency regarding the assortment/food offerings through a menu.	Transparency via menu	Food offering, patients
13, 21	Staff: In all eat and drink facilities for staff, at least 60% of the total displayed offerings are better choices, and ideally >80% (better choices = Wheel of Five & day choice; see 'Guidelines Eating Environments'). Visitors: In all eat and drink facilities for visitors, at least 60% of the total displayed offerings are better choices (better choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').	More than half of the food is healthy	Food offering, staff, visitors

Table 1. Monitoring action description, abbreviated action description, and categorization into policy or food offering category and target group (*continued*)

#	Complete action description in monitoring checklist	Abbreviated action description in Results	Policy or food offering category and target group
14, 22	Staff: At (almost) all prominent places, only better choices are available. Visitors: At (almost) all prominent places, only better choices are available.	Only healthy choices on prominent place	Food offering, staff, visitors
15, 23	Staff: We (primarily) promote healthier, vegetarian and/or plant-based choices (e.g., promotions and discounts). Visitors: We (primarily) promote healthier, vegetarian and/or plant-based choices (e.g., promotions and discounts).	Only promotion of healthy choices	Food offering, staff, visitors
16, 24	Staff: We stimulate better choices with lower prices. Visitors: We stimulate better choices with lower prices.	Stimulating healthy choices with lower prices	Food offering, staff, visitors
17, 25	Staff: Vegetarian dishes/options are lower-priced than comparable meat dishes/options. Visitors: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.	Vegetarian option is lower-priced tan meat	Food offering, staff, visitors
18, 26	Staff: We provide free tap water. Visitors: We provide free tap water (at least provided by the healthcare institution itself, for example in the central hall).	Free tap water	Food offering, staff, visitors
19, 27	Staff: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes. Visitors: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.	Vegetarian/plant-based marked on menu	Food offering, staff, visitors
20, 28	Staff: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut. Visitors: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut.	Easy to consume vegetables and fruits	Food offering, staff, visitors

Data analysis

First, the raw data were cleaned using the original Excel monitoring checklists of the hospitals and healthcare institutions. Answers were checked by the first author (JJW) and a colleague. If the answer was unclear, e.g. only text instead of a color, the comment field was consulted for possible clarification and identification of the level of implementation. If it remained unclear, scores were included as missing. This was cross-checked by a staff member of the Nutrition and Healthcare Alliance. Descriptive statistics in Microsoft Excel were used to identify and visualize the level of implementation (green - fulfilled; orange - work in progress; red - not fulfilled) at baseline and one-year follow-up. The overall percentage for each answer score and each action was calculated by counting the number of hospitals or healthcare institutions that selected each traffic light colour code score and

dividing this by the number of valid responses (excluding 'not applicable' and missing data). This ratio was then multiplied by 100 to obtain a percentage. For example, if 20 hospitals responded, 9 scored green, 4 selected scored orange, 5 scored red, while 2 were missing, the percentage for score 'green' was 9/(20-2)*100 = 50%. In Excel, this was calculated using the COUNTIF function for each specific score and action. Results were presented by healthcare setting type (hospital or healthcare institution) as the food offering is distinctly organized in hospitals and healthcare institutions [20]. If data were missing at T0 or T1 for an action or the hospital or healthcare institution filled in 'not applicable', the respective hospital or healthcare institution was not included for that action and the n (total) changed for that action. Hospitals and healthcare institutions were excluded from analyses when the full monitoring checklist was missing at T0 and/or T1.

5.3 Results

Participant characteristics

Eighteen hospitals and eight healthcare institutions completed the monitoring checklist regarding action implementation for a healthy and sustainable food environment at the start of commitment to the TEH program (T0) and after one-year (T1). The monitoring checklist was predominantly completed by staff from facility management and/or dietitians. Four hospitals and three healthcare institutions were excluded from the analysis because there was no one-year of follow-up (e.g. T1 was missing), another hospital was excluded because they completed the monitoring retrospectively and a half year later than the requested year quarter. Of the included hospitals and healthcare institutions, 15 hospitals and eight healthcare institutions completed the T0 monitoring in Q4 2022 and the T1 monitoring in Q4 2023; three hospitals completed the T0 monitoring in Q2 2023 and T1 in Q2 2024. One hospital indicated that both staff and visitors used the same eat and drink facilities in the hospital and therefore they completed the checklist for staff actions and visitor actions regarding these eat and drink facilities equally. The numbers of the actions (#) correspond with the numbers in Table 1.

Hospital policy actions

Fig.1 illustrates the implementation of policy actions for a healthy and sustainable food environment in the participating hospitals at the start of commitment to the TEH program, and one year after, expressed as proportion of hospitals per response category.

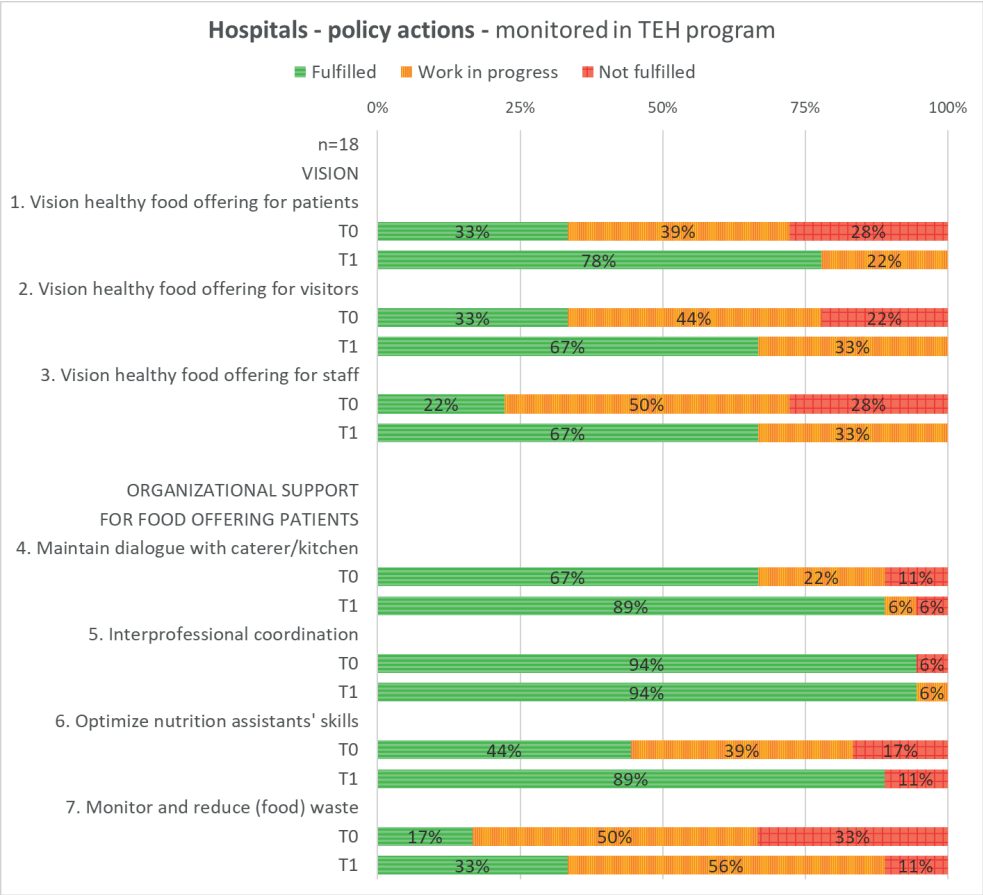


Fig. 1. Implementation of policy actions, expressed as proportion of hospitals (T0,T1).

Food vision for patients, staff, and visitors

After one year, the largest implementation progress was observed in the number of hospitals having a food vision for patients (with 33% of the hospitals having this at T0 versus 78% at T1) and for staff (22% at T0 versus 67% at T1). At T1, all hospitals either had a food vision for patients, staff, and visitors or were working on this – this has changed compared to T0, where 28% of the hospitals indicated that they did not have a food vision for patients, 22% did not have a food vision for visitors and 22% did not have a food vision for staff.

Organizational support for food offering to patients

In all actions implementation progress was observed, except for interprofessional coordination that was already implemented by 94% of the hospitals at T0 and remained

unchanged at T1. The largest implementation progress was seen in optimizing the skills of nutrition assistants, 44% of the hospitals implemented this at T0 versus 89% at T1, and in maintaining the dialogue with caterer/kitchen, 67% of the hospitals implemented this at T0 vs. 89% at T1. Little implementation progress was observed in monitoring and reducing (food) waste: only a minority of the hospitals implemented this at T0 (17%) and this slightly increased to 33% at T1.

Hospital food offering actions

Fig.2 and Fig.3 illustrate the implementation of actions with respect to patients' food offering (Fig.2) and staff' and visitors' food offering (Fig.3) in the participating hospitals at the start of commitment to the TEH program, and one year after, expressed as proportion of hospitals per response category.

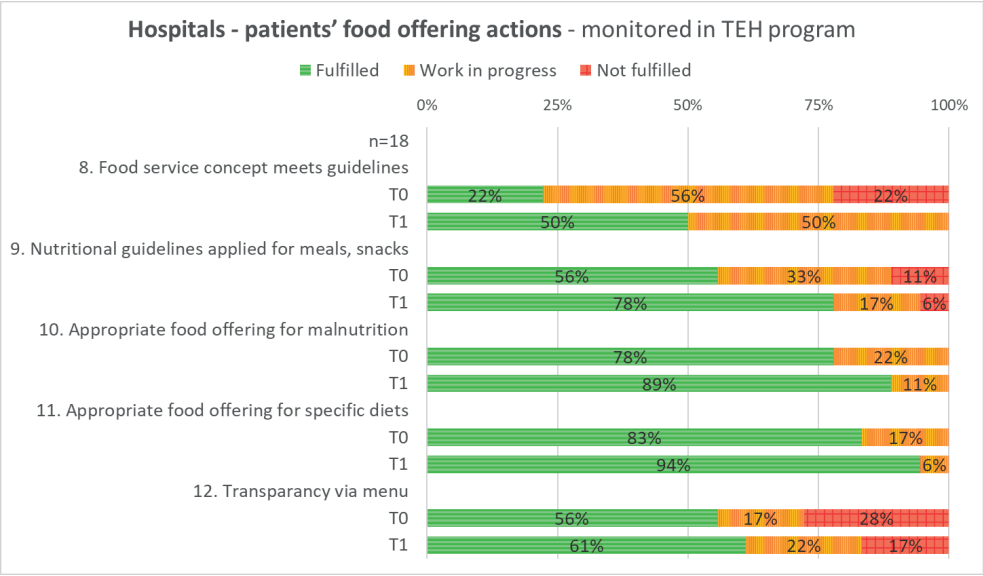


Fig. 2. Implementation patients' food offering actions, expressed as proportion of hospitals (T0, T1).

Food offering for patients (Fig.2)

At the start, the majority of hospitals already offered an appropriate diet for malnourished patients (78%) and for patients with specific diets (83%), which increased slightly at T1 (89% and 94%, successively). For patients, the largest implementation progress was observed in the number of hospitals that aligned their food concept for patients with the Dutch food-based dietary guidelines, i.e., an observed increase from 22% at T0 to 50% at T1.

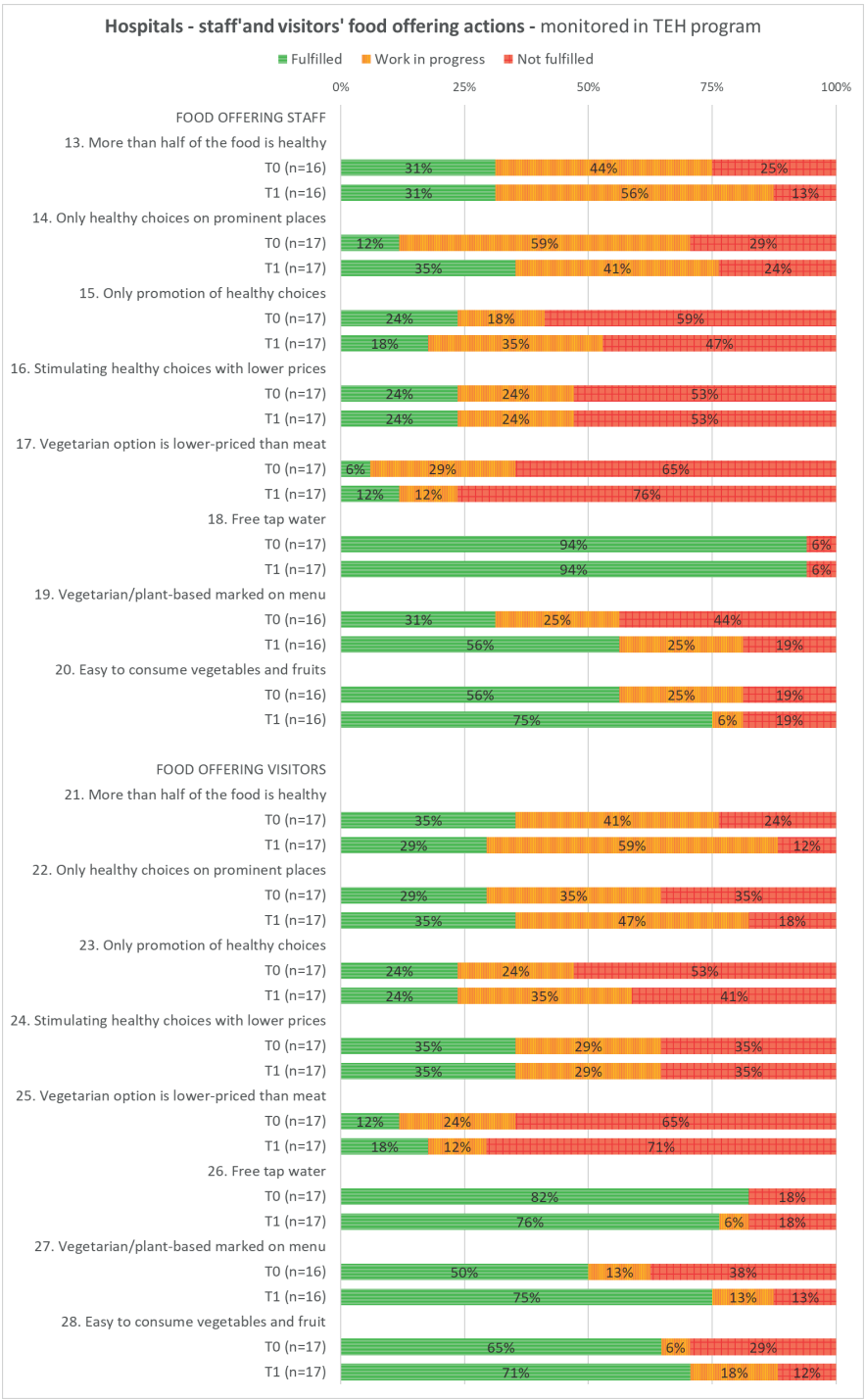


Fig. 3. Implementation staff' and visitors' food offering actions, expressed as proportion of hospitals (T0, T1)

Food offering for staff and visitors (Fig.3)

Free tap water for staff and visitors was available in the majority of hospitals, for staff 94% at both T0 and T1 and for visitors 82% at T0 and 76% at T1. For staff, the largest implementation progress was observed in hospitals marking the vegetarian or plant-based options on the menu (T0=31% vs. T1=56%), exclusively offering healthy foods at prominent places (T0=12% vs. T1=35%) and offering easy to consume vegetables and fruits (T0=56% vs. T1=75%). Also, for visitors, the largest implementation progress observed in hospitals marking the vegetarian or plant-based options on the menu for visitors (T0=50% vs. T1=75%). Little implementation at T0 and T1 was observed in actions regarding price and promotions for both staff and visitors. At the start of the TEH program, a minority of hospitals solely promoted healthy food options for staff (24%) and visitors (24%), this decreased slightly for staff (18%) and remained similar for visitors (24%) at T1. However, more hospitals indicated that this was work in progress for staff (T0=18% vs. T1=35%) and visitors (T0=24% vs. T1=35%). A minority of hospitals encouraged healthy choices among their staff (24%) or visitors (35%) by offering lower prices for healthy foods at T0. These figures remained unchanged at T1. Finally, in 31% of the hospitals, more than half of the foods offered to staff were healthy at both T0 and T1, although a greater number of hospitals indicated working toward this ambition (T0=44% vs. T1=56%). Similar patterns were observed for visitors, within 35% of the hospitals more than half of the foods offered to visitors were healthy at T0 and a slight decrease to 29% at T1.

Healthcare institutions policy actions

Fig.4 illustrates the implementation of policy actions for a healthy and sustainable food environment in the participating healthcare institutions at the start of commitment to the TEH program, and one year after, expressed as proportion of healthcare institutions per response category.

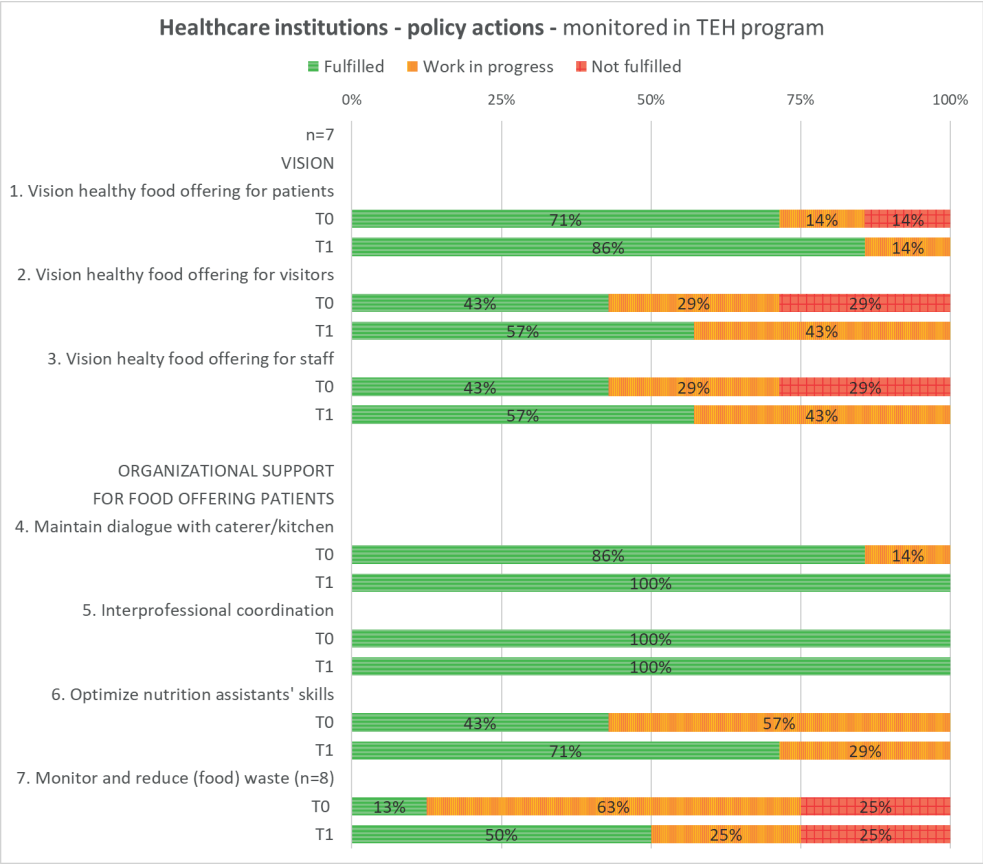


Fig. 4. Implementation of policy actions, expressed as proportion of healthcare institutions (T0, T1).

Food vision for patients, staff, and visitors

More healthcare institutions had a food vision for patients (71% at T0, 86% at T1) compared to a food vision for staff or visitors and little implementation progress was observed here for both staff and visitors (43% at T0 versus 57% at T1).

Organizational support for food offering patients

At T0, all healthcare institutions already had interprofessional coordination about the food assortment and this remained unchanged after one year. Almost all healthcare institutions maintained the dialogue with the caterer/kitchen at T0 (86%) and this changed to all healthcare institutions at T1 (100%). The largest implementation progress was observed in optimizing the skills of nutrition assistants (43% at T0 versus 71% at T1). Furthermore, more healthcare institutions monitored and reduced (food) waste, this changed from one healthcare institution to half of the healthcare institutions.

Healthcare institutions food offering actions

Fig.5 and Fig.6 illustrate the implementation of actions with respect to patients' food offering in the participating healthcare institutions at the start of commitment to the TEH program, and one year after, expressed as proportion of healthcare institutions per response category.

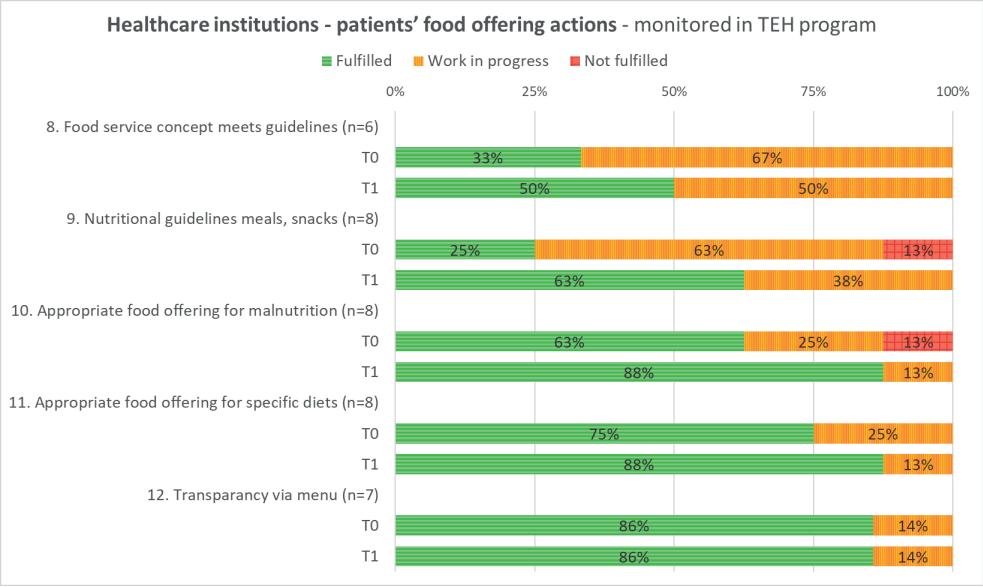


Fig. 5. Implementation patients' food offering actions, expressed as proportion of healthcare institutions (T0,T1).

Food offering for patients (Fig.5)

At the start of commitment to the TEH program, all healthcare institutions had already appropriate diets for specific needs of patients (75% at T0 with a slight increase to 88% at T1). Furthermore, almost all healthcare institutions had a menu for patients for transparency in food choices (86% at T0 and T1). The largest implementation progress was observed in healthcare institutions applying nutritional guidelines for meals and snacks for patients (25% at T0 versus 63% at T1), in the implementation of the food service meeting the Dutch food-based dietary guidelines (33% at T0 to 50% at T1), and having appropriate diets for patients with malnutrition risk (63% at T0 which increased to 88% at T1).

Fig. 6. Implementation staff' and visitors' food offering actions, expressed as proportion of healthcare institutions (T0, T1)

Food offering for staff and visitors (Fig.6)
At the start of commitment to the TEH program, all healthcare institutions already had free tap water for visitors and staff (both 100% at T0 and T1) and many healthcare institutions already had easy to eat vegetables and fruit for visitors (88% at T0 and T1). For staff, the largest implementation progress was seen in having only healthy choices on prominent places (14% at T0 vs 29% at T1) and healthcare institutions working on this changed from 29% at T0 to 43% at T1. Another large implementation progress for both staff and visitors was seen in healthcare institutions working on realizing that more than half of the food offering is healthy, with 33% working on this for staff and visitors at T0 versus 67% at T1. Little implementation at T0 and T1 was seen in action regarding food prices and promotion for both staff and visitors. A minority of healthcare institutions stimulated healthy choices for staff with lower prices 38% at T0 and 13% at T1 and this was also the case for visitors, 25% at T0 and T1. However, an increase was observed in healthcare institutions working on implementing only healthy choices on prominent places for visitors, with 17% working on this at T0 and 67% at T1. Finally, within a minority of the healthcare institutions more than half of the offered foods were healthy for staff and visitors, both 17%, and this remained unchanged at T1.

5.4 Discussion

This study explored the degree to which hospitals and healthcare institutions implemented actions to improve the healthiness and sustainability of the food environment for patients, staff and visitors, after one-year of commitment to the program 'A Taste of Excellent Healthcare'. The results showed that the largest improvements in the food environment of hospitals and healthcare institutions occurred in policy actions that support the creation of a healthy and sustainable food environment. For example, more organizations developed a vision regarding a healthy food offering for patients, staff, and visitors. Although free tap-water and appropriate food offering for patients with specific diets were commonly present in most of the hospitals and healthcare institutions, little action implementation was observed in the actual food offering after one-year follow-up, e.g. the food service for patients meeting the Dutch food-based dietary guidelines and the food offering for staff and visitors including food prices and promotions. The findings of this study revealed three main observations.

A first observation is that the majority of hospitals and healthcare institutions did not have a food service concept for patients that meets the Dutch food-based guidelines, and did not provide or promote predominantly healthy food options for staff and visitors after one year TEH. This is most likely explained by the relatively short follow-up period of this one-year follow-up study, while the participating hospitals and healthcare institu-

tions have a longer period of time in practice to realize a healthy and sustainable food environment and follow the stepwise TEH approach, that starts with other steps (e.g., develop a food vision). It is anticipated that more than one year is required before a food vision and organizational support lead to actual change in the food offering. It likely requires more time for organizational adjustments, and a change in coordination at a more systemic level involving multiple stakeholders (e.g., management, suppliers, caterers) to embed these changes in the entire organization. To illustrate, the '2022-TEH-hospitals' showed higher implementation rates of actions to improve the food environment, two years after committing to TEH, although it should be acknowledged they had a different requirement for participating in TEH and in general a better starting position at baseline [17]. Another explanation is that having a food vision and organizational support does not automatically translate into e.g. actual food offering improvements and lower prices for healthy products, emphasizing the need for additional efforts (e.g. procurement policies). This would align with nationwide governmental food environment policies; while the national government has voluntary guidelines and visions to improve the Dutch food environment (e.g., NPA), without mandatory policies, food providers continue to provide and promote foods that do not support a healthy or sustainable diet [21, 22]. A study that assessed the voluntary National Healthy Food and Drink Policy in hospitals in New Zealand, concluded that some positive improvements in the healthiness of products were observed, but recommended to make the policy mandatory for further positive changes and accelerate progress [23]. Follow-up measures (post-2025) should assess whether additional time, support, or stricter measures are needed for the longer-term implementation of actions for healthier food environments in hospitals and healthcare institutions.

A second main observation is that the largest extent of action implementation in the food environment of hospitals and healthcare institutions were observed in the food environment for patients and less for staff and visitors. This suggests that in the first year of commitment to TEH, the focus is predominantly on patients, which is plausible in a setting where the core business is the care for patients. Another explanation for the focus on actions for the improvement of the patients' food environment could be that the organizational support actions (e.g., interprofessional coordination) were only monitored for the patients' food environment, not for staff and visitors. It might be helpful when such actions are tailored to staff and visitors and monitored, and initiate action implementation, e.g. including monitoring of actions as 'The hospital or healthcare institution maintains the dialogue with the caterer/supplier/kitchen regarding the food offering for staff and visitors'. It is important to focus on the food environment for staff and visitors as well. To provide high-quality care for patients, it is essential to maintain the health of staff. At the end of 2022, more than 15% of the total workforce in the Netherlands accounted for people employed in the healthcare and welfare sector [24]. Yearly, millions of people

in the Netherlands make use of hospital care [25] and hundreds of thousands rely on healthcare institutions [26] – people who are also often visited by relatives.

A third observation is that implementation of pricing strategies to support healthy or sustainable food choices for staff and visitors so far was limited in hospitals and healthcare institutions, while it has been demonstrated in the literature this is one the most effective strategies to incentivize or disincentivize consumers' food decisions [27, 28]. Beyond the short-follow up period of this study, another possible explanation for the lack of taxes or subsidies in hospitals and healthcare institutions is that they are challenging to implement. For example because of financial interests of external parties such as caterers or suppliers, and their influential role in shaping the food offerings that are sold. To overcome these challenges, financial measures could be implemented and stimulated by the national government [29]. For example, by increasing the prices of unhealthy and unstainable foods, lowering the value-added tax of healthy plant-based food or providing subsidies for organizations that implement the protein transition.

A final point of attention, also observed in the current study, are the differences in the food environment in hospitals versus healthcare institutions. While hospitals and healthcare institutions showed mainly similar in trends of implementation of actions and focus, also some differences emerged. For example, in general the actions regarding the food offering for staff and visitors were less implemented in healthcare institutions compared to hospitals, which can be explained by the fact that healthcare institutions often have less facilities for staff and visitors in place. This is in line with our previous study, where it was concluded that the food environment of hospitals and healthcare institutions varies, and differences should be incorporated into designing strategies for implementation for a transition of the food environment [20].

This study had several strengths. First, this study explored the degree to which institutions implemented a nationwide practice-based program in multiple healthcare settings in a real-world setting. Second, the inclusion of a diverse range of both hospitals and healthcare institutions enhances the external validity of the outcomes. Third, the focus is on the entire healthcare food environment for patients, staff and visitors. The study also has limitations. First, the monitoring of the degree of action implementation reflects perceptions of a single or a few person(s) in the organization, and the two consecutive self-audits with one-year in-between were not always conducted by the same person(s) (e.g., due to personnel changes). Second, in this practice-based intervention minor adjustments were made to the formulation of actions at T1 compared to T0 and sometimes adjustments were made to the formulation of actions for hospitals versus healthcare institutions. Although the meaning or scope of the actions did not change, this should be taken into account when interpreting the results. Third, the monitoring instrument

is based on the high ambitions of TEH program, and therefore minor, albeit positive, changes may remain unnoticed, e.g. a transition from 0% at T0 to 40% at T1 remains undetectable for this monitoring instrument. A fourth limitation is the lack of a control group, to explore whether hospitals and healthcare institutions without commitment to TEH showed a similar shift in the food environment. In addition, some hospitals had already been informally involved in the TEH network before they signed an intention letter and before monitoring started, e.g. for seeking knowledge and inspiration, which may have provided them with initial advantage at T0.

The insights obtained from this study provide hospitals, healthcare institutions, and policymakers how healthcare settings work on a healthier food environment in the first year committing to a nationwide program to improve food environments. This also provides insights where improvements are still needed or where additional action might support the realization of a healthy and sustainable healthcare food environment. This may result in developing policies and measures accordingly. Although hospitals and healthcare institutions committed to achieving healthy and sustainable food environments, it could be helpful when stricter policies and measures are implemented, especially regarding the actual food offering and pricing and promotion strategies. Such policies and measures should not only apply to hospitals and healthcare institutions, but also to external parties, e.g. caterers and suppliers. This may help hospitals and healthcare institutions to realize their commitment to have a healthy and sustainable food environment. More broadly, it may help to fulfil the ambitions of the National Prevention Agreement. Monitoring the implementation in all healthcare organizations should continue and future data will provide insights into how food environment policies are changing over time. Hospitals and healthcare institutions can use the monitoring checklist to identify areas for improvement in their food environment and use it as a benchmarking tool to compare their progress or their current status with others.

The TEH program is continuously evolving, to keep up with practice, new knowledge, insights and guidelines. Initially, TEH was focused on a healthy food environment. The focus on a sustainable food environment became more important in response to the Green Deal on Sustainable Healthcare 3.0 signed in 2022, an agreement of the Dutch government to make the healthcare sector more sustainable [30]. Another development within the TEH program is the formulation of the TEH 'norm', September 2023. The TEH norm was established in collaboration with the field, to have criteria that hospitals and healthcare institutions need to meet to successfully implement the TEH program. The TEH norm will be tailored for different types of healthcare institutions, e.g. mental care, rehabilitation. There is potential to extend the monitoring checklist and TEH norm on healthcare food environments by incorporating additional items, such as expanded policy actions for staff' and visitors' food offerings (e.g., on food procurement, or on the items also monitored for patient food offering, e.g. maintaining the dialogue with the caterer/supplier/

kitchen, and interprofessional coordination) or on food environment characteristics (e.g., sustainable food offerings, waste). This would allow the monitoring to better reflect the comprehensiveness of healthcare food environments. However, extending the monitoring checklist might compromise its practical applicability and feasibility. Additionally, future research could broaden its scope to monitor the entire TEH program encompassing all participating hospitals and healthcare institutions for a longer follow-up period.

Recommendation for future research is to perform a process evaluation of the TEH program, to understand in depth how the program works and measure process indicators, for example reach and adoption of the program, via e.g. logbooks and attendance lists. Another recommendation is to independently audit the food environment in the TEH supported hospitals and healthcare settings, for a longer follow-up period, especially by the end of 2025. Additionally, a recommendation is to assess whether the food offering, but also what is sold actually has changed, e.g. via a multilevel approach at purchase, procurement, and consumption level. Finally, long-term effect evaluation studies may assess how changes in the food environment of hospitals and healthcare institutions contribute to the diets of patients, staff and visitors.

5.5 Conclusions

This study examined the implementation of actions for improving food environments for patients, staff and visitors in hospitals and healthcare institutions. After one year of commitment to the TEH program, most of the action implementation was observed in the food environment of patients and less of staff and visitors. Furthermore, most implementation was observed in policy actions, i.e., having a food vision and organizational support, and there is opportunity for progress in the implementation of actions that create healthier and more sustainable food offerings, e.g., healthier food offerings or pricing strategies to support healthy and sustainable food choices. These results are in line with the TEH program's step-by-step approach. It remains to be seen whether the actual ambitions as committed by the '2025-TEH-hospitals' and '2025-TEH-healthcare institutions' will be achieved at the end of 2025. After 2025, monitoring should be conducted to assess whether the hospitals and healthcare institutions were able to implement the food environment improvements as aspired, or that additional incentives are needed, for example financial measures and develop policies accordingly. This study showed what was achieved after one-year follow-up and underlines that continuous efforts as well as continuous and expanded monitoring are needed to realize a healthy and sustainable food environment for patients, staff, and visitors. The results of this study can be used by hospitals, healthcare institutions and policy makers to identify where leverage exists to implement a healthy and sustainable healthcare food environment and develop policies accordingly.

References Chapter 5

1. Pelikan JM, Krajic K, Dietscher C. The health promoting hospital (HPH): concept and development. Patient Educ Couns. 2001;45:239–43.
2. Kromhout D, Spaaij CJK, de Goede J, Weggemans RM. The 2015 Dutch food-based dietary guidelines. Eur J Clin Nutr. 2016;70:869–78.
3. Thibault R, Abbasoglu O, Ioannou E, Meija L, Ottens-Oussoren K, Pichard C, et al. ESPEN guideline on hospital nutrition. Clinical Nutrition. 2021;40:5684–709.
4. Cranney L, Thomas M, O'Connell T, Moreton R, Corbett L, Bauman A, et al. Creating healthy hospital retail food environments: Multiple pathways to successful at scale policy implementation in Australia. J Health Serv Res Policy. 2023;28:100–8.
5. Fanzo J, Miachon L. Harnessing the connectivity of climate change, food systems and diets: Taking action to improve human and planetary health. Anthropocene. 2023;42:100381.
6. Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The Lancet. 2019;393:447–92.
7. Story M, Kaphingst KM, Robinson-O'Brien R, Glanz K. Creating healthy food and eating environments: policy and environmental approaches. Annu Rev Public Health. 2008;29:253–72.
8. Swinburn B, Vandevijvere S, Kraak V, Sacks G, Snowdon W, Hawkes C, et al. Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: a proposed Government Healthy Food Environment Policy Index. Obesity Reviews. 2013;14:24–37.
9. Ministerie van Volksgezondheid Welzijn en Sport. Nationaal Preventieakkoord. Een gezonder Nederland. 2018.
10. Alliantie Voeding in de Zorg. https://www.alliantievoeding.nl/nl/wie-we-zijn.
11. Alliantie Voeding in de Zorg. Goede zorg proef je. https://goedezorgproefje.nl/.
12. Ni Mhurchu C, Gerritsen S, Kidd B, Rosin M, Shen S, Mackay S, et al. 2021 assessment of New Zealand district health boards' institutional healthy food and drink policies. New Zealand Medical Journal. 2022;135:67–76.
13. Moran A, Krepp EM, Johnson Curtis C, Lederer A. An Intervention to Increase Availability of Healthy Foods and Beverages in New York City Hospitals: The Healthy Hospital Food Initiative, 2010–2014. Prev Chronic Dis. 2016;13:150541.
14. Swinburn B, Vandevijvere S, Kraak V, Sacks G, Snowdon W, Hawkes C, et al. Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: a proposed Government Healthy Food Environment Policy Index. Obesity Reviews. 2013;14:24–37.
15. Vandevijvere S, Tseng M. Towards comprehensive global monitoring of food environments and policies to reduce diet-related non-communicable diseases. Public Health Nutr. 2013;16:2101–4.
16. Vandevijvere S, Swinburn B. Towards global benchmarking of food environments and policies to reduce obesity and diet-related non-communicable diseases: design and methods for nation-wide surveys. BMJ Open. 2014;4:e005339.
17. Pot GK, Winkels RM, van Loenhout T. Letter to the Editor: An omission in guidelines. Cardiovascular disease prevention should also focus on dietary policies for healthcare facilities. Clinical Nutrition. 2023;42:1240–2.
18. Voedingscentrum. Richtlijn Eetomgevingen. https://www.voedingscentrum.nl/professionals/gezonde-eetomgeving/de-richtlijn-gezondere-eetomgevingen.aspx.

19. van der Meij B, Kruizenga H. Voedingsconcepten in de Nederlandse Ziekenhuizen. 2016.
20. Wierda JJ, de Vet E, Troost E, Poelman MP. Characterizing food environments of hospitals and long-term care facilities in the Netherlands: a mixed methods approach. BMC Health Serv Res. 2024;24:31.
21. Djojosoeparto S, Kamphuis C, Vandevijvere S, Poelman M, on behalf of the JPI-HDHL Policy Evaluation Network. The Healthy Food Environment Policy Index (Food-EPI): Nederland : Een beoordeling van rijksoverheidsbeleid met betrekking tot de voedselomgeving in Nederland en beleidsaanbevelingen voor het creëren van een gezonde voedselomgeving. Utrecht; 2020.
22. Rijksinstituut voor Volksgezondhedi en Milieu (RIVM). Impact van het Nationaal Preventieakkoord voor roken, overgewicht en problematisch alcoholgebruik. 2024.
23. Mackay S, Rosin M, Kidd B, Gerritsen S, Shen S, Jiang Y, et al. Slow and steady—small, but insufficient, changes in food and drink availability after four years of implementing a healthy food policy in New Zealand hospitals. BMC Med. 2024;22:437.
24. Centraal Bureau voor de Statistiek (CBS). Arbeidsmarkt zorg en welzijn. 2024. https://www.cbs.nl/nl-nl/dossier/arbeidsmarkt-zorg-en-welzijn. Accessed 22 Dec 2024.
25. Centraal Bureau voor de Statistiek (CBS). StatLine Ziekenhuisopnamen en -patiënten; diagnose-indeling VTV. 2024. https://opendata.cbs.nl/statline/#/CBS/nl/dataset/84067NED/table?dl=A181F. Accessed 22 Dec 2024.
26. Centraal Bureau voor de Statistiek (CBS). StatLine Monitor Langdurige Zorg Personen met indicatie zorg met verblijf; grondslag. 2024. https://mlzopendata.cbs.nl/#/MLZ/nl/dataset/40005NED/table?dl=1F5E4. Accessed 22 Dec 2024.
27. Niebylski ML, Redburn KA, Duhaney T, Campbell NR. Healthy food subsidies and unhealthy food taxation: A systematic review of the evidence. Nutrition. 2015;31:787–95.
28. Springmann M, Mason-D'Croz D, Robinson S, Wiebe K, Godfray HCJ, Rayner M, et al. Mitigation potential and global health impacts from emissions pricing of food commodities. Nat Clim Chang. 2017;7:69–74.
29. Djojosoeparto SK, Verain MCD, Schebesta H, Biesbroek S, Poelman MP, Candel JJL. Harnessing the potential of public procurement for the protein transition – perceived barriers and facilitators. Agric Human Values. 2024.
30. Government of the Netherlands. Green Deal on Sustainable Healthcare. https://www.government.nl/topics/sustainable-healthcare/more-sustainability-in-the-care-sector.
31. World Medical Association. World Medical Association Declaration of Helsinki. JAMA. 2013;310:2191.
32. Regional Deal Foodvalley. Regio Deal Foodvalley. https://www.regiofoodvalley.nl/programma/regio-deal/.
33. Website of The Nutrition & Healthcare Alliance. https://www.alliantievoeding.nl/en.

CHAPTER

6

General discussion

This thesis aimed to gain insight into the food environment within the Dutch healthcare setting and to identify which factors, mechanisms, and actions contribute to shifting to a healthy and sustainable food environment in hospitals and long-term care facilities. In this chapter, the General discussion, the main findings of the studies presented in this thesis are summarized and reflected upon in terms of their contribution to knowledge development and how the findings are embedded within the broader literature. Moreover, methodological considerations, future research implications, and important recommendations for practice and policy are discussed.

6.1 Summary of main findings

Chapter 2 provided a comprehensive characterization and comparison of the physical, socio-cultural, political, and economic food environment in hospitals and long-term care facilities. The food environment was characterized using a mixed methods approach, including 37 interviews with staff members representing 11 hospitals and 26 long-term care facilities and a quantitative checklist to audit the food environment of 28 hospitals and 36 long-term care facilities. The main findings showed that the physical dimension of the food environment in the healthcare setting was affected by various factors, such as availability of facilities, logistic limitations, and physical space. Hospitals adopted a more organized and structured method in managing the physical food environment whereas long-term care facilities often exhibited a more individual-oriented approach and created an adaptable 'homely' food environment. Related to the socio-cultural food environment, hospitals placed a more prominent focus on health and using nutrition for fast recovery, while long-term care facilities also used nutrition as an instrument, for example to structure the day of health care receivers. With respect to the political dimensions, the findings showed that most hospitals and long-term care facilities had a written food policy, but participants mentioned that adequate implementation and receiving broad organizational support were important to operate effectively. Commercial interests, profit motives, contracts with external parties and strict budgets characterized the economic food environment and shaped the food available, as these aspects often provided less flexibility and autonomy in determining the types and prices of the food offered. In both hospitals and long-term care facilities there was a limited focus on the food environment for staff and visitors and low emphasizes on sustainability aspects of the food environment.

Chapter 3 presented a group model building (GMB) approach to gain insight into factors, connections and underlying mechanisms that shape the food environment in long-term care facilities. Stakeholders from five different long-term care facilities in the Netherlands participated in two GMB workshops and stakeholder perspectives about the process and

progress towards action implementation were evaluated up to one-year follow-up. The created causal loop diagram (systems map) illustrated the causal structures and complexity of the food environment in long-term care facilities and allowed to identify places or leverage points that can be shifted to transform the system. The factors in the causal loop diagram were divided over four subsystems, namely 1) the patient; 2) the healthcare organization; 3) purchasing, procurement, and budget; and 4) national governance and policy. Based on the leverage points, 40 actions at different systems levels were identified that could contribute to a system that promotes a healthy and sustainable food environment for patients, staff, and visitors in long-term care facilities. The actions were however predominantly developed at the lower levels of the system (events and structures levels) and to a lesser extent on the deeper levels of the system which provide greater potential for changing how the system functions (goals and beliefs levels). The one-year evaluation showed that actual implementation of identified actions within the long-term care facilities was not fulfilled, although smaller in-between steps towards improvements were enacted. This illustrates that changing the food environment is a slow and long-term process (> 1 year) and likely requires the inclusion of all stakeholders (system architects and users, e.g. policy makers, health care staff, suppliers) to foster impactful change.

In **Chapter 4**, factors influencing the implementation of a healthy and sustainable food environment in the hospital setting were investigated in three hospitals that were participating in the national Dutch program 'A Taste of Excellent Healthcare' (TEH) and thereby committed to work towards a healthy and sustainable food environment. Semi-structured interviews were conducted with 30 stakeholders from a wide spectrum of hospital stakeholder groups (i.e. facility professionals, healthcare professionals, project coordinators and board of directors). Stakeholders identified multiple influencing factors in various domains within and outside the hospital, ranging from internally available resources to external government-established guidelines, and from the personal drive of key stakeholders to societal momentum for change. One of the main facilitators identified by all stakeholder groups for enhancing a healthy and sustainable food environment in the hospital setting was having support and motivation at all levels in the hospital. Another observation from the study was the perceived resistance for a healthy and sustainable food environment among stakeholders, particularly among hospital staff. Altogether, the outcomes revealed an interplay of perceived factors that influence the enhancement of a healthy and sustainable food environment and underscored the importance of addressing various facilitators and barriers across multiple domains within and outside the hospital setting. The diverse stakeholder interests and experiences confirm again that changing the food environment in the hospital setting is complex, showing that it is important to ensure that all stakeholders are motivated and aligned when it comes to the realization of a healthy and sustainable food environment.

The implementation of actions for a healthy and sustainable food environment in diverse TEH hospitals and TEH long-term care facilities was examined in **Chapter 5**. Hospitals and long-term care facilities participating in the national Dutch program TEH and committed to have a healthy and sustainable food environment were monitored and it was explored to what extent actions were implemented after one-year of commitment to the TEH program. Each hospital and long-term care facility self-audited their food environment with a monitoring checklist including 28 actions regarding the healthiness and sustainability of the food environment. After one year of commitment to the TEH program, most implementation success was observed in policy actions, i.e., having a food vision and organizational support, and there was opportunity for progress in the actual implementation of actions that create healthier and more sustainable food environments, e.g., healthier food offerings or pricing strategies to support healthy and sustainable food choices. Furthermore, most of the action implementation was observed in the food environment of patients and less of staff and visitors. The findings underline that for actual realization of a healthy and sustainable food environment for patients, staff, and visitors, more time is required, as well as continuous monitoring and additional efforts.

6.2 Reflection on main findings

Upon reflecting on the main findings of this thesis, three key themes emerged: food environment characteristics in different types of healthcare settings, the current state of shifting towards a healthy and sustainable healthcare food environment, and finally, what is needed to foster this transformation moving forward.

6.2.1 The food environment in the healthcare setting: unique and different per type of healthcare settings

Grasping the unique healthcare food environment

This thesis showed that the healthcare food environment is unique in the sense that it includes elements that are specific for hospitals and long-term care facilities (e.g. foodservice for patients, restaurants, a gift shop, or a community room in a household-like setting) compared to other types of food environments (e.g., the food environment in supermarkets, or the school food environment). To the best of my knowledge, there is no existing model or framework that fully grasps the healthcare food environment incorporating the unique and specific aspects of both hospitals and long-term care facilities. Also, these elements are currently not fully grasped by existing conceptual frameworks that model specific food environment settings (e.g., the organizational food environment [1], the home food environment [2], or the retail food environment [3]). However, some elements of these frameworks partially align with the healthcare food environment. The

organizational food environment model most closely aligns with the food environment in the healthcare setting, as hospitals and long-term care facilities are organizations [1]. This model has been developed simultaneously to conducting the studies presented in this thesis, and similar to our study also inspired by the definition of the food environment of Swinburn [4], recognizing the complexity by structuring the food environment into four levels: the institutional level (e.g. availability of eating spaces), internal level (e.g. availability of foods in eating spaces), decisional level (e.g. governance of the food environment), and surroundings (e.g. food available in the surroundings of the organization). However, what is lacking in this broad organizational model is for example the sociocultural surroundings. This is especially essential for long-term care facilities that operate more as household-like settings and therefore align better with the home food environment model [2]. However, this model does not fully grasp the long-term healthcare food environment either, as it does not include, for example, the organizational point of view. While the model of de Castro & Canella (2022) [1] incorporates contracted food services, caterers and suppliers are more extensively described in the Retail Food Environment and Customer Interaction Model from Winkler et al. (2020) [3]. This model incorporates the customer, yet, this model only focuses on the retail food environment which also not includes all important elements of the healthcare food environment. The results in the thesis can complement the current literature by providing directions for elements to consider when studying the entire healthcare food environment (Table 1) and emphasize the need for the development of comprehensive conceptual food environment frameworks for hospitals and long-term care facilities. Please note that Table 1 is not exhaustive and should be further developed and empirically verified within the healthcare setting.

Differences in the food environment between healthcare settings

The findings of this thesis showed that substantial differences exist in the food environments within and between hospitals and long-term care facilities. For example, hospitals placed a more prominent focus on health in shaping their food environment and used nutrition for fast recovery, while long-term care facilities used it as an instrument, e.g. to structure the day. Another example revealed from this thesis is that food and drink facilities in hospitals were more outsourced and/or with profit motives, compared to long-term care facilities which were less attached to profit motives and often operated more as home-like settings. The varied characterization of the healthcare food environment may be attributed to three likely explanations.

A **first** reason explaining the differences in the healthcare food environment could be due to the different nutritional needs of patients in hospitals and long-term care facilities, reflected in the food environments. For example, Chapter 2 showed that participants representing hospitals highlighted that nutrition should contribute to recovery and that compliance with protein requirements was essential, while in nursing homes, most im-

Table 1. Elements from existing food environment models linked to unique sub-elements of the healthcare food environment, based on the main findings of the studies in this thesis

Main element (from other models and frameworks)	**Sub-element** (unique healthcare food environment element based on the studies in this thesis)
Institutional level (cf. Castro & Canella, 2022)	Facilities existing *in* hospitals and long-term care institutions (Chapter 2, 5): - Food service for patients - On-site kitchen for cooking or reheating - Restaurant accessible for patients, staff, and visitors restaurant for staff only; canteen for staff (also to consume foods brought from home) - Coffee-/lunch corner - Kiosk or small (gift) shop - Supermarket - Vending machines
Built & Natural Environments of the home food environment (cf. Rosenkranz & Dzewaltowski, 2008)	- Community room, e.g. where patients eat whether or not together with staff (Chapter 2) - Garden to grow vegetables and fruit (Chapter 2)
Retail actors and business models (cf. Winkler et al., 2020)	- External parties, caterers, suppliers, with (non)commercial interests and (long-term) contracts, e.g. for management of restaurants or delivering of prepared meals (Chapter 2, 3, 4, 5) - In-house management of food facilities (Chapter 2, 4)
The customer (cf. Winkler et al., 2020)	- Patients, e.g. with clinical dietary restrictions or requirements and enhanced protein needs (Chapter 2, 3, 4, 5) - Staff - Visitors
Sociocultural environment of the home food environment (cf. Rosenkranz & Dzewaltowski, 2008)	- Knowledge and skills of staff and patients (Chapter 3) - Norms and beliefs of staff and patients (Chapter 3) - Autonomy (Chapter 3) - Social network, e.g. family, friends (Chapter 3) - Cultural food practices, e.g. food as reward or celebrating (un)favorable outcomes (Chapter 2) - Religious food preferences (Chapter 2)
Internal decisional level (cf. de Castro & Canella, 2022)	- Internal vision or policy (Chapter 2, 3, 4, 5) - Statement of Requirements and procurement policies (Chapter 2, 4) - Decisional making agents, e.g. management, nutrition assistants, facility staff, nurses and patients that buy food for themselves (Chapter 2, 3, 4, 5) - Resources: time, budget, staff (Chapter 2, 3, 4)
External decisional level (cf. de Castro & Canella, 2022)	- Governmental policies, guidelines, agreements (e.g National Prevention Agreement) (Chapter 3, 4, 5), - Legislation for the right of patients (Care and Coercion Act) (Chapter 3) - Dutch food-based dietary guidelines, Wheel of Five, the Guidelines Eating Environments of the Dutch Nutrition Centre (Chapter 2, 4, 5)
Surroundings, outside the organization (cf. de Castro & Canella, 2022)	- Food outlets near the hospital or long-term care facilities e.g. supermarkets, cafeterias (Chapter 2) - Collaboration and networks outside, e.g. other healthcare institutions, knowledge institutions, alliances (Chapter 3, 4)

portant was that food and drinks were tasty to ensure that people would eat sufficiently. This finding is also reflected in the differences in nutrition guidelines and recommendations for patient groups, with available guidelines mostly focusing on clinical nutrition in hospitals, rehabilitation centres and nursing homes [5], compared to the absence of specific guidelines addressing the role of (healthy) nutrition in long-term care facilities for mental healthcare and for people with intellectual disabilities. This was also reflected in Chapter 3, where it was stated that the autonomy and rights of individuals receiving involuntary care are protected in the Netherlands by the Care and Coercion Act [6], but that preventive measures (e.g., prohibiting the overconsumption of unhealthy foods leading to weight gain) are not specified. This suggests that clinical nutrition is primarily driven by medical conditions, yet it currently lacks a focus on the importance of healthy nutrition in conditions that do not always require a specific diet, but for which healthy nutrition is desirable.

A **second** reason explaining the differences in the healthcare food environment could be due to differences in operational management, for example, different logistic possibilities and facilities for preparing and providing food and drinks. For example, Chapter 2 showed that hospitals had more facilities (e.g. restaurant, kiosk) than long-term care facilities and in hospitals there were often more profit motives in the management of these facilities. Even within the same long-term care organization, this could vary between locations, from only regeneration of meals to freshly cooked. A healthy and sustainable food environment should be achieved regardless of operational management, however, each presents their own challenges. For instance, if reheating meals is the only option, the hospital is constrained by the range of products offered by a supplier. Or, when meals are prepared by a caregiver in kitchen of a community of a nursing home, the healthiness and sustainability of the meal is dependent on the skills and knowledge of the caregivers [7, 8].

A **third** reason explaining the differences in the healthcare food environment could be due to different needs of staff and visitors. In hospitals, staff predominantly bring their own food and drinks or purchase them, often in the hospital restaurant or staff canteen, while in particular long-term care facilities, staff more frequently eat together with patients, or have a direct role in the eating moment of the patient (e.g. as part of therapy). While there is limited research on long-term care facilities as worksite food environments, hospitals have been more frequently studied as worksite site food environment. Research indicates that hospitals employees often experience pressure due to their working conditions, such as long work hours, shift work, and insufficient opportunities for regular breaks, which are barriers to healthy eating [9]. This may reduce the chance to eat regular meals and could lead to reliance on quick meals or snacks [10]. A systematic review identified barriers to healthy eating for nurses in the hospital environment and identi-

fied frequently the high availability of unhealthy options in food outlets [11]. In terms of visitors, hospitals often have more visitors and a higher turnover due to short-term care and the presence of outpatients who visit the hospital and do not stay overnight (inpatient). Visitors can buy food and drinks in for example the visitor restaurant or kiosk. Long-term care facilities often have smaller flows of visitors, though more frequent visits from the same individuals. Visitors bring food for the patient, or eat along, for example in the community room. The study by Gerritsen et al. (2024) [12] on the evaluation of staff and visitors' satisfaction with the food environment and their support for healthy food and drink policy in hospitals, reported factors that affected the food and drink choice of hospital visitors, namely convenience, price/value for money, healthiness, appearance, comfort/feeling and familiarity. They concluded that for implementation of a healthy food and drink policy, the healthiest options should be the most convenient, appealing and most affordable options available.

6.2.2 Transforming towards a healthy and sustainable healthcare food environment

In transforming towards a healthy and sustainable healthcare food environment, the following observations were made.

The current state of the transformation

The nutrition transition describes the shifts that have occurred in human diets and health related outcomes, in accordance with changes in demographic, socioeconomic, spatial, and epidemiological outcomes that are linked with those shifts in diets. Introduced in the 1990s by Barry Popkin and further developed over the years, the nutrition transition model originally describes four stages of the nutrition transition, from 'collecting food, with low fertility rates and low life expectancies' (stage 1) to the current stage, 'the chronic disease stage' (stage 4), which is characterized by high intake of sugar, fat, ultra-processed foods and the high prevalence of NCDs [13]. More recently, Popkin & Ng also state that the current stage (4) is reversible, and that we can move to the next stage, stage 5: 'the behavioral change stage', with healthy diets, reduced processed foods and a decrease in chronic diseases, with government programs and policies to promote a healthy food environment to support human and planetary health [14].

While the nutrition transition model is at societal level, the change towards a healthy and sustainable healthcare food environment can also be considered as one transition pathway. To progress towards healthier and more sustainable healthcare food environments, it is also critical to shift from stage 4 to stage 5 as proposed by Popkin and Ng [14]. The findings of this thesis indicate that the transformation of the healthcare food environment is at the start of shifting from stage 4 to stage 5. Actions and changes were visible in multiple places in the healthcare food environment system, for example, top-down, e.g.

the ambition to create a healthy food environment in 50% of Dutch hospitals by 2025, as initiated by the national government in 2018 (National Prevention Agreement) [15] and the growing number of hospitals and long-term care facilities that are part of the learning network of the Nutrition and Healthcare Alliance [16]. More generally, hospitals and long-term care facilities showed interest in participating in the various studies presented in this thesis, suggesting their willingness to transform towards a healthy food environment.

Bottom-up change was also observed through hospitals and long-term care facilities taking steps themselves to improve their food environment. Chapter 5 showed that in multiple places within the food environments of hospitals and long-term care facilities changes were made. Examples are more hospitals and long-term care facilities having a vision on food, more hospitals and long-term care facilities optimizing nutrition assistants' skills, and more hospitals and long-term care facilities maintaining the dialogue with caterer/kitchen. However, the healthcare setting as a whole has not yet transformed to a new system with a healthy and sustainable food environment (e.g. 'stage 5'). This requires more time for organizational adjustments, and a change in coordination at a more systemic level involving multiple stakeholders (e.g., management, suppliers, caterers) to embed these changes in the entire healthcare setting. Further transformation is needed to move to a phase of more action and maintenance where a healthy and sustainable healthcare food environment is the norm.

Although this thesis has not specifically examined differences in the transformation state of the food environment between hospitals and long-term care facilities, from the results of Chapter 2 and Chapter 5 it could be argued that greater transformation can be observed in hospitals. For example, Chapter 5 demonstrated that long-term care facilities implemented fewer actions related to the food environment of staff and visitors. The findings in this thesis could indicate that hospitals are further in the transformation toward a healthy and sustainable food environment, while long-term care facilities still have to take more steps (Chapter 2, Chapter 5). This is in line with the findings of a scoping review into healthy and environmentally sustainable food procurement and foodservice in Australian healthcare and aged care, that illustrated that sustainable food services were being implemented more rapidly in the healthcare sector compared to the aged care sector [17]. They stated that this sector needed further research and monitoring of healthy and environmentally practice. While writing this thesis, limited literature was found about the full food environment in long-term care facilities, such as nursing homes, mental healthcare facilities and facilities for people with intellectual disabilities. This suggests that food environment studies are underrepresented in long-term care facilities and more research is needed to provide insight into the long-term healthcare food environment.

Healthy versus sustainable food environments

A second observation of this thesis is that in the healthcare organizations' attempts to change their food environment, the emphasis was on healthy food and human health, with less emphasis on sustainable food and planetary health. The health context may implicitly evoke healthy associations more than sustainability ones. Or this might suggest that in the healthcare setting there is less awareness of the role of food environments in planetary health, especially since hospitals are active on reducing (food) waste as sustainable strategy [18, 19]. Also a systematic review aimed to identify factors that influence integration of sustainable nutrition into health-related institutions, reported that primarily health promotion was encouraged and environmental issues ranked second place [20]. Moreover, Reinders et al (2024) [21] observed that also staff members in hospitals and elderly care considered health more important than sustainability, and they argued that this may be because the guidelines for a healthy diet are generally more familiar than those for a sustainable diet. Although a healthy food environment is often also more sustainable [22], for further transformation of the healthcare food environment it is important to also focus on sustainability aspects. Carino et al. (2021) [23] stated that for more sustainable food services within healthcare, a systems approach is needed with e.g. standards of practice and organizational policy. It is expected that the focus on sustainability aspects of the food environment will increase in the coming years, as the Green Deal on Sustainable Healthcare 3.0 was signed in 2022 [24].

International comparison

A third observation in the transformation towards a healthy and sustainable healthcare food environment in the Netherlands, is that also in other countries similar initiatives and efforts have been observed aimed at monitoring and improving the healthcare food environment. I will highlight a few examples that align with the findings of this thesis. In Canada, a recent INFORMAS report showed the results of a self-reported online survey examining retail food environments in hospitals. The results indicated for example that of the 152 hospitals surveyed, 64.7% of the hospitals reported to have a written food policy or strategy [25]. However, the authors concluded that policy implementation did not always translate into a healthier food environment, which is comparable to our findings in Chapter 5 where it was also observed that having a food vision did not directly lead to actual change in the food offering. The Canada report explained that other factors are likely required for policy success, e.g. staff capacity and adequacy of facilities. The systematic review of Nguyen et al. (2021) [26] explored where government healthy food and drink policies had been implemented at scale and found only two in the healthcare setting, the 'Healthy Hospital Food Initiative' in New York City [27], and 'A Better Choice' in Queensland, Australia [28]. In England, healthcare organizations are required to meet food and drinks standards for patients, staff, and visitors and this report states that around 90% comply with these standards [29]. However, the authors recommend to incorporate

these standards in law, as there is concern that the monitoring process became a 'tickbox' process, which should be considered in further monitoring of the Dutch healthcare food environment (e.g., that is currently conducted every six months to monitor healthcare settings process, in hospitals and long-term care facilities committed to the TEH program of the Nutrition and Healthcare Alliance). In Australia, a state-wide policy was introduced for a healthy food environment for staff and visitors in diverse health facilities (e.g. public hospitals, community health centers, rehabilitation centres), with successful implementation and for example reduction of availability of sugar-sweetened beverages [30, 31]. In New Zealand, a voluntary policy was introduced in public hospitals, 'the National Healthy Food and Drink Policy', supporting healthier food and drink options for staff and visitors [32]. The authors concluded that after five years of implementation of the policy, improvements were seen, but no hospital fully met the criteria and it was concluded that the policy did not succeed in ensuring that the healthier options were the majority of choices available [32]. The examples in other countries show that efforts are made for improvement of the healthcare food environment, however, these do not always translate yet into healthier healthcare food environments. Studies suggest that effectiveness will be strengthened when these policies are made mandatory rather than voluntary, to ensure compliance [33, 34]. The anchoring of policies could potentially also benefit the Dutch healthcare setting, however, long-term evaluation of these efforts remains important.

6.2.3 Needs to foster the transformation towards a healthy and sustainable healthcare food environment

The results of this thesis highlight that while (small) steps have been taken towards implementing systemic actions, more significant changes are required to transform to a healthy and sustainable food environment in the healthcare setting. Hereto, several challenges need to be tackled.

A first challenge to tackle is that more substantial actions are needed to go from systems thinking to systems acting. In the GMB study in Chapter 3, the formulated actions for system change were predominantly developed at the lower 'events' and 'structures' levels of the system (e.g. educational courses about healthy and sustainable diets, labels at buffets to indicate the healthy and sustainable choice), and to a lesser extent on the deeper 'goal' and 'belief' levels (e.g. government makes the creation of a healthy and sustainable food environment a healthcare quality indicator, food procurement policies). These actions targeting the goals and beliefs level provide greater potential for changing the system [35]. This is in line with GMB studies in other settings that also revealed that developing actions at the goals and beliefs levels remained challenging [36, 37]. A recent GMB study in the hospital setting [38] showed that similar 'quick wins' actions were developed that were insufficient to induce actual systems change. Also in Chapter 5 of this thesis, it was observed that after one year of participating in the TEH program, predominantly

event/structural level actions were enacted (for instance having a vision), but not core improvements (goal/belief changes) that actually affected the physical domains of the food environment (such as pricing strategies).

Higher-order actions to transform to a healthy and sustainable food environment might involve overhauling policies to make healthy, sustainable food more accessible and affordable. This would require long-term planning, engagement across sectors (government, healthcare, food industry), and addressing established food systems. This may involve risk due to opposition from vested interests (e.g. industry) and the challenge of shifting societal norms around diet. Popkin & Ng (2022) [14] stated that for acceleration towards a pattern of behavioral change, "large scale government programs and policies to promote a healthier food environment that better supports human and planetary health is critical". For example, intervening by the national government enforcing substantial changes (e.g. compulsory food procurement policies that prioritize positive health or environmental outcomes in the healthcare setting) for transformation of the healthcare food environment on a larger scale. On the other end, lower-order actions like a vision, or training of staff are more accessible and offer immediate rewards (low-hanging fruit). Actions should be implemented across multiple levels of the system and should have a collective coherence to ensure efforts are mutually reinforcing, however, targeting deeper system levels, a tipping point is more likely to be achieved [35]. It is, of course, also questionable to change societal beliefs or deeply rooted goals within the healthcare food environment with a single action, but such a shift may result from a series of coordinated, incremental actions over time. Over time, the 'lower/higher level' actions may collectively create a tipping point where healthier food choices become the norm, and societal beliefs or goals evolve in favor of better health outcomes within the healthcare system.

This brings me to the second challenge. Chapter 5 showed that actual change of the physical food environment could not yet be observed after one year monitoring. In contrast, hospitals that started working on a healthier food environment a longer time ago, and thus had more time, showed greater improvements in the food environment [39]. This is in line with the fact that system change takes a prolonged period of time. The one-year evaluation in the GMB study of Chapter 4 also showed that actual action implementation remained challenging. This resonates with a review examining the application of GMB to foster implementation of evidence-based interventions in public health and healthcare [40]. This study observed that actual system change, behavior change, and positive results of system change were the least observed outcomes, and insight, consensus, and communication the most reported outcomes of GMB. While using GMB is a promising tool for developing systems solutions [40], it is important to acknowledge that system change is a prolonged process and demands sustained effort, beyond the timeframe of the period of this four-year PhD trajectory.

A **third challenge** to tackle for further progress in shifting to a healthy and sustainable food environment in the healthcare setting is to engage stakeholders to create support in the entire healthcare organization. This thesis showed that to ensure successful realization of a healthy and sustainable food environment in the healthcare setting, it is crucial to engage diverse stakeholders and address their barriers with tailored implementation strategies (Chapter 4). Support at all levels throughout the entire healthcare organization was found to be a key facilitator in this thesis (Chapter 3, 4). The importance of stakeholder support for a healthy and sustainable food environment was also emphasized in other studies [8, 23, 26, 41, 42]. Conflicting interests or resistance of stakeholders can slow down the transformation. For example, it was mentioned in Chapter 2 and 4 that caterers and suppliers had commercial- and financial interests that sometimes took precedence. In Chapter 4, resistance of staff was observed as perceived barrier for realizing a healthy and sustainable food environment. Other studies also found that main complaints for a healthy food and drink policy implementation were related to removal of unhealthy options without providing alternatives [12, 33]. Moreover, this thesis showed the importance of having ambassadors (or forerunners) in all levels of the healthcare organization (e.g. (para)medical staff, management, and facility staff). These ambassadors or champions are important enablers to initiate or lead change in the transformation towards a healthy and sustainable food environment, also aligning with literature, for example, when implementing the protein transition in public food procurement [42], and implementing environmentally sustainable foodservice practices [23].

6.3 Methodological considerations

The studies presented in this thesis used a combination of methods (methodological triangulation [43]), predominantly qualitative (Chapter 2, sub-study 1, Chapter 3, Chapter 4) and some descriptive quantitative (Chapter 2, sub-study 2, Chapter 5). In general, the studies in this thesis were practice-based empirical research, in the specific context of real-world healthcare settings across the Netherlands, including a diversity of hospitals, long-term care institutions and stakeholders. The qualitative character, incorporating the context and perspectives of stakeholders in the complex healthcare setting, provided enriched in-depth insights [43]. Several methodological considerations will be discussed regarding the sample, design, materials and measures, and ethical reflection.

Selection of participants and the sample of hospitals and healthcare institutions

A point of consideration regarding the selection of participants and the sample of hospitals and long-term care facilities included in this thesis is that not all important stakeholder groups have been involved. For example, not all end users of the food environ-

ment were included, especially the patients (different age groups, with different diseases and needs, cultures) and visitors. Furthermore, the wider system architects, outside of the healthcare food environments, e.g. food producers, suppliers, and policy makers, were not involved. Especially in Chapter 3, where a participatory system dynamics approach was used, a richer group of stakeholders including system architects (e.g., management level, board level) could have enriched the results of the GMB. Including these stakeholders with more mandate to enact change could have resulted in for example, a more extended system map with additional influencing factors and an extended list of actions, possibly with more actions on the higher levels of the system (e.g. goals and beliefs level).

Design

Several methodological key considerations need to be considered regarding the design of the studies included in this thesis. **First,** the practice-based character of the research in a non-controlled real-world setting makes the results more relevant for practice, more actionable and tailored to the setting and circumstances of the reality of practice [44]. Literature states that more evidence-based public health practice is needed, but the paradoxical challenge is that we need more practice-based evidence for more evidence-based practice, to reduce the gap between research and practice [45, 46]. The practice-based character also presented various shortcomings, including the absence of controlled research conditions (that did not allow to control for potential biases) and its limited generalizability.

In the studies in this thesis, I was able to align the research with a movement that was started by the Nutrition and Healthcare Alliance, and that movement was already in motion on its way to change towards a healthy and sustainable food environment. As a result, in some of the studies it was difficult to distinguish wat has been initiated by the Nutrition and Healthcare Alliance (e.g. the TEH program) and what the hospitals and long-term care facilities had initiated themselves, and to what extent the broader societal and healthcare movement (e.g., increased attention to prevention and lifestyle medicine, also amplified by Covid-19) had contributed to improvements in healthy and sustainable food environments. This complicates determining why changes occur, what the underlying causes are, how they can be optimized, as well as the evaluation of the effectiveness of such programs. To illustrate, it would have been interesting to have measured the food environment even before any contact had been made between the hospitals and long-term care facilities and the Nutrition and Healthcare Alliance (baseline measurement, Chapter 5), to gain better understanding of the additional impact of TEH (Chapter 4, 5), or to identify differences when comparing TEH hospitals and long-term care facilities to non-TEH hospitals and long-term care facilities (control condition). **Second,** the systems approach is innovative and important in the healthcare setting. However, it is possible that more robust support, encouragement and a longer follow-up period were required

to facilitate action implementation and achieve system change, as achieving substantial change requires more than just two GMB sessions and one year of follow-up (Chapter 3). **Third,** the research project started in the heat of the COVID-19 pandemic (September 2020), which introduced insecurity in research opportunities and played a role in making choices in the design and procedures of the study project. To illustrate, this led to methodological changes in the work presented, for example in Chapter 2. Instead of visiting all the hospitals and long-term care facilities in person for a more objective audit, the choice was made that hospitals and healthcare institutions conducted self-audits. This could have impacted the reliability of the data, and for example, social desirability bias, which could have led to a more positive characterization of the food environment.

Materials en measures

Several methodological considerations regarding the materials used in this thesis should be noted. **First,** to obtain a comprehensive understanding of the healthcare food environment, the studies in this thesis were in general based on the most dominant, validated and broad theoretical models, frameworks, and scripts, e.g. the ANGELO framework [4], Consolidated Framework for Implementation Research (CFIR) [47], and standardized scripts for developing structured Group Model Building sessions [48]. Those were most suitable for exploring and understanding the broad and complex healthcare food environment from an empirical qualitative perspective. However, more models and frameworks exist that might have provided different insights. **Second,** the food environments in the studies of Chapter 2 and Chapter 5 in this thesis were self-audited by staff of hospitals and long-term care facilities with non-validated instruments, or staff shared their perspectives on the food environment. Nevertheless, the checklist in Chapter 2 was partly inspired by international literature and adapted to the Dutch context [49], and the monitoring checklist in Chapter 5 was based on national and evidence-based guidelines [5, 50–52]. Although self-auditing has advantages in terms of e.g., creating awareness and accountability, it can lead to bias in terms of lack of objectivity and control, limited reliability due to e.g., misinterpretation or subjective perceptions, lack of validation, and response bias such as social desirability [53, 54]. **Third,** the monitoring tool outline in Chapter 5 faced challenges as the tool was unable to capture small organizational changes that could contribute to future changes in the food environment for all users (e.g. allocation of resources or staff, identified as key drivers in the studies presented in Chapters 3 and 4). As such, the tool could benefit from enhancements, such as the inclusion of additional items, including broader policy actions related to food offerings for staff and visitors. However, the downside of lengthening the tool is that the tool could lose its self-evaluation benefits, which may be valuable for hospitals and long-term care facilities in tracking their own progress. To further strengthen a scientific monitoring process, the self-auditing approach could be supplemented or, where feasible, replaced with independent external audits to ensure a more objective and reliable evaluation [29].

Ethical considerations

There are several ethical considerations related to the studies in this thesis that should be noted. First, the collaboration with the Nutrition and Healthcare Alliance provided many opportunities, for example, opening several doors regarding recruitment and linking the research to the Alliance, where most hospitals and long-term care facilities were already familiar with, thereby building trust. However, the collaboration with the Nutrition and Healthcare Alliance, could have affected the independence of the research as for example, they were actively involved in writing Chapter 5, where the implementation of actions of their own program was examined. Nevertheless, this collaboration and approach facilitated a more sustained impact of the research into practice, because the Nutrition and Healthcare Alliance can translate and adopt the outcomes of these studies. Second, the explorative and semi-structured character of the interviews and the GMB approach could be prone to bias, for example confirmation bias or researcher bias [55, 56].

In general, it is important to critically assess the extent to which efforts should be concentrated on the healthcare setting. The potential of the food environment for health improvement might be more considerable in settings where more significant population health gain can be achieved. For instance, there is still ample opportunity in the school and supermarket food environment for preventive measures yielding long-term benefits [57, 58]. However, in long-term elderly care, the preventive impact of a healthy and sustainable food environment might be limited. Nevertheless, it can also be argued that public facilities like the healthcare setting, serve vulnerable populations and might therefore require even more extensive policies to facilitate healthy dietary behaviors, than settings visited by predominantly healthy populations [59].

6.4 Recommendations for future research

Several recommendations for future research result from this thesis. A **first** noteworthy recommendation is to assess the generalizability of the outputs of this thesis to see whether these are representative for other hospitals and long-term care facilities in the Netherlands and internationally. For example, in Chapter 3, we applied Group Model Building to a convenience sample of long-term care facilities, it would be interesting to see whether the underlying system dynamics as observed for these long-term care facilities and corresponding actions are comparable to other long-term care facilities and hospitals in the Netherlands. Moreover, we conducted the Group Model Building sessions in an aggregated way, combining a variety of long-term care types serving different patient target groups in the same sessions. It would be interesting for future research to conduct the Group Model Building and study the system dynamics per healthcare institution type, to see whether it yields similar or more specific and tailored insights, and see if

it can foster further action implementation. In general, it would be interesting to take the end users of the food environment into account and assess the generalizability for different age groups (e.g. children, elderly) and different disease groups with different needs. Furthermore, other important stakeholders of the healthcare food environment system should be involved, e.g. system architects, policy makers, caterers, and suppliers. There is a dearth of evidence for these stakeholders with their determining voice in shaping the food environment. A **second** recommendation for future research is to gain a clearer and comprehensive understanding of the transformation of the healthiness and sustainability of the food environment over time by independently auditing the food environment at multiple moments in time for a longer follow-up period in all hospitals and long-term care facilities in the Netherlands. To illustrate, in Chapter 2, a snapshot in time of the food environment was made, while ideally the intention would have been to measure the food environment throughout the process of change at multiple moments in time. In line, Garton et al. (2022) [53] argue that it should be a fundamental state responsibility to systematically monitor the healthiness and sustainability of national food systems, including food environments. The Healthy Food Environment Policy Index (FOOD-EPI) is an international standardized tool and process to evaluate and compare the extent of governmental policy implementation to improve food environments [60]. It would be interesting to explore possibilities of adapting or developing an international FOOD-EPI for the healthcare setting, to contribute to a global database for monitoring and evaluating, thereby enhancing the generalizability of insights. A **third** recommendation for future research is to realize, evaluate, and monitor long-lasting implementation of actions to reorientate the system of the healthcare food environment. It is recommended to explore how to come from action ideas to implementation for improvement of the food environment in healthcare institutions – from systems thinking to systems acting. To guide implementation of systems change in practice, the Public Health 12 framework might be valuable. The Public Health 12 framework is a translation of the 'Meadows 12 places to act in a system' for public health [61], and can be tailored to the healthcare food environment to create '12 places to act in the healthcare food environment'. Next to support in practice and policy, researchers can use this framework to examine and understand gaps in action implementation required to facilitate systems change as well as achieving a deeper understanding of the consequences of actions for a healthy and sustainable healthcare food environment [61]. A **fourth** recommendation for future research is to evaluate and understand the dynamics underlying the change in the complex system of the healthcare food environment. It is important to evaluate this beyond monitoring and explore *how* the transformation of the healthcare food environment works – for cohesion between systems thinking and evaluation research and practice. The evaluation of complex adaptive systems approaches is still developing and remains challenging. It is important to understand and evaluate wider intended and unintended impacts and small system efforts and changes, for example via the Ripple Effects Mapping method [62]. An example

for guidance of the evaluation of public health prevention programs in complex adaptive systems in a practical way is the ENCOMPASS framework [63]. Another framework to evaluate a system undergoing change is the evaluation framework of McGill et al. (2020) [64], that uses a 2-phases framework for qualitative complex system process evaluations. Evaluating how the transformation of the healthcare food environment works requires a thorough approach and multiple years of follow-up. A **fifth** recommendation for future research is to assess the effect of healthy and sustainable healthcare food environments on food consumption (e.g. what is purchased, consumed) of patients, staff, and visitors in hospitals and long-term care facilities. A calculation of the impact of the National Prevention Agreement also mentioned that it is not clear whether the sales of healthier food have increased or the sales of unhealthy food have decreased in the healthcare setting [65]. A next step would be to conduct a healthcare setting-wide effect evaluation and examine if and how a healthy and sustainable food environment impacts food consumption. Or perform a cost-effectiveness analysis to compare costs of a healthy and sustainable food environment with healthcare costs (e.g. expressed in recovery time, stay duration) [66].

6.5 Implications for policy and practice

Based on this thesis, a number of implications for policy and practice are presented. A **first policy** recommendation is to develop agreements and policies more tailored and specified to the different healthcare setting types (e.g. hospitals, rehabilitation centers, nursing homes, institutions for people with intellectual disabilities and mental healthcare institutions) and different target groups within those settings (e.g. different patients, clients, staff and visitors). As this thesis highlighted the diversity in food environments of hospitals and healthcare institutions, thus a one-size-fits-all policy, such as the National Prevention Agreement, does not fully suffice. A **second policy** recommendation, also applicable for **practice**, is to take a systems approach in designing governmental as well as institutional policy, by incorporating the entire healthcare food environment and all its components. For example, focus on the food environment for patients, staff, and visitors, but also on external parties such as caterers and suppliers, for example by making a healthy and sustainable food environment part of procurement policy [42]. A **third policy** recommendation, is to emphasize not only health policies and agreements, but also explicitly attain sustainability alongside healthiness of healthcare food environments. The findings in this thesis indicated that health is sometimes prioritized over sustainability. However, it should be acknowledged that half way of this PhD-project the Green Deal on Sustainable Healthcare 3.0 [24] was implemented, likely not reflected in the findings of this study. Continued monitoring is needed to identify if sustainability will increase in attention in the healthcare food environment. A **fourth policy** recommendation is to moni-

tor and evaluate the effectiveness of agreements as the National Prevention Agreement [15] , IZA [67] and the Green Deal for Sustainable Healthcare [24]. To determine whether actual change is occurring, and to ensure that signing such agreements is not merely a form of window dressing or promotion of a positive image. If these voluntary agreements seem to have limited effect, the options for more mandatory policies should be explored, as regulatory policies seem more promising than voluntary policies for food environment improvement [14, 66, 68].

A **first practical** recommendation is that hospitals and long-term care facilities should take into account all elements of the healthcare food environment when seeking opportunities where and how to improve their food environment. The created systems map in Chapter 3 can be used as a starting point as a structured tool to start a dialogue within the hospitals or long-term facilities to identify key leverage points for improvement. A **second practical** recommendation is that hospitals and long-term care facilities should acknowledge that different stakeholder groups within and outside the healthcare setting encounter unique challenges and opportunities affecting the implementation of a healthy and sustainable food environment. It is crucial to engage diverse stakeholders (e.g. facility staff, kitchen staff, management, (para)medical staff, nutrition assistants, dietitians, project coordinators, caterers, suppliers) and gain support with tailored strategies and communication approaches (tailored to different target groups, explain the how and the why) to ensure successful integration of a healthy and sustainable food environment within the entire organization. The **third and last practical** recommendation for hospitals and long-term care facilities is to continuously monitor their food environment, as a lack of monitoring translates into a lack of action [69]. Monitoring is important to track progress and see where improvements are still needed or where additional action might support the realization of healthy and sustainable healthcare food environments.

6.6 Overall conclusions

This thesis has provided new insights into the healthcare food environment in the Netherlands. It characterized the food environment in hospitals and long-term care facilities and showed the diversity of the healthcare food environment, highlighting the need for tailored solutions per setting. This thesis identified a comprehensive, collectively acknowledged understanding of the system dynamics underlying a healthy and sustainable food environment in long-term care facilities. This underscores the importance of systems-based approaches to foster impactful change in the healthcare food environment. Furthermore, this thesis revealed an interplay of factors influencing the enhancement of a healthy and sustainable food environment in hospitals within and outside the hospital. It showed the importance of engaging diverse stakeholders throughout the

organization and having support at all levels in the hospital. The monitoring results of the healthcare food environment showed that first progress was made in the implementation of actions that contribute to realizing a healthy and sustainable food environment. However, for further transformation of the healthcare food environment more time and substantial actions are needed that actually create a healthy and sustainable healthcare food environment in both hospitals and long-term care facilities. Overall, this thesis demonstrated the need for additional and continued efforts for shifting towards a healthy and sustainable healthcare food environment, incorporating different types of healthcare settings, addressing all beneficiaries, while engaging various stakeholders throughout healthcare organizations when implementing changes. Future research needs to assess the generalizability of the results by validating them in different hospitals and long-term care facilities and with other stakeholders, involving the end users and system architects of the healthcare food environment.

References Chapter 6

1. de Castro IR, Canella DS. Organizational food environments: advancing their conceptual model. Foods. 2022;11(7):993.
2. Rosenkranz RR, Dzewaltowski DA. Model of the home food environment pertaining to childhood obesity. Nutr. Rev. 2008;66(3):123-40.
3. Winkler MR, Zenk SN, Baquero B, Steeves EA, Fleischhacker SE, Gittelsohn J, et al. A model depicting the retail food environment and customer interactions: components, outcomes, and future directions. Int J Environ Res Public Health. 2020;17(20):7591.
4. Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. Prev Med. 1999;29(6):563-70.
5. Thibault R, Abbasoglu O, Ioannou E, Meija L, Ottens-Oussoren K, Pichard C, Rothenberg E, Rubin D, Siljamäki-Ojansuu U, Vaillant MF, Bischoff SC. ESPEN guideline on hospital nutrition. Clin Nutr. 2021;40(12):5684-709.
6. Ministerie van Volksgezondheid, Welzijn en Sport. Wet Zorg en dwang (Wzd) [Internet]. Available from: https://www.dwangindezorg.nl/wzd. Accessed 10 Mar 2024.
7. do Rosario VA, Walton K. Hospital food service. Handbook of Eating and Drinking: Interdisciplinary Perspectives. 2020:1007-33.
8. Hoefnagels FA, Patijn ON, Meeusen MJ, Battjes-Fries MC. The perceptions of food service staff in a nursing home on an upcoming transition towards a healthy and sustainable food environment: a qualitative study. BMC Geriatr. 2023;23(1):784.
9. Worley V, Fraser P, Allender S, Bolton KA. Describing workplace interventions aimed to improve health of staff in hospital settings–a systematic review. BMC Health Serv Res. 2022;22(1):459.
10. Poulsen S, Jørgensen MS. Hospitals as food arenas: can the hospital make a difference for staff? In: Green Mega Food: Promoting Healthy and Sustainable Food Consumption Through Large Scale Public Food Systems. 2010.
11. Marko S, Wylie S, Utter J. Enablers and barriers to healthy eating among hospital nurses: a systematic review. Int J Nurs Stud. 2023;138:104412.
12. Gerritsen S, Rosin M, Te Morenga L, Jiang Y, Kidd B, Shen S, et al. Awareness, support, and opinions of healthy food and drink policies: a survey of staff and visitors in New Zealand healthcare organisations. BMC Public Health. 2024;24:2179.
13. Popkin BM. An overview on the nutrition transition and its health implications: the Bellagio meeting. Public Health Nutr. 2002;5(1A):93-103.
14. Popkin BM, Ng SW. The nutrition transition to a stage of high obesity and noncommunicable disease prevalence dominated by ultra-processed foods is not inevitable. Obes Rev. 2022;23(1):e13366.
15. Ministerie van Volksgezondheid Welzijn en Sport. Nationaal Preventieakkoord. Naar een gezonder Nederland. 2018.
16. Alliantie Voeding in de Zorg. Goede zorg proef je. [Internet]. Available from: https://goedezorgproefje.nl/.
17. Stephens LD, Porter J, Lawrence M. Healthy and environmentally sustainable food procurement and foodservice in Australian aged care and healthcare services: a scoping review of current research and training. Sustainability. 2021;13(20):11207.
18. Bravo D, Thiel C, Bello R, Moses A, Paksima N, Melamed E. What a waste! The impact of unused surgical supplies in hand surgery and how we can improve. Hand. 2023;18(7):1215-21.

19. Williams P, Walton K. Plate waste in hospitals and strategies for change. e-SPEN Eur e-J Clin Nutr Metab. 2011;6:e235-41.
20. Guillaumie L, Boiral O, Baghdadli A, Mercille G. Integrating sustainable nutrition into health-related institutions: a systematic review of the literature. Can J Public Health. 2020;111:845-61.
21. Reinders MJ, Battjes-Fries MC, Bouwman EP, Meeusen–van Onna MJ. Effectively implementing healthy and sustainable food practices in out-of-home food service locations: the perspective of the catering staff members. Appetite. 2024;193:107152.
22. Willett W, Rockstrom J, Loken B, Springmann M, Lang T, Vermeulen S, et al. Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. Lancet. 2019;393:447–92.
23. Carino S, Malekpour S, Porter J, Collins J. The drivers of environmentally sustainable hospital foodservices. Front Nutr. 2021;8:740376.
24. Government of the Netherlands. Green Deal on Sustainable Healthcare. [Internet]. Available from: https://www.government.nl/topics/sustainable-healthcare/more-sustainability-in-the-care-sector.
25. Vanderlee L, Vaillancourt C, McLaughlin A, Olstad DL, Ahmed M, Kirk S, et al. An in-depth look at Canada's food environments: Results from INFORMAS Canada. 2025. https://informascanada.com/2025-report
26. Nguyen B, Cranney L, Bellew B, Thomas M. Implementing food environment policies at scale: what helps? What hinders? A systematic review of barriers and enablers. Int J Environ Res Public Health. 2021;18(19):10346.
27. Moran A, Krepp EM, Curtis CJ, Lederer A. An intervention to increase availability of healthy foods and beverages in New York City hospitals: the Healthy Hospital Food Initiative, 2010–2014. Prev Chronic Dis. 2016;13:E77.
28. Miller J, Lee A, Obersky N, Edwards R. Implementation of A Better Choice Healthy Food and Drink Supply Strategy for staff and visitors in government-owned health facilities in Queensland, Australia. Public Health Nutr. 2015;18(9):1602-9.
29. Shelley P. Report of the independent review of NHS hospital food. Department of Health and Social Care. 2020.
30. Trevena H, Munn E, King L, Thomas M, Shepherd L, Cranney L, et al. Healthy choices in New South Wales health facilities for staff and visitors: a policy evaluation. Eur J Public Health. 2020;30(Suppl 5).
31. Cranney L, Drayton B, Thomas M, Tang B, O'Connell T, Crino M, et al. Impact and acceptance of a state-wide policy to remove sugar-sweetened beverages in hospitals in New South Wales, Australia. Health Promot J Austr. 2021;32:444–50.
32. Mackay S, Rosin M, Kidd B, Gerritsen S, Shen S, Jiang Y, et al. Slow and steady—small, but insufficient, changes in food and drink availability after four years of implementing a healthy food policy in New Zealand hospitals. BMC Med. 2024;22:437.
33. Rosin M, Mackay S, Gerritsen S, Te Morenga L, Terry G, Ni Mhurchu C. Barriers and facilitators to implementation of healthy food and drink policies in public sector workplaces: a systematic literature review. Nutr Rev. 2024;82:503–35.
34. Gerritsen S, Kidd B, Rosin M, Shen S, Mackay S, Te Morenga L, et al. 2021 Assessment of New Zealand district health boards' institutional healthy food and drink policies: the HealthY Policy Evaluation (HYPE) study. N Z Med J. 2022;135:67–76.
35. Nobles JD, Radley D, Mytton OT. The Action Scales Model: A conceptual tool to identify key points for action within complex adaptive systems. Perspect Public Health. 2022;142:328–37.

36. Conway-Moore K, Knai C, Finegood D, Johnston L, Brinsden H, Aguiar A, et al. Co-creating obesity prevention policies with youth: Policy ideas generated through the CO-CREATE project. Obesity Reviews. 2023;24:e13623.
37. Gerritsen S, Renker-Darby A, Harré S, Rees D, Raroa DA, Eickstaedt M, et al. Improving low fruit and vegetable intake in children: Findings from a system dynamics, community group model building study. PLoS One. 2019;14:e0221107.
38. Vargas C, Venegas Hargous C, Grainger F, Perera L, Pymer S, Bell C, et al. Applying systems thinking to improve a hospital food retail environment. J Nutr Educ Behav. 2024;56:569–78.
39. Pot GK, Winkels RM, van Loenhout T. Letter to the Editor: An omission in guidelines. Cardiovascular disease prevention should also focus on dietary policies for healthcare facilities. Clin Nutr. 2023;42:1240–42.
40. Estrada-Magbanua WM, Huang TT-K, Lounsbury DW, Zito P, Iftikhar P, El-Bassel N, et al. Application of group model building in implementation research: A systematic review of the public health and healthcare literature. PLoS One. 2023;18:e0284765.
41. Cranney L, Thomas M, O'Connell T, Moreton R, Corbett L, Bauman A, et al. Creating healthy hospital retail food environments: Multiple pathways to successful at scale policy implementation in Australia. J Health Serv Res Policy. 2023;28:100–8.
42. Djojosoeparto SK, Verain MCD, Schebesta H, Biesbroek S, Poelman MP, Candel JJL. Harnessing the potential of public procurement for the protein transition – perceived barriers and facilitators. Agric Human Values. 2025;42:351-68.
43. Patton MQ. Qualitative Research & Evaluation Methods. 3rd ed. Thousand Oaks (CA): SAGE; 2002.
44. Green LW. Making research relevant: if it is an evidence-based practice, where's the practice-based evidence? Fam Pract. 2008;25(Suppl 1):i20–24.
45. Green LW. Public health asks of systems science: to advance our evidence-based practice, can you help us get more practice-based evidence? Am J Public Health. 2006;96:406–9.
46. Ammerman A, Smith TW, Calancie L. Practice-based evidence in public health: improving reach, relevance, and results. Annu Rev Public Health. 2014;35:47–63.
47. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. Implement Sci. 2009;4:50.
48. Hovmand P, Rouwette EAJA, Andersen D, Richardson G, Calhoun A, Rux K, et al. Scriptapedia: a handbook of scripts for developing structured group model building sessions. Proc Syst Dyn Conf. 2011;1476–91.
49. Derrick JW, Bellini SG, Spelman J. Using the Hospital Nutrition Environment Scan to evaluate health initiative in hospital cafeterias. J Acad Nutr Diet. 2015;115:1855–60.
50. Kromhout D, Spaaij CJK, de Goede J, Weggemans RM. The 2015 Dutch food-based dietary guidelines. Eur J Clin Nutr. 2016;70:869–78.
51. Voedingscentrum. Richtlijn Eetomgevingen. [Internet]. Available from: https://www.voedingscentrum.nl/professionals/gezonde-eetomgeving/de-richtlijn-gezondere-eetomgevingen.aspx.
52. van der Meij B, Kruizenga H. Voedingsconcepten in de Nederlandse Ziekenhuizen. Stuurgroep ondervoeding. 2016.
53. Garton K, Kraak V, Fanzo J, Sacks G, Vandevijvere S, Haddad L, et al. A collective call to strengthen monitoring and evaluation efforts to support healthy and sustainable food systems: 'The Accountability Pact.' Public Health Nutr. 2022;25:2353–7.

54. Meier KJ, O'Toole LJ. Subjective organizational performance and measurement error: common source bias and spurious relationships. J Public Adm Res Theory. 2013;23:429–56.
55. Roulston K, Shelton SA. Reconceptualizing bias in teaching qualitative research methods. Qual Inq. 2015;21:332–42.
56. Onwuegbuzie AJ, Leech NL. Validity and qualitative research: an oxymoron? Qual Quant. 2007;41:233–49.
57. Welker E, Lott M, Story M. The school food environment and obesity prevention: progress over the last decade. Curr Obes Rep. 2016;5:145–55.
58. Escaron AL, Meinen AM, Nitzke SA, Martinez-Donate AP. Supermarket and grocery store–based interventions to promote healthful food choices and eating practices: a systematic review. Prev Chronic Dis. 2013;10:120156.
59. Raine KD, Atkey K, Olstad DL, Ferdinands AR, Beaulieu D, Buhler S, et al. Healthy food procurement and nutrition standards in public facilities: evidence synthesis and consensus policy recommendations. Health Promotion and Chronic Disease Prevention in Canada. 2018;38:6–17.
60. Swinburn B, Sacks G, Vandevijvere S, Kumanyika S, Lobstein T, Neal B, et al. INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. Obes Rev. 2013;14(Suppl 1):1–12.
61. Bolton KA, Whelan J, Fraser P, Bell C, Allender S, Brown AD. The Public Health 12 framework: interpreting the 'Meadows 12 places to act in a system' for use in public health. Arch Public Health. 2022;80:72.
62. Nobles J, Wheeler J, Dunleavy-Harris K, Holmes R, Inman-Ward A, Potts A, et al. Ripple effects mapping: capturing the wider impacts of systems change efforts in public health. BMC Med Res Methodol. 2022;22:72.
63. Luna Pinzon A, Stronks K, Dijkstra C, Renders C, Altenburg T, den Hertog K, et al. The ENCOMPASS framework: a practical guide for the evaluation of public health programmes in complex adaptive systems. Int J Behav Nutr Phys Act. 2022;19:33.
64. McGill E, Er V, Penney T, Egan M, White M, Meier P, et al. Evaluation of public health interventions from a complex systems perspective: A research methods review. Soc Sci Med. 2021;272:113697.
65. Rijksinstituut voor Volksgezondheid en Milieu (RIVM). Impact van het Nationaal Preventieakkoord voor roken, overgewicht en problematisch alcoholgebruik. Bilthoven: RIVM; 2024.
66. Blanchard L, Ray S, Law C, Vega-Salas MJ, Bidonde J, Bridge G, et al. The effectiveness, cost-effectiveness and policy processes of regulatory, voluntary and partnership policies to improve food environments: an evidence synthesis. Public Health Res. 2024;12:1–173.
67. Ministerie van Volksgezondheid, Welzijn en Sport. Integraal Zorgakkoord (IZA): "Samen werken aan gezonde zorg." Den Haag: VWS; 2022.
68. Djojosoeparto SK, Kamphuis CBM, Vandevijvere S, Poelman MP. How can national government policies improve food environments in the Netherlands? Int J Public Health. 2022;67:1604115.
69. Vandevijvere S, Tseng M. Towards comprehensive global monitoring of food environments and policies to reduce diet-related non-communicable diseases. Public Health Nutr. 2013;16:2101–4.

Supplementary files

Supplementary files Chapter 2

Supplementary File 1 – Chapter 2

Interview guide for the semi-structured interviews with questions and prompts, used to obtain information regarding the food environment in hospitals and long-term care facilities.

Introduction and physical food environment

Thank you for participating in this interview.

1. Since when have you been working in the hospital/long-term care facility?
2. What is your function within the hospital/long-term care facility? On which location(s) are you working?
3. The interview is about the food and drinks in the hospital/long-term care facility and not about you, but I'm curious, what do you think in general of the food and drink offer in the hospital/long-term care facility?
   > Could you please provide information on how the food and drinks are organised in the hospital/long-term care facility?
   > Is the offer for health care receivers, staff and visitors organised separate or together? Managed in-house or outsourced?
   > Where can you get food and drinks and how do people eat?

Socio-cultural food environment

Attitude

4. How do people within the hospital/long-term care facility think about healthy eating and drinking, from the perspective of: the management board, facility management, staff, health care receivers, caterer(s)?
5. How do people within the hospital/long-term care facility think about sustainable eating and drinking, from the perspective of: the management board, facility management, staff, health care receivers, caterer(s)?

Culture

6. Which culture prevails in the hospital/long-term care facility when it comes to healthy eating and drinking? With culture I mean the whole of norms, values, traditions and rules of the hospital/long-term care facility.
7. Which culture prevails in the hospital/long-term care facility when it comes to sustainable eating and drinking? With culture I mean the whole of norms, values, traditions and rules of the hospital/long-term care facility.

Extra questions for long-term care facilities – habits: # Which habits are in place in the long-term care facility regarding healthy eating and drinking? With habit I mean a commonly accepted practice or habit. For example, every Friday fries? Ever Saturday a cake? Fish on Wednesday?
Which habits are in place in the long-term care facility regarding sustainable eating and drinking? With habit I mean a commonly accepted practice or habit.

Modelling

8. To what extent does the hospital/long-term care facility want to give the right example regarding healthy eating and drinking? If yes, how and to whom? For example to health care receivers, staff, visitors, the outside world, and/or other hospitals/ long-term care facilities? If not, why not?
9. To what extent does the hospital/long-term care facility want to give the right example regarding sustainable eating and drinking? If yes, how and to whom? For example to health care receivers, staff, visitors, the outside world, and/or other hospitals/long-term care facilities? If not, why not?

Empowerment

10. To what extent is the hospital/long-term care facility supporting her staff to eat healthy? If yes, how is the hospital/long-term care facility supporting them in this? And what about visitors? And health care receivers? If not, why not?
11. To what extent is the hospital/long-term care facility supporting her staff to eat sustainable? If yes, how is the hospital/long-term care facility supporting them in this? And what about visitors? And health care receivers? If not, why not?
12. To what extent is the hospital/long-term care facility supporting external stakeholders (caterers, suppliers, to whom the hospital/long-term care facility is outsourcing the eat- and drink facilities) to realize a healthy offer of food and drinks? If yes, how is the hospital/long-term care facility stimulating them in this? If not, why not?
13. To what extent is the hospital/long-term care facility supporting external stakeholders (caterers, suppliers, to whom the hospital/long-term care facility is outsourcing the eat- and drink facilities) to realize a sustainable offer of food and drinks? If yes, how is the hospital/long-term care facility stimulating them in this? If not, why not?

Extra questions for long-term care facilities: # Can you provide some information about the role staff on the floor have in the long-term care facility during eating and drinking moments? Do they stimulate/encourage health care receivers to consume healthy and sustainable food an drinks?
To what extent are staff aware of healthy and sustainable eating? Does this have a role in their work? Do they stimulate health care receivers for example in making the health and sustainable choice?

> Are there training programs for staff to stimulate healthy and/or sustainable eating among health care receivers?

Can you tell something about the preferences and needs of the target group in your long-term care facility, regarding eating and drinking? Do the preferences and needs play a role in determining what is consumed?

Political food environment

14. Does the hospital/long-term care facility have a vision regarding food and drinks in the hospital/long-term care facility, a vision on nutrition?
    > If yes, what does it entails?
    > If no, do you know why there is no vision on this? Do you know what could be of influence?
15. Does the hospital/long-term care facility have a policy regarding food and drinks in the hospital/long-ter care facility?
    > If yes, what does the policy entails? Is the policy separated for health care receivers, staff and visitors? Where is it written down, is there a document available? Can I read the document, can you mail it?
    > If no policy, do you know why there is no policy on this? Do you know what could be of influence?
16. Can you describe what is mentioned in the policy about healthy food and drinks in the hospital/long-term care facility? If nothing is mentioned, do you know the reason why?
    > Is the policy separated for health care receivers, staff and visitors? If yes, what is mentioned for health care receivers? What is mentioned for staff? What is mentioned for visitors?
    > To what extent and how are health care receivers, staff and visitors informed about the policy?
    > With what kind of rules and/or regulations must the food and drinks offer comply, as mentioned in the policy of the hospital/long-term care facility? You can think of the Dutch dietary guidelines and the Wheel of five.
    > Are there any restrictions concerning the food and drinks offered? If yes, what are those restrictions and how were those established?
    > In the determination of the provision of food and drinks, is health considered as a procurement criterion (requirements and preferences in the tendering process)?
17. Can you describe what is mentioned in the policy about sustainable food and drinks in the hospital/long-term care facility? If nothing is mentioned, do you know the reason why?

    If something is mentioned about sustainability:

- > Is the policy separated for health care receivers, staff and visitors? If yes, what is mentioned for health care receivers? What is mentioned for staff? What is mentioned for visitors?
- > To what extent and how are health care receivers, staff and visitors informed about the policy?
- > In the determination of the provision of food and drinks, is sustainability considered as a procurement criterion (requirements and preferences in the tendering process)?
- > How is this monitored? For instance, impact on the environment, seasonal fruits and vegetables?
- > To what extent is preference given to local products/suppliers?

18. Who made the policy? Who were involved*? Could you please tell something more about who determines what the offer of food and drinks for health care receivers, staff and visitors? * (Think of integrated policy/ formulated by an interprofessional team, for example facility management, dietician, kitchen, nurse).
19. How are policies, rules and/or regulations adhered to? And if yes, how is this controlled/monitored/assessed?

Economic food environment

20. To what extent do profit and loss play a role in determining the food and drink offer in the hospital/long-term care facility? Are there any economic considerations whether to sell or not sell food and drinks? And how does this differ per facility, for example meals for inpatients versus the restaurant for visitors? Could you provide information which food offer generates most profit? Do you intentionally strategize your offer to this?
21. Are the healthy food and drinks more expensive compared to the unhealthy food and drinks in the hospital/long-term care facility? If yes/no, why? And how is this for sustainable- versus non sustainable food and drinks?
22. > Eat and drink facilities for visitors, staff and health care receivers: Is healthy eating and drinking promoted in for example the restaurant or coffee corner? For instance by promotions, as discount and combo deals? Is sustainable eating and drinking promoted? For instance by promotions, as discount and combo deals?
    > Staff: does the hospital/long-term care facility offer any price incentives for employees who pay for food and drinks? If yes, how? (Is there a difference in the extent of the price incentive for healthy versus unhealthy food and beverages?)
    > Health care receivers: what is the daily food-budget for a health care receiver who resides in the hospital/long-term care facility? And what are the daily expenses the hospital/long-term care facility has for food and drinks for a health care receiver? Is there a difference between these two (budget and expenses)?

If yes, why? Is the daily-food budget sufficient to provide a complete offer of healthy and sustainable food and drinks to the health care receiver?

Transition towards a healthy and sustainable food environment – how to realize?

23. What is currently going well in your hospital/long-term care facility regarding the healthiness and sustainability of the food environment?
24. Where do you believe there are still opportunities/chances for improvement? What are the risks? What are barriers to realize this?
25. What are ambitions for the coming years concerning food and drinks, in terms of the offer, policies and pricing? Where does the hospital/long-term care facility aim to be and when does it intend to reach these goals? What is the current focus in this regard?
26. During this interview I have heard many stakeholders of the food environment – including caterer, supplier, dietician. Which stakeholders haven't been mentioned today, but are important stakeholders of the food environment?
27. Are you aware of-/ what do you think of the ambition of the National Prevention Agreement, that states that all hospitals should have a completely healthy offer of food and drinks in 2030? And ensuring a healthier food offer in other types of healthcare institutions?
    > If yes, what do you think of this ambition and why? Do you think it is good, or not good? Needed? Financially feasible/realistic? Organizationally feasible/realistic?
    > If no, [interviewer explains the ambition]: the Dutch government, in collaboration with many other organisations, has established agreements and documented them in the National Prevention Agreement, with important steps towards achieving a healthier Netherlands, by addressing smoking, overweight, and problematic alcohol consumption. One of these agreements is that all hospitals should have a healthy food offer in 2030 (for health care receivers, visitors and staff). And ensuring a healthier food offer in other types of healthcare institutions. What do you think of this ambition? Do you think it is good, or not good? Needed? Financially feasible/realistic? Organizationally feasible/realistic?

Only for hospitals: If the hospital is involved as a 'frontrunner hospital' in the initiative of the Nutrition & Healthcare Alliance: in what way are you, as frontrunner hospital/Goede Zorg Proef Je hospital of the Nutrition & Healthcare Alliance, working to realize the ambition in an accelerated pace?

If the hospital is not a 'frontrunner hospital': are you aware of the Goede Zorg Proef Je/ frontrunner hospitals of the Nutrition & Healthcare Alliance? Are you involved in this initiative? If yes, how? If no, why not?

28. What is needed in your hospital according to you to realize the ambition of the National Prevention Agreement? Think for example of selling less or no more fried snacks, making the price of healthy products lower compared to unhealthy products, or a different vision of a caterer or hospital or long-term care facility.
    > What do you need for this? > Who could help you with this? > What is needed from the management board, which adjustments, agreements or attitude? > What is needed from the in-house management situation? Which adjustments, agreements or attitude? > What is needed from the outsourced situation? Which adjustments, agreements or attitude? > What is needed from the consumers? For example the visitors who eat in the visitor restaurant or the staff who eat in the restaurant for staff?

Closing

Is there anything you want to add? Something we already discussed? Something we have not discussed yet? Do you have any remaining questions? *Thank you very much for your time and shared information.*

Supplementary File 2 – Chapter 2

Table 1 Food products offered in hospitals and long-term care facilities displayed per food outlet type

	Hospitals n (%)		**Long-term care facilities n (%)**	
	Restaurant for everyone Yes, present = 26 (92.9%)	**Restaurant for staff only** Yes, present = 18 (64.3%)	**Restaurant for everyone** Yes, present = 21 (58.3%)	**Restaurant for staff only** Yes, present = 5 (13.9%)
Croissants and puff pastry snacks	25 (96.2)	8 (44.4)	10 (47.6)	1 (20.0)
Sweets and chocolates	16 (61.5)	6 (33.3)	12 (57.1)	2 (40.0)
Fried snacks	23 (88.5)	17 (94.4)	13 (61.9)	3 (60.0)
Crisps and salted savoury snacks	13 (50.0)	7 (38.9)	12 (57.1)	2 (40.0)
Nuts non-salted	14 (53.8)	9 (50.0)	5 (23.8)	1 (20.0)
Cakes and pastries	22 (84.6)	5 (27.8)	12 (57.1)	1 (20.0)
Biscuits, muesli bars	23 (88.5)	15 (83.3)	16 (76.2)	4 (80.0)
Ice cream	13 (50.0)	1 (5.6)	13 (61.9)	2 (40.0)
Fruits	24 (92.3)	18 (100.0)	20 (95.2)	4 (80.0)
Vegetables	16 (61.5)	15 (83.3)	12 (57.1)	2 (40.0)
Free water	17 (65.4)	18 (100.0)	19 (90.5)	4 (80.0)
Paid water	26 (100.0)	18 (100.0)	15 (71.4)	3 (60.0)
Sugar-Sweetened Beverages	24 (92.3)	16 (88.9)	18 (85.7)	3 (60.0)
Sugar free beverages (diet or light)	26 (100.0)	17 (94.4)	18 (85.7)	3 (60.0)
Fruit juices (freshly squeezed) and smoothies	22 (84.6)	15 (83.3)	12 (57.1)	3 (60.0)
Skimmed milk, semi-skimmed milk and buttermilk	25 (96.2)	18 (100.0)	21 (100.0)	5 (100.0)
Whole milk	2 (7.7)	0 (0.0)	5 (23.8)	0 (0.0)
Plant based beverages (dairy substitutes)	11 (42.3)	6 (33.3)	10 (47.6)	1 (20.0)
Sweetened dairy drinks	21 (80.8)	18 (100.0)	16 (76.2)	5 (100.0)
Brown bread and wholemeal bread	23 (88.5)	18 (100.0)	21 (100.0)	5 (100.0)
White bread	21 (80.8)	15 (83.3)	16 (76.2)	5 (100.0)
Cold meat cuts	16 (61.5)	18 (100.0)	20 (95.2)	5 (100.0)
Cold meat cuts substitutes (vegetarian)	8 (30.8)	8 (44.4)	6 (28.6)	3 (60.0)
Low-fat cheese	13 (50.0)	16 (88.9)	15 (71.4)	4 (80.0)
Full fat cheese	16 (61.5)	18 (100.0)	17 (81.0)	5 (100.0)
Salad spreads for bread	15 (57.7)	18 (100.0)	14 (66.7)	4 (80.0)
Other savoury vegetarian bread filling	12 (46.2)	16 (88.9)	14 (66.7)	3 (60.0)
Sweet bread filling	16 (61.5)	18 (100.0)	17 (81.0)	5 (100.0)

Table 2 Food products offered to health care receivers in hospitals and long-term care facilities

	Hospitals n (%), n total = 28	**Long-term care facilities n (%), n total = 36**
Products offered for breakfast and lunch		
Fruits	28 (100.0)	30 (83.3)
Vegetables	22 (78.6)	19 (52.8)
Water	28 (100.0)	30 (83.3)
Sugar-Sweetened Beverages	26 (92.9)	16 (44.4)
Sugar free beverages (diet or light)	19 (67.9)	11 (30.6)
Fruit juices (freshly squeezed) and smoothies	12 (42.9)	15 (41.7)
Skimmed milk, semi-skimmed milk and buttermilk	28 (100.0)	36 (100.0)
Whole milk	15 (53.6)	11 (30.6)
Plant based beverages (dairy substitutes)	15 (53.6)	17 (47.2)
Sweetened dairy drinks	17 (60.7)	16 (44.4)
Brown bread and wholemeal bread	28 (100.0)	36 (100.0)
White bread	26 (92.9)	23 (63.9)
Cold meat cuts	28 (100.0)	36 (100.0)
Cold meat cuts substitutes (vegetarian)	14 (50.0)	17 (47.2)
Low-fat cheese	26 (92.9)	28 (77.8)
Full fat cheese	25 (89.3)	28 (77.8)
Salad spreads for bread	22 (78.6)	14 (38.9)
Other savoury vegetarian bread filling	24 (85.7)	29 (80.6)
Sweet bread filling	27 (96.4)	35 (97.2)
Products offered as snacks in-between meals		
Croissants and puff pastry snacks	6 (21.4)	16 (44.4)
Sweets and chocolates	4 (14.3)	13 (36.1)
Fried snacks	7 (25.0)	17 (47.2)
Crisps and salted savoury snacks	5 (17.9)	16 (44.4)
Nuts non-salted	18 (64.3)	15 (41.7)
Cakes and pastries	8 (28.6)	17 (47.2)
Biscuits, muesli bars	21 (75.0)	27 (75.0)
Ice cream	15 (53.6)	11 (30.6)
Fruits	27 (96.4)	32 (88.9)
Vegetables	18 (64.3)	15 (41.7)

Table 1 Description of the activities during the one year study trajectory, chronologically displayed including methods, aims and measures[1]

Time point	Activity	Method or program	Aim	Adaptations to script or own script explanation	Measures for research
T0 May 2022	**GMB session 1**	Own script, opening of the session	To welcome participants, explain the goal of the session.	Own script, opening, introduce the team, presentation on food environment, systems thinking and goal of session.	Not applicable
		Script from Scriptapedia: hopes and fears	To elicit group expectations for the first GMB session.	No adaptations.	Not applicable
		Script from Scriptapedia: graphs over time	To engage participants in the session, frame the problem, initiate mapping, elicit variables, and gather input to decide the reference modes for the session.	Graphs were not placed on the wall. Small groups of 2-4 persons were formed.	Candidate variables for the CLD
		Script from Scriptapedia: building a CLD with paper	To capture the variables and causal structures that emerge during a participant discussion early in the GMB process.	All variables were included on the wall, not limited to 5-6 key variables as the Script says. No identification of feedback loops, because there was no time left.	CLD with variables and connections
		Script from Scriptapedia: next steps and closing	To identify next steps and close the session.	No adaptations.	Evaluation form filled in by participants during the closing, developed for this study.
In between session 1 and 2	**Preparation for session 2**	Not applicable	To finetune the CLD for presentation during session 2.	CLD finetuned by the research team. Variables directly influencing the environment were included in the CLD. Variables considered as part of the food environment were excluded. Leverage points were identified. Feedback loops were identified and highlighted.	Not applicable

1 GMB = group model building, CLD = causal loop diagram

Table 1 Description of the activities during the one year study trajectory, chronologically displayed including methods, aims and measures[1] (*continued*)

Time point	Activity	Method or program	Aim	Adaptations to script or own script explanation	Measures for research
June 2022	**GMB session 2**	Own script, opening of the session	To welcome participants, explain the goal of the session.	Own script, opening, recap of session 1 and goal of session.	Not applicable
		Script from Scriptapedia: Transferring Group Ownership from One Image to Another	To show and explain the participants how insights and input from the first session were incorporated into the CLD and ask the participants feedback on the CLD.	CLD on large screen and handed out to participants.	Feedback on CLD
		Script from Scriptapedia: Places to intervene (in this study: leverage points)	To show participants leverage points and let them find out and understand which are most changeable and impactful.	Leverage points were listed beforehand by the research team. Participants had to score these points on changeability and impact on a form.	Scores on changeability and impact of the leverage points
		Script from Scriptapedia: Action ideas	To identify and prioritize actions based on the leverage points in the CLD.	Participants were instructed to think of actions related to the leverage points in the CLD.	Formulated actions
		Script from Scriptapedia: next steps and closing	To identify next steps and close the session.	No adaptations.	Evaluation form filled in by participants during the closing, developed for this study.
After session 2	**After session 2**	Not applicable	To finalize the CLD.	No script. CLD was finalized by research team, based on input of participants during session 2.	CLD

1 GMB = group model building, CLD = causal loop diagram

Table 1 Description of the activities during the one year study trajectory, chronologically displayed including methods, aims and measures[1] (*continued*)

Time point	Activity	Method or program	Aim	Adaptations to script or own script explanation	Measures for research
T1 September-December 2022	**Action conversation, live at the main location of each long-term care facility**	Using a semi-structured conversation guide. The Nutrition & Healthcare Alliance showed website and tools to start improving the food environment. Website 'Goede Zorg Proef Je' (A Taste of Excellent Healthcare) of the Nutrition and Healthcare Alliance: https://goede-zorgproefje.nl/	An extra contact moment, stimulus for action.	Showing the preliminary CLD and actions participants indicated in session 1 and 2. Asked questions about what the organization is planning to do and what they need.	Not applicable
February 2023	**Webinar**	Organised by the Nutrition & Healthcare Alliance, integrated into/ part of their network	An extra contact moment, stimulus for action.	Introducing all long-term healthcare facilities in the webinar, updates and news from the network of Nutrition & Healthcare Alliance, inspiration presentation by a hospital as a good example of how to change the food environment.	Not applicable
T2 May 2023	**Closing session**	Time-line wall	To explore the past and the future, by creating a time-line wall.	Own script. Using post-its, participants were asked to write down activities and milestones that took place in the past year. They were also asked to think of what is needed to realize a transition of the food environment by 2030. Participants had to place the post-its on the time-line wall.	Activities and milestones that participants wrote on post-its.

Supplementary File 2 – Chapter 3

Table 1 Topics and prompts for interviews with long-term care facilities at six and twelve months after the GMB sessions[1]

Topics	Prompts
Looking back on study trajectory (interviewer recaps activities)	- What did participating in this study trajectory deliver, did it benefit you or the healthcare organization? In which way or why not? - Did the discussions initiate collaborations with other healthcare organizations? - Have you or the healthcare organization used the developed CLD? How? Why not? - Have you or the healthcare organization started implementing the developed actions? If yes, how? If not, why not? - Have other things been initiated or implemented to improve the food environment? If yes, how? Or what has been planned to initiate or implement? - Have you involved or inspired other people? - Any new meetings, documents or guidelines developed in the previous (half) year, regarding to this theme? Initiated because of participating in study trajectory, or have you been working on this theme before? If yes, in what way?
Facilitators and barriers for transitioning to a healthy and sustainable food environment	- What is going well? What helps? - What is challenging, difficult? What causes this? - What do you need to overcome these challenges? Support from the organization, management, time, budget? - Support from other actors, Nutrition and Healthcare Alliance, national government, other parties?
Goals and ambitions for transitioning to a healthy and sustainable food environment	- Goals and ambitions set? If not, why? - Who was involved? - When do you want to achieve these goals? Term attached? - How will you achieve these goals, what is your plan, approach? - What do you need to achieve these goals? - How realistic is it to achieve goals? - When are you satisfied? What is your ultimate ambition?

1 GMB = group model building, CLD = causal loop diagram

Interview guide for the semi-structured interviews with long-term care facilities at six and twelve months after the GMB sessions[2]

Introduction. Thank you for participating in this interview.

Looking back on study trajectory activities

- What have these moments and your participation in the project/research given you? How have they been helpful to you? If they were helpful, in what way? If not: why not?
- What did the first two sessions last year start for you? (e.g. discussions? memos?) What does participating in such a project cause? Has anything concrete changed in the food environment as a result of your participation in the project/research? If yes, what? If no, why not?
- Did the conversations with the other participating healthcare institutions during these sessions, start any collaborations or connections or something similar?
- In the sessions we developed a systems map of the food environment. Did you do anything with this? How did you approach this? If nothing was initiated: why not? What was the reason? Did it lead to anything else (e.g. discussions)?
- In the second session we developed actions for transition to a healthy and sustainable food environment. In what way have you been working on this? How did you approach this? How did you start working on this? If nothing was initiated: why not? What was the reason? Did it result in anything else (e.g. discussions?)
- Apart from the actions we formulated together last year, have other things been initiated in the past (half) year to optimize the food environment? Can you describe how that happened, what steps were taken? And what is planned to achieve or initiate?
- Who did you talk to about this, who did you involve? Who did you inspire?
- Have any new meetings, documents, or guidelines on this theme been developed at your institution over the past (half) year?
- Was this initiated because of participation in this project, or were you already engaged with these theme in a broader sense before? In what ways were you already addressing this theme?

Facilitators/barriers

- What is going well so far in the transition to a healthy and sustainable food environment within your healthcare institution? What has been helpful in that process?
- What challenges are you encountering? What is difficult? What is causing this? What is needed to resolve this? What support would you like to receive in this regard, from

2 GMB = group model building

the a) healthcare institution, b) from management/board, c) in terms of resources, e.g. budget/time?
- What support would you like to receive from other stakeholders, for example from the Nutrition & Healthcare Alliance, the government or other external parties?

Goals/ambitions
- Have you set concrete goals/ambitions together that you aim to achieve as healthcare institution in the transition to a healthy and sustainable food environment, whether or not this was prompted by the study trajectory activities?
- If yes, what goal(s)/ambition(s) have been set (can you formulate these as specifically as possible)? If not, why not?
- Who did you formulate this with, who was involved in this process?
- Is there a deadline attached to this, and if so, by what time do you aim to achieve this? / When do you expect this to be accomplished?
- How do you plan to approach achieving these goals and ambitions (to implement a healthy and sustainable food environment)?
- What do you need to accomplish this? Are there any other steps you want to take or have taken to achieve this?
- How likely do you think it is at this moment that these goals will be achieved?
- When will you be satisfied? What is your ultimate ambition in the transition to a healthy and sustainable food environment?
- *Extra question at 6 months:* In June 2023, I would like to interview you again. What do you as healthcare institution expect to have achieved by then?

Closing. Is there anything you want to add? Something we already discussed? Something we have not discussed yet? Do you have any remaining questions? Thank you very much for your time and shared information.

Supplementary File 3 - Chapter 3

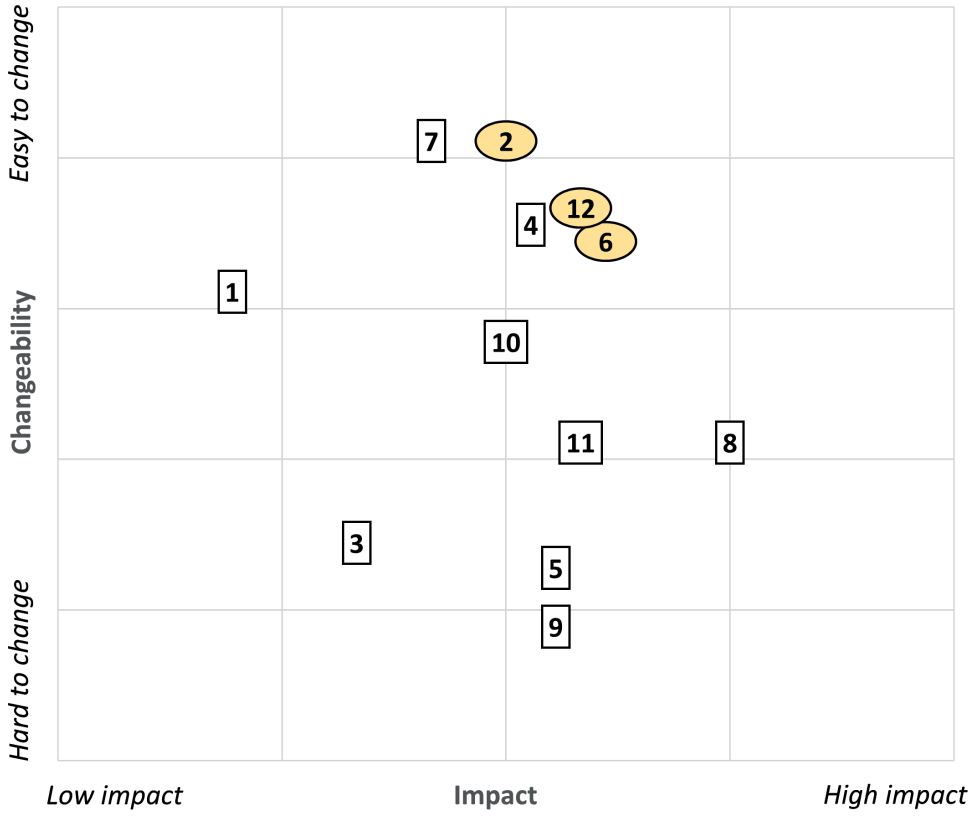


Figure 1 Changeability and impact of leverage points[1] scored by participants, the numbers in a yellow oval shape are the three leverage points that had the highest score combination of the sum of impact and changeability. The numbers of the leverage points correspond to the underlined numbered factors in the causal loop diagram in Figure 3 of the Chapter 3.

[1] **Description of the numbered leverage points:**
1 Nutritional knowledge and skills of patient
2 Nutritional knowledge and skills of staff
3 (digital) Food marketing
4 Staff/patient purchases healthy and sustainable food
5 Budget allocated to healthy and sustainable food
6 Healthy and sustainable food is part of (preventive) care plan
7 Working interdisciplinary around food
8 Support within entire organization
9 Staff availability in time
10 Policy on food environment formulated and implemented by the organization
11 (National) Policy on food environment
12 Lobby and agenda setting

Supplementary File 4 – Chapter 3

Table 1 Actions formulated by participants during session 2 per subsystem and appraised on the levels of the Actions Scales Model (ASM)

Subsystem the healthcare organization	Level of ASM
The healthcare institutions provides all (new) employees with education, workshops and/or training to increase knowledge about healthy and sustainable foods and its relevance	Events
The healthcare institution communicates and promotes healthy and sustainable eating and its relevance throughout the entire healthcare organization (for patients, visitors and staff) via posters, brochures, flyers, infographics, information	Events
Install a menu committee (consisting of e.g. patients and staff?) that ensures the menu is healthy and sustainable, e.g. by identifying healthy and sustainable recipes or adapting existing recipes	Structures
Organize a healthy and sustainable theme week within the healthcare organization at least once a year, with various activities to promote healthy and sustainable diets (e.g. cooking workshops, cooking together, information market)	Events
The healthcare institution makes sure that fruit and vegetables are standard part of every meal	Structures
The healthcare institution allocates time and budget to education for staff about healthy and sustainable foods	Structures
Develop structures to collaborate in projects and consultation groups within and between healthcare institutions, to exchange knowledge, inspire and learn from each other concerning the transition towards a healthy and sustainable food environment	Structures
Make healthy nutrition a fixed/standard part of the treatment- or care plan for patients	Structures
Create support and guidance from the management level of the healthcare organization, e.g. via signing a declaration of intention	Beliefs
Stimulate the management of the healthcare organization to make a plan for transition to a healthy and sustainable food environment (agenda setting), to ensure that the management prioritizes this plan and increase support and ownership for the importance of the transition towards healthy food in the entire organization (all levels, all functions)	Beliefs
The healthcare institution uses online (e.g. social) media to provide information on healthy nutrition and steer the demand towards healthy foods (e.g. via videos with influencers)	Events
Involve the Human Resources (HR) department of the healthcare institution in providing initiatives for stimulating healthy behaviour for staff, e.g. via giving vitality credits	Events
Create possibilities for sharing best practices between healthcare institutions on how to change to a healthy and sustainable food environment, e.g. via a network.	Structures
Provide training on the job: healthcare institutions teach staff how to order healthy and sustainable foods, e.g. by staff purchasing food together with a dietitian	Events
Healthcare institutions invite dietitians or doctors, to explain e.g. the benefits of healthy and sustainable foods to patients and staff	Events
The healthcare institution monitors and evaluates the efforts and progress towards a healthy and sustainable food environment, starting with a baseline measurement	Structures
Ensure more available time of staff, e.g. by increasing the number of nutritional assistants or using volunteers	Structures

The healthcare institutions continuously pursues and implements actions and efforts for realizing a healthy and sustainable food environment, e.g. by incorporating automatic mechanisms	Structures
Use cards at meal buffets to indicate the healthy and sustainable food choice	Events
Make someone in the healthcare institution responsible for ownership, e.g. appointing a portfolio holder, contact person tasked with managing the transition of the food environment	Structures

Subsystem the patient	**Level of ASM**
The healthcare institution involves and consults the client- or relative-council in the transition to a more healthy and sustainable food environment	Structures
Ensure that patients and/or staff eat together, as part of care or treatment plan	Structures
Organize courses about healthy and sustainable diets within the care department or daytime care for patients, e.g. to which can be referred when discussing menus with patients?	Events

Subsystem national governance and policy	**Level of ASM**
Include healthy and sustainable nutrition as a fixed subject into the healthcare education's curriculum	Structures
Introduce/enter social service to enthuse adolescents, who just finished high school, to work in the healthcare sector, thereby decreasing the staff shortage in the long-term, more time for staff to focus on the food environment	Structures
The national government makes the creation of a healthy and sustainable food environment a healthcare quality indicator and monitors it	Goals
Develop specific visions and guidelines for healthy and sustainable food environments for each type of healthcare institution (e.g. the one for rehabilitation centres is different from the one for mental healthcare)	Goals
Stimulate the national government to prioritize and support creating a healthy and sustainable food environment in the healthcare setting, e.g. increase the lobby (e.g. from healthcare sector, professionals associations or health care insurances) or by sending an urgent letter, signing a petition	Beliefs
Appoint a (regional) portfolio holder, e.g. to do regional agenda setting, who initiates and leads action implementation for a healthy and sustainable food environment in the healthcare setting in a specific region (especially for larger healthcare institutions)	Structures
The national, regional or local government allocates budget for stimulation of healthcare institutions to realize a healthy and sustainable food environment, e.g. via research funding, subsidies	Beliefs

Subsystem purchasing, procurement and budget	Level of ASM
The healthcare institution makes agreements with suppliers and caterers operating in the healthcare institutions or develops policies, concerning a healthy and sustainable food offer (e.g. via food procurement policies)	Goals
The healthcare institution ensures transparency in the budget and reviews expenses on a regular base to get insights into the adequacy and sufficiency of the budget to realize a healthy and sustainable food offer within the healthcare institution	Structures
The healthcare institutions increases the available budget, e.g. via approval at management level, for healthy and sustainable foods	Structures
The healthcare institution or caterer changes the positioning of products: place healthy products in prominent locations, at the front and place unhealthy products at the back	Events
The healthcare institution or caterer increases the healthy and sustainable food availability in the healthcare institution for patients, staff and visitors (e.g. by applying a 80/20 rule and ensuring that 80% is healthy)	Structures
A caterer ensures that he/she has a wide offer of healthy and sustainable products	Structures
The healthcare institution and/or caterer ensures that healthy and sustainable products are attractively priced and are cheaper than unhealthy and unsustainable foods	Structures
The healthcare institution allocates budget specifically to purchase fruits or the institution provides fruits for both staff and patients	Structures
Identify and express the financial benefits of healthy and sustainable food, e.g. via showing the benefits in health gain or quality of life, making a business case, and use this to steer financial decisions in favour of a healthy and sustainable food environment	Beliefs
The electronic health record of patients includes *positive health* as an indicator, facilitating a more holistic perspective and give healthy eating a more prominent position	Structures

Supplementary files Chapter 4

Supplementary file 1 - Chapter 4

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	9
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	9
Occupation	3	What was their occupation at the time of the study?	9
Gender	4	Was the researcher male or female?	9
Experience and training	5	What experience or training did the researcher have?	9
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	9
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	8
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	N/A
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	7

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	8
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	8
Sample size	12	How many participants were in the study?	11
Non-participation	13	How many people refused to participate or dropped out? Reasons?	11
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	11
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	9
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	Supplementary file 4
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	9
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	N/A
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	11
Field notes	20	Were field notes made during and/or after the interview or focus group?	N/A
Duration	21	What was the duration of the inter views or focus group?	11
Data saturation	22	Was data saturation discussed?	8
Transcripts returned	23	Were transcripts returned to participants for comment and/or correction?	9
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	10
Description of the coding tree	25	Did authors provide a description of the coding tree?	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
			10
Derivation of themes	26	Were themes identified in advance or derived from the data?	10
Software	27	What software, if applicable, was used to manage the data?	10
Participant checking	28	Did participants provide feedback on the findings?	9
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	10
Data and findings consistent	30	Was there consistency between the data presented and the findings?	10
Clarity of major themes	31	Were major themes clearly presented in the findings?	11, 29, 38, 39
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	11, 29, 38, 39

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Supplementary file 2 – Chapter 4

Interview guide for the semi-structured interviews with participants from a wide spectrum of stakeholder groups, conducted in three hospitals

Introduction. Thank you for participating in this interview.

Starter

- How did you become involved with the topic a healthy and sustainable food environment/ A Taste of Excellent Healthcare'?
- What is/was your role/contribution in the implementation of the 'A Taste of Excellent Healthcare' activities? Was this an active role?
- And what does a healthy and sustainable environment mean to you?

Motivation

- What prompted your hospital to get involved in 'A Taste of Excellent Healthcare'?
- What was the initial motivation, and what were your drivers?
  Prompts: national policy, positioning/branding of the hospital, space for a pilot/testing ground
- Were you already working on the topic a healthy and sustainable food environment? If so, in what way? What is/was your role/contribution within that?

Preparation/ Prerequisites

- What resources (who and what) have been made available for 'A Taste of Excellent Healthcare' (or: changing towards a healthy and sustainable food environment)? Consider aspects such as time, budget, full-time equivalents (FTE), and for how long?
- How has this taken shape? Was it a smooth process to make resources available, or not?
  Prompts: driving force/champion, steering committee, room for commitment and urgency, visible in budget/vision/policy
- What would you have preferred to see differently in this? What resources did you find lacking?
  At the start of 'A Taste of Excellent Healthcare' (or: changing towards a healthy and sustainable food environment), were concrete ambitions and goals established in your opinion, regarding where you as a hospital /intend to head? And if so, which ones?
- And by whom was this developed/formulated?
- Are there key focus areas that you want to emphasize as a hospital? If so, which ones?
- And tot hey align with 'A Taste of Excellent Healthcare'?

Stakeholders

- Who are involved inside the hospital, regarding your activities for 'A Taste of Excellent Healthcare'? (in which levels of the organization do they operate?)
- Who are involved outside the hospital, regarding your activities for 'A Taste of Excellent Healthcare'?
- What is the level of commitment/involvement/support from management/board of directors?
- What did this concretely mean?
- And how did you experience this?
- Does this relate to your own commitment and beliefs regarding 'A Taste of Excellent Healthcare'?
- Who made the decisions regarding the activities of 'A Taste of Excellent Healthcare'? (decision-making process)

Activities / conditions

- What does 'A Taste of Excellent Healthcare'? mean to you within your hospital?
  Prompts: push, facilitator, network, information, tools, service desk, masterclasses, trainings, steering committee, ambassadors, support.
  And, outcome: realizing a healthy and sustainable food environment in the hospital.
- How did you get started?
- How did you approach this?
- What concrete actions have you taken?

Output

- What have you achieved so far? (referring back to ambitions and goals)
- Has anything concrete changed in the hospital so far?
- When will you be satisfied?
- What made it possible for you to achieve this?
  (What key ingredients are necessary for realizing the activities?)
- What do you believe has really made a difference for a healthy and sustainable food environment in the hospital?
- What went well? What helped in this?
- What was difficult? What caused that? Were you able to resolve it?
- Are there things that didn't succeed? If so, what caused this?
- What would have been needed?
- Has the program 'A Taste of Excellent Healthcare' initiated any other things in the hospital? This can be positive or negative.

Maintenance

- To what extent do you expect that what you have accomplished so far will be sustainable?
- What is needed to continue doing this sustainably (what are the key ingredients/conditions for securing this)? What have you already done in this regard? Follow up

on ambitions and goals: How do you ensure that the current efforts are retained? What is going well in this process?

- What challenges are you facing? What is causing these challenges? (barriers for maintenance)

Future

- You have started this; how do you envision it in the future?
- How will you continue with this as hospital?
- And what do you need to continue?
- You mentioned several ambitions/goals at the beginning of our conversation; do you want to pursue any other goals/ambitions in the future?
- Which support from 'A Taste of Excellent Healthcare', the hospital, the government or other parties would contribute to this? Or what support would you like to receive?
- Finally, what are your main suggestions for other hospitals who want to realize a healthy and sustainable food environment? What should they consider? Suggestions? What do they need?

Closing. Is there anything you want to add? Something we already discussed? Something we have not discussed yet? Do you have any remaining questions? Thank you very much for your time and shared information

Supplementary file 3 – Chapter 4

CODEBOOK TRANSLATED FROM DUTCH TO ENGLISH

1 INNOVATION DOMAIN 'THE THING BEING IMPLEMENTED'
(A Taste of Excellent Healthcare, TEH)

a Evidence base for the TEH approach for a healthy and sustainable food environment
b Presence of clear guidelines/frameworks defining a healthy and sustainable food environment
c Contribution of TEH to a healthier and sustainable food environment
d Flexibility and freedom for adaptation/change within the process

2 OUTER SETTING DOMAIN 'THE SETTING IN WHICH THE INNER SETTING EXISTS'
(Outside the hospital)

a Tools provided by other stakeholders
b Societal problem in the Netherlands
c The Nutrition and Healthcare Alliance as a catalyst
d COVID
e Role of the government
f Networks
g Supplier/caterer: assortment sufficient or not
h Supplier/caterer: interests
i Supplier/caterer: cooperative or not

3 INNER SETTING DOMAIN 'THE SETTING IN WHICH THE INNOVATION IS IMPLEMENTED'
(Within the hospital)

a Conflicting interest in the hospital
b Staff changes in the hospital
c Role perception of the hospital
d Support from management/board
e Branding/frontrunner
f Food as key focus of the hospital
g Shared ownership
h Embedded in the hospital
i Translation of TEH to own program
j People in the hospital are familiar/not familiar with TEH
k Involvement of all levels within the organization

4 INDIVIDUALS DOMAIN 'THE ROLES AND CHARACTERISTICS OF INDIVIDUALS' (The individual/interviewee)

a Individual/interviewee: as role model
b Individual/interviewee: dealing with resistance
c Individual/interviewee: guidelines/tools to change
d Individual/interviewee: experienced time
e Individual/interviewee: perceived role as driver
f Individual/interviewee: intrinsic motivation
g Individual/interviewee: experienced freedom to implement the change

5 IMPLEMENTATION PROCESS DOMAIN 'THE ACTIVITIES AND STRATEGIES USED TO IMPLEMENT THE INNOVATION'

a Allocated time
b Available resources
c Drivers / ambassadors
d Communication about the change
e Support
f Monitoring progress
g Learning approach
h Clear action plan from the organization for implementation of change
i Long process
j Vision and goals

6 END-USER (patient, staff, visitors using the food environment)

a Attitude end-user

Supplementary file 4 – Chapter 4

Table 1 of Supplementary file 4 Participant characteristics

N (P#)	Gender	Function	Stakeholder group	Individual or duo, in person or online
P1	M	Department manager of sports medicine clinic, orthopaedics clinic	healthcare professionals	Individual, in person
P2	F	Meal service employee	facility professionals	Individual, in person
P3	M	Location manager visitor restaurant	facility professionals	Individual, in person
P4	F	Facility coordinator cure and care	project coordinators	Individual, in person
P5	F	Facility services coordinator	facility professionals	Individual, in person
P6	F	Program maker nutrition	project coordinators	Individual, in person
P7	F	Hotel service department manager	project coordinators	Individual, in person
P8	F	Dietitian	healthcare professionals	Individual, in person
P9	M	Food and beverage advisor/chef	facility professionals	Individual, in person
P10	F	Team leader food and catering	facility professionals	Individual, online
P11	F	Chairman of the board of directors	board of directors	Individual, in person
P12	M	Theme manager care	healthcare professionals / board of directors	Individual, online
P13	M	Chairman of the board of directors	board of directors	Individual, in person
P14	F	Head of traumatology orthopaedics	healthcare professionals	Individual, online
P15	F	Service assistant	facility professionals	Individual, online
P16	F	Team leader food and beverage facilities	facility professionals	Individual, online
P17	F	Head of food and beverages	project coordinators	Individual, online
P18	F	Team leader catering facilities	facility professionals	Individual, online
P19	F	Dietitian	healthcare professionals	Individual, online
P20	M	Chef cook	facility professionals	Individual, online

Table 1 of Supplementary file 4 Participant characteristics (*continued*)

N (P#)	Gender	Function	Stakeholder group	Individual or duo, in person or online
P21	F	Paediatrician	healthcare professionals / project coordinators	Individual, online
P22	F	Head of oncology care	healthcare professionals	Individual, online
P23	F	Project leader nutrition	project coordinators	Individual, online
P24	M	Contract manager food and beverages	project coordinators	Duo, together with P25, online
P25	M	General manager caterer	facility professionals	Duo, together with P24, online
P26	F	Professor of obstetrics and gynaecology	healthcare professionals	Individual, online
P27	F	Program leader prevention program	project coordinators	Individual, online
P28	F	Gastroenterologist	healthcare professionals	Individual, online
P29	M	Chef of caterer	facility professionals	Individual, online
P30	M	Professor of prevention in healthcare	project coordinators	Individual, online

Supplementary file Chapter 5

Supplementary file 1 - Chapter 5

Monitoring checklist[1] actions used for this study, as requested during the monitoring moments for hospitals and healthcare institutions

VISION, 1-3

1. Action in figures of manuscript: Vision healthy food offering for patients

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for patients.
- Hospitals Q4 2023:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines for patients).
- Hospitals Q2 2024:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines for patients).
- Healthcare institutions Q4 2022:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for patients.
- Healthcare institutions Q4 2023:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for patients.

1 The 'A Taste of Excellent Healthcare' monitoring checklist was based upon the 2015 Dutch food-based dietary guidelines [1], ESPEN guidelines for hospital nutrition [2] and success factors for meal systems [3] (for patients), and the Guidelines Eating Environments of the Dutch National Nutrition Centre [4] for staff and visitors.

1. Kromhout D, Spaaij CJK, De Goede J, Weggemans RM, Brug J, Geleijnse JM, et al. The 2015 Dutch food-based dietary guidelines [Internet]. Vol. 70, European Journal of Clinical Nutrition. Nature Publishing Group; 2016 [cited 2020 Nov 23]. p. 869–78. Available from: www.gr.nl
2. Thibault R, Abbasoglu O, Ioannou E, Meija L, Ottens-Oussoren K, Pichard C, et al. ESPEN guideline on hospital nutrition. Clinical Nutrition. 2021 Dec 1;40(12):5684–709.
3. van der Meij B, Kruizenga H. Voedingsconcepten in de Nederlandse Ziekenhuizen. [Internet]. 2016. Available from: https://www.kenniscentrumondervoeding.nl/voedingsconcepten-in-ziekenhuizen/#toggle-id-4-closed
4. Voedingscentrum. Richtlijn Eetomgevingen [Internet]. Available from: https://www.voedingscentrum.nl/professionals/gezonde-eetomgeving/de-richtlijn-gezondere-eetomgevingen.aspx

2. Action in figures of manuscript: Vision healthy food offering for visitors

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for visitors.
- Hospitals Q4 2023:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for visitors.
- Hospitals Q2 2024:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for visitors.
- Healthcare institutions Q4 2022:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for visitors.
- Healthcare institutions Q4 2023:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for visitors.

3. Action in figures of manuscript: Vision healthy food offering for staff

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for staff
- Hospitals Q4 2023:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines for staff
- Hospitals Q2 2024:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines for staff
- Healthcare institutions Q4 2022:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for staff
- Healthcare institutions Q4 2023:
  There is a vision regarding a healthy food offering (starting point Dutch food-based dietary guidelines) for staff

PATIENTS, 4-12

4. Action in figures of manuscript: Maintain dialogue with caterer/kitchen

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  The healthcare institution maintains the dialogue with the caterer/kitchen regarding the food offering for patients, following the Dutch food-based guidelines
- Hospitals Q4 2023:
  The healthcare institution maintains the dialogue with the caterer/supplier/kitchen regarding the food offering for patients, following the Dutch food-based guidelines
- Hospitals Q2 2024:
  The healthcare institution maintains the dialogue with the caterer/supplier/kitchen regarding the food offering for patients, following the Dutch food-based guidelines
- Healthcare institutions Q4 2022:
  The healthcare institution maintains the dialogue with the caterer/supplier/kitchen/nutrition staff regarding the food offerings for health care receivers, following the Dutch food-based guidelines
- Healthcare institutions Q4 2023:
  The healthcare institution maintains the dialogue with the caterer/supplier/kitchen/nutrition staff regarding the food offerings for healthcare receivers, following the Dutch food-based guidelines

5. Action in figures of manuscript: Interprofessional coordination

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  There is interprofessional coordination regarding the food offering, involving at least the departments of dietetics and facility management
- Hospitals Q4 2023:
  There is interprofessional coordination regarding the food offering, involving at least the departments of dietetics and facility management
- Hospitals Q2 2024:
  There is interprofessional coordination regarding the food offering, involving at least the departments of dietetics and facility management
- Healthcare institutions Q4 2022:
  There is interprofessional coordination regarding the food offering, involving at least a dietitian
- Healthcare institutions Q4 2023:
  There is interprofessional coordination regarding the food offering, involving at least a dietitian

6. Action in figures of manuscript: Optimize nutrition assistants' skills

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  Attention is given to optimizing the skills and services of the nutrition assistant. The nutrition assistant = healthcare provider in the food provision process.
- Hospitals Q4 2023:
  Attention is given to optimizing the nutrition skills, knowledge, and services of the nutrition assistant. The nutrition assistant = healthcare provider in the food provision process.
- Hospitals Q2 2024:
  Attention is given to optimizing the nutrition skills, knowledge, and services of the nutrition assistant. The nutrition assistant = healthcare provider in the food provision process.
- Healthcare institutions Q4 2022:
  Attention is given to optimizing the nutrition skills, knowledge, and services of nutrition staff
- Healthcare institutions Q4 2023:
  Attention is given to optimizing the nutrition skills, knowledge, and services of nutrition staff

7. Action in figures of manuscript: monitor and reduce (food) waste

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  General waste and food waste are monitored and reduced
- Hospitals Q4 2023:
  General waste and food waste are monitored and reduced when necessary
- Hospitals Q2 2024:
  General waste and food waste are monitored and reduced when necessary
- Healthcare institutions Q4 2022:
  General waste and food waste are monitored and reduced when necessary
- Healthcare institutions Q4 2023:
  General waste and food waste are monitored and reduced when necessary

8. Action in figures of manuscript: Food service concept meets guidelines

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  The food service concept for patients complies with the Dutch food-based guidelines

- Hospitals Q4 2023:
  Where possible, the food service concept for patients complies with the Dutch food-based guidelines
- Hospitals Q2 2024:
  Where possible and medically appropriate, the food service concept for patients complies with the Dutch food-based guidelines
- Healthcare institutions Q4 2022:
  Where possible, the food service concept for healthcare receivers complies with the Dutch food-based guidelines
- Healthcare institutions Q4 2023:
  Where possible, the food service concept for healthcare receivers complies with the Dutch food-based guidelines

9. Action in figures of manuscript: Nutritional guidelines meals, snacks

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  Guidelines for the nutritional value of meals and snacks are applied
- Hospitals Q4 2023:
  Guidelines for the nutritional value of meals and snacks are applied
- Hospitals Q2 2024:
  Guidelines for the nutritional value of meals and snacks are applied
- Healthcare institutions Q4 2022:
  Guidelines for the nutritional value of meals and snacks are applied.
- Healthcare institutions Q4 2023:
  Guidelines for the nutritional value of meals and snacks are applied

10. Action in figures of manuscript: Appropriate food offering for malnutrition

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  There is an appropriate food offering for patients with (risk of) malnutrition (energy and protein enriched).
- Hospitals Q4 2023:
  There is an appropriate food offering for patients with (risk of) malnutrition (energy and protein enriched).
- Hospitals Q2 2024:
  There is an appropriate food offering for patients with (risk of) malnutrition (energy and protein enriched).
- Healthcare institutions Q4 2022:
  There is an appropriate food offering for healthcare receivers with (risk of) malnutrition (energy and protein enriched).

- Healthcare institutions Q4 2023:
  There is an appropriate food offering for healthcare receivers with (risk of) malnutrition (energy and protein enriched).

11. Action in figures of manuscript: Appropriate diets for specific diets

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  There is an appropriate food offering for patients with specific diets (e.g., low sodium, low potassium, fluid restriction, different consistencies, etc.).
- Hospitals Q4 2023:
  There is an appropriate food offering for patients with specific diets (e.g., low sodium, low potassium, fluid restriction, different consistencies, etc.).
- Hospitals Q2 2024:
  There is an appropriate food offering for patients with specific diets (e.g., low sodium, low potassium, fluid restriction, different consistencies, etc.).
- Healthcare institutions Q4 2022:
  There is an appropriate food offering for patients with specific diets (e.g., low sodium, low potassium, fluid restriction, different consistencies, etc.).
- Healthcare institutions Q4 2023:
  There is an appropriate food offering for patients with specific diets (e.g., low sodium, low potassium, fluid restriction, different consistencies, etc.).

12. Action in figures of manuscript: Transparency via menu

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  There is transparency regarding the assortment/food offerings through a menu
- Hospitals Q4 2023:
  There is transparency regarding the assortment/food offerings through a menu.
- Hospitals Q2 2024:
  There is transparency regarding the assortment/food offerings through a menu.
- Healthcare institutions Q4 2022:
  There is transparency regarding the assortment/food offerings (e.g., through a menu, menu list, calendar, etc.)
- Healthcare institutions Q4 2023:
  There is transparency regarding the assortment/food offerings (e.g., through a menu, menu list, calendar, etc.)

STAFF – 13-20

13. Action in figures of manuscript: STAFF - More than half of the food is healthy

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: In staff restaurants, more than half of the offerings are healthy choices, ideally >80% (see 'Guidelines Eating Environments')
- Hospitals Q4 2023:
  STAFF facilities: In all eat and drink facilities for staff, at least 60% of the total displayed offerings are better choices, and ideally >80% (better choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').
- Hospitals Q2 2024:
  STAFF facilities: In all eat and drink facilities for staff, at least 60% of the total displayed offerings are better choices, and ideally >80% (better choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').
- Healthcare institutions Q4 2022:
  STAFF facilities: In all eat and drink facilities for staff, at least 60% of the offerings are healthier choices and ideally >80% (healthier choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').
- Healthcare institutions Q4 2023:
  STAFF facilities: In all eat and drink facilities for staff, at least 60% of the offerings are healthier choices and ideally >80% (healthier choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').

14. Action in figures of manuscript: STAFF - only healthy choices on prominent places

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: At (almost) all prominent places, only healthier choices are available.
- Hospitals Q4 2023:
  STAFF facilities: At (almost) all prominent places, only better choices are available.
- Hospitals Q2 2024:
  STAFF facilities: At (almost) all prominent places, only better choices are available.
- Healthcare institutions Q4 2022:
  STAFF facilities: At (almost) all prominent places, only healthier choices are available.
- Healthcare institutions Q4 2023:
  STAFF facilities: At (almost) all prominent places, only healthier choices are available.

15. Action in figures of manuscript: STAFF – Only promotion of healthy choices

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: We promote only healthier, vegetarian, and plant-based choices (e.g., promotions and discounts)
- Hospitals Q4 2023:
  STAFF facilities: We (primarily) promote healthier, vegetarian and/or plant-based choices (e.g., promotions and discounts).
- Hospitals Q2 2024:
  STAFF facilities: We (primarily) promote healthier, vegetarian and/or plant-based choices (e.g., promotions and discounts).
- Healthcare institutions Q4 2022:
  STAFF facilities: We primarily promote healthier choices (e.g., promotions and discounts).
- Healthcare institutions Q4 2023:
  STAFF facilities: We primarily promote healthier choices (e.g., promotions and discounts).

16. Action in figures of manuscript: STAFF – stimulating healthy choices with lower prices

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: We stimulate healthier choices with lower prices.
- Hospitals Q4 2023:
  STAFF facilities: We stimulate better choices with lower prices.
- Hospitals Q2 2024:
  STAFF facilities: We stimulate better choices with lower prices.
- Healthcare institutions Q4 2022:
  STAFF facilities: We stimulate healthier choices with lower prices.
- Healthcare institutions Q4 2023:
  STAFF facilities: We stimulate healthier choices with lower prices.

17. Action in figures of manuscript: STAFF – Vegetarian option is lower-priced than meat

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.
- Hospitals Q4 2023:

STAFF facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.

- Hospitals Q2 2024:
  STAFF facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.
- Healthcare institutions Q4 2022:
  STAFF facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.
- Healthcare institutions Q4 2023:
  STAFF facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.

18. Action in figures of manuscript: STAFF – Free tap water

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: We provide free tap water.
- Hospitals Q4 2023:
  STAFF facilities: We provide free tap water.
- Hospitals Q2 2024:
  STAFF facilities: We provide free tap water.
- Healthcare institutions Q4 2022:
  STAFF facilities: We provide free tap water (at least provided by the healthcare institution itself, for example in the central hall).
- Healthcare institutions Q4 2023:
  STAFF facilities: We provide free tap water (at least provided by the healthcare institution itself, for example in the central hall).

19. Action in figures of manuscript: STAFF – Vegetarian/plant-based marked on menu

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.
- Hospitals Q4 2023:
  STAFF facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.
- Hospitals Q2 2024:
  STAFF facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.

- Healthcare institutions Q4 2022:
  STAFF facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.
- Healthcare institutions Q4 2023:
  STAFF facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.

20. Action in figures of manuscript: STAFF – Easy to consume vegetables and fruit

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  STAFF facilities: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut.
- Hospitals Q4 2023:
  STAFF facilities: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut.
- Hospitals Q2 2024:
  STAFF facilities: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut.
- Healthcare institutions Q4 2022:
  STAFF facilities: We provide (snack) vegetables and fruits (in a way that makes them easy to consume).
- Healthcare institutions Q4 2023:
  STAFF facilities: We provide (snack) vegetables and fruits (in a way that makes them easy to consume).

VISITORS, 21-28

21. Action in figures of manuscript: VISITORS - More than half of the food is healthy

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: In the visitor restaurant, more than half of the offerings are healthy choices, ideally >80% (see 'Guidelines Eating Environments')
- Hospitals Q4 2023:
  VISITOR facilities: In all eat and drink facilities for visitors, at least 60% of the total displayed offerings are better choices (better choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').
- Hospitals Q2 2024:
  VISITOR facilities: In all eat and drink facilities for visitors, at least 60% of the total displayed offerings are better choices (better choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').

- Healthcare institutions Q4 2022:
  VISITOR facilities: In all eat and drink facilities for visitors, at least 60% of the offerings are healthier choices and ideally >80% (healthier choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').
- Healthcare institutions Q4 2023:
  VISITOR facilities: In all eat and drink facilities for visitors, at least 60% of the offerings are healthier choices and ideally >80% (healthier choices = Wheel of Five & day choice; see 'Guidelines Eating Environments').

22. Action in figures of manuscript: VISITORS – only healthy choices on prominent places

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: At (almost) all prominent places, only healthier choices are available.
- Hospitals Q4 2023:
  VISITOR facilities: At (almost) all prominent places, only better choices are available.
- Hospitals Q2 2024:
  VISITOR facilities: At (almost) all prominent places, only better choices are available.
- Healthcare institutions Q4 2022:
  VISITOR facilities: At (almost) all prominent places, only healthier choices are available.
- Healthcare institutions Q4 2023:
  VISITOR facilities: At (almost) all prominent places, only healthier choices are available.

23. Action in figures of manuscript: VISITORS – Only promotion of healthy choices

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: We promote only healthier, vegetarian, and plant-based choices (e.g., promotions and discounts)
- Hospitals Q4 2023:
  VISITOR facilities: We (primarily) promote healthier, vegetarian and/or plant-based choices (e.g., promotions and discounts).
- Hospitals Q2 2024:
  VISITOR facilities: We (primarily) promote healthier, vegetarian and/or plant-based choices (e.g., promotions and discounts).
- Healthcare institutions Q4 2022:
  VISITOR facilities: We primarily promote healthier choices (e.g., promotions and discounts).

- Healthcare institutions Q4 2023:
  VISITOR facilities: We primarily promote healthier choices (e.g., promotions and discounts).

24. Action in figures of manuscript: VISITORS – stimulating healthy choices with lower prices

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: We stimulate healthier choices with lower prices.
- Hospitals Q4 2023:
  VISITOR facilities: We stimulate better choices with lower prices.
- Hospitals Q2 2024:
  VISITOR facilities: We stimulate better choices with lower prices.
- Healthcare institutions Q4 2022:
  VISITOR facilities: We stimulate healthier choices with lower prices.
- Healthcare institutions Q4 2023:
  VISITOR facilities: We stimulate healthier choices with lower prices.

25. Action in figures of manuscript: VISITORS – Vegetarian option is lower-priced than meat

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.
- Hospitals Q4 2023:
  VISITOR facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.
- Hospitals Q2 2024:
  VISITOR facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.
- Healthcare institutions Q4 2022:
  VISITOR facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.
- Healthcare institutions Q4 2023:
  VISITOR facilities: Vegetarian dishes/options are lower-priced than comparable meat dishes/options.

26. Action in figures of manuscript: VISITORS – Free tap water

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: We provide free tap water.
- Hospitals Q4 2023:
  VISITOR facilities: We provide free tap water (at least provided by the healthcare institution itself, for example in the central hall).
- Hospitals Q2 2024:
  VISITOR facilities: We provide free tap water (at least provided by the healthcare institution itself, for example in the central hall).
- Healthcare institutions Q4 2022:
  VISITOR facilities: We provide free tap water (at least provided by the healthcare institution itself, for example in the central hall).
- Healthcare institutions Q4 2023:
  VISITOR facilities: We provide free tap water (at least provided by the healthcare institution itself, for example in the central hall).

27. Action in figures of manuscript: VISITORS – Vegetarian/plant-based marked on menu

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.
- Hospitals Q4 2023:
  VISITOR facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.
- Hospitals Q2 2024:
  VISITOR facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.
- Healthcare institutions Q4 2022:
  VISITOR facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.
- Healthcare institutions Q4 2023:
  VISITOR facilities: On the menu/price list, the vegetarian and plant-based choices are clearly marked from the other dishes.

28. Action in figures of manuscript: VISITORS – Easy to consume vegetables and fruit

Action in monitoring checklist for hospitals and healthcare institutions:

- Hospitals Q4 2022:
  VISITOR facilities: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut.
- Hospitals Q4 2023:
  VISITOR facilities: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut.
- Hospitals Q2 2024:
  VISITOR facilities: We provide vegetables and fruits in a way that makes them easy to consume, for example, cleaned and pre-cut.
- Healthcare institutions Q4 2022:
  VISITOR facilities: We provide (snack) vegetables and fruits (in a way that makes them easy to consume).
- Healthcare institutions Q4 2023:
  VISITOR facilities: We provide (snack) vegetables and fruits (in a way that makes them easy to consume).

CHAPTER

7

Summary
Nederlandse samenvatting

Summary

There is growing attention to nutrition in healthcare settings (i.e., hospitals and long-term care facilities), with healthy nutrition increasingly recognized as one of the key solutions to improve health and support recovery. Improving the food environment, i.e. the surroundings, opportunities and conditions that influence people's food and beverage choices and nutritional status, can not only confer health and well-being benefits to patients, staff, and visitors, but also planetary benefits by offering more sustainable food and beverage options. Paradoxically, the healthcare setting does not always provide healthy food options, and may contribute to conditions they aim to prevent, manage or cure. Hospitals and long-term care facilities can fulfil an exemplary role in promoting health, via improvement of their food environment and making the healthy and sustainable choice the easy choice for patients, staff, and visitors. More recently, the importance of the food environment is increasingly recognized in the healthcare setting. However, there is a lack of knowledge about the food environment in healthcare settings and to what extent a shift towards healthy and sustainable food environments is ongoing. Therefore, the main aim of this thesis, as introduced in **Chapter 1,** was to gain insight into the food environment within the Dutch healthcare setting and to identify which factors, mechanisms, and actions contribute to shifting to a healthy and sustainable food environment in hospitals and long-term care facilities.

Chapter 2 provides a comprehensive characterization and comparison of the physical, socio-cultural, political and economic food environment in hospitals and long-term care facilities for patients, staff, and visitors. Semi-structured interviews were conducted with staff of hospitals and long-term care facilities to assess the food environment and staff of hospitals and long-term care facilities self-audited the food environment within their organization with a checklist. Results show that the food environment in the Dutch healthcare setting varies substantially and disclose differences and similarities between hospitals and long-term care facilities. The physical dimension of the food environment in the healthcare setting was affected by various factors, such as availability of facilities, logistic limitations and physical space. For example, hospitals and larger long-term care facilities featured more often restaurants and utilized central spaces for preparation of meals, while smaller long-term care facilities often operated as household-like settings. The type of healthcare setting shaped the socio-cultural food environment, with hospitals primarily emphasizing nutrition for fast recovery, while long-term care facilities more often used nutrition as an instrument (i.e., to structure the day of patients). The findings showed that most hospitals and long-term care facilities had a written policy, but that adequate implementation and receiving broad organizational support were important to operate effectively. Commercial interests, profit motives, contracts with external parties and strict budgets characterized the economic food environment and shaped the food

available within hospitals and long-term care facilities. The results show that for designing effective approaches for the implementation of food environment improvements, it is imperative to incorporate various healthcare types, as well as patients, staff, and visitors and to attain sustainability alongside healthiness.

Chapter 3 provides a comprehensive, collectively acknowledged understanding of the system dynamics underlying the food environment in Dutch long-term care facilities. Stakeholders from five different long-term care facilities in the Netherlands participated in two GMB workshops and stakeholder perspectives about the process and progress towards action implementation were evaluated up to one-year follow-up. The created causal loop diagram (systems map) illustrated the causal structures and complexity of the food environment in long-term care facilities. The factors in the causal loop diagram could be divided over four subsystems, namely 1) the patient; 2) the healthcare organization; 3) purchasing, procurement, and budget; and 4) national governance and policy. Furthermore, participants identified 40 actions at different systems levels that could contribute to a system that promotes a healthy and sustainable food environment for patients, staff, and visitors. The one-year follow-up showed that actual implementation of actions and system change remained challenging. This illustrates that changing the food environment is a slow and long-term process and likely requires the inclusion of all stakeholders (system architects and users, e.g. policy makers, health care staff, suppliers) to foster impactful change.

Chapter 4 gives insight into factors influencing the implementation of a healthy and sustainable food environment in the hospitals setting. Three hospitals were participating in the national Dutch program 'A Taste of Excellent Healthcare' (TEH) and committed to have a healthy and sustainable food environment. The interviews with a variety of stakeholders (i.e. facility professionals, healthcare professionals, project coordinators and board of directors) in these three hospitals identified multiple influencing factors in various domains within and outside the hospital, ranging from internally available resources to external government established guidelines and from the personal drive of key stakeholders to societal momentum for change. The diverse stakeholder interests and experiences confirm again that changing the food environment in the hospital setting is complex, showing that it is important to ensure that all stakeholders throughout the entire organization are motivated and aligned when it comes to the realization of a healthy and sustainable food environment.

The implementation of actions for a healthy and sustainable food environment in diverse TEH hospitals and long-term care facilities was examined in **Chapter 5**. Hospitals and long-term care facilities participating in the national Dutch program TEH and committed to have a healthy and sustainable food environment were monitored and it was explored

to what extent actions were implemented after one-year of commitment to the TEH program. After one year, the results showed that the largest improvements in the food environment of hospitals and long-term care facilities occurred in policy actions that support the creation of a healthy and sustainable food environment (e.g., having food a vision). Little action implementation was observed in the actual food offering (e.g., healthier food offerings) after one-year follow-up. Most of the action implementation was observed in the food environment of patients and less of staff and visitors. The findings underline that for actual realization of a healthy and sustainable food environment for patients, staff, and visitors, more time is required, as well as continuous monitoring and additional efforts.

Chapter 6 provides a reflection on the results of the studies presented in the previous chapters in terms of the contribution to knowledge development and the embedding of the findings within the broader literature. Moreover, methodological considerations, recommendations for practice and policy and future research priorities are discussed. **Concluding**, this thesis showed that the healthcare food environment is unique and complex and varies substantially within and between hospitals and long-term care facilities. The transformation of the healthcare food environment towards a healthy and sustainable food environment is commencing, however, this needs further shifting. To foster impactful change for healthy and sustainable food environments in the entire Dutch healthcare landscape, it is imperative to take a systems lens, incorporate all healthcare settings and engage all stakeholders. Moreover, it is important to extend the focus beyond patients and encompass the food environment for staff and visitors, and attain sustainability alongside healthiness of healthcare food environments. More structural actions and continuous monitoring are needed for system change of the healthcare food environment, thereby eventually contributing to transform the healthcare setting into a health promoting environment.

Nederlandse samenvatting

Er is steeds meer aandacht voor voeding in ziekenhuizen en langdurige zorginstellingen, waarbij gezonde voeding in toenemende mate wordt erkend als een van de belangrijkste oplossingen om gezondheid te verbeteren en herstel te ondersteunen. Het verbeteren van de voedselomgeving, dat wil zeggen de mogelijkheden en omstandigheden die voedselkeuzes en daarmee de voedingsstatus van mensen beïnvloeden, kan niet alleen gezondheids- en welzijnsvoordelen opleveren voor patiënten, medewerkers en bezoekers, maar het kan ook voordelen opleveren voor de planeet door duurzamere keuzes te stimuleren. Toch biedt de zorgsetting niet altijd gezonde opties, en draagt hiermee mogelijk bij aan aandoeningen die de zorgsetting juist wil voorkomen, beheersen of genezen. Ziekenhuizen en langdurige zorginstellingen kunnen ook een voorbeeldrol vervullen in het promoten van gezondheid door de gezonde en duurzame keuze de makkelijke keuze te maken voor patiënten, medewerkers en bezoekers. Recentelijk wordt het belang van een gezonde en duurzame voedselomgeving steeds meer erkend in de zorgsetting. Echter, wetenschappelijke kennis over de voedselomgeving in zorgsettingen, en in welke mate een verschuiving gaande is naar een gezonde en duurzame voedselomgeving ontbreekt. Het hoofddoel van dit proefschrift, zoals geïntroduceerd in **Hoofdstuk 1**, is dan ook om inzicht te krijgen in de voedselomgeving binnen de Nederlandse ziekenhuizen en langdurige zorginstellingen en om te achterhalen welke factoren, mechanismen en acties bijdragen aan het verschuiven naar een gezonde en duurzame voedselomgeving in de zorgsetting.

Hoofdstuk 2 biedt een uitgebreide karakterisering en vergelijking van de fysieke, sociaal-culturele, beleidsmatige en economische voedselomgeving van patiënten, medewerkers en bezoekers in ziekenhuizen en langdurige zorginstellingen. Semigestructureerde interviews werden gehouden met medewerkers binnen de zorgsetting om de voedselomgeving in kaart te brengen. Daarnaast voerden medewerkers van ziekenhuizen en langdurige zorginstellingen zelf een audit uit van de voedselomgeving binnen hun organisatie aan de hand van een checklist. Resultaten lieten zien dat de voedselomgeving in de Nederlandse zorgsetting substantieel varieerde en de resultaten toonden de verschillen en overeenkomsten tussen ziekenhuizen en langdurige zorginstellingen. Zo varieerde de fysieke dimensie van de voedselomgeving tussen de verschillende zorginstellingen, wat werd beïnvloed door verschillende factoren, zoals beschikbaarheid van faciliteiten, logistieke beperkingen en de fysieke ruimte. In ziekenhuizen en grotere langdurige zorginstellingen waren bijvoorbeeld vaker restaurants aanwezig en werden centrale ruimtes gebruikt voor de bereiding van maaltijden, terwijl kleine langdurige zorginstellingen vaak als huiselijke setting functioneerden. Type zorgsetting had ook invloed op de sociaal-culturele voedselomgeving, waar in ziekenhuizen voornamelijk het belang van voeding voor snel herstel werd benadrukt, werd in langdurige zorginstellingen voe-

ding vaker ingezet als een middel, bijvoorbeeld om de dag van patiënten te structureren. De bevindingen laten zien dat de meeste ziekenhuizen en langdurige zorginstellingen gedocumenteerd voedselbeleid hadden, maar dat adequate implementatie en breed organisatorisch draagvlak ook belangrijk zijn voor het verbeteren van de voedselomgeving. Commerciële belangen, winstmotieven, contracten met externe partijen en beperkte budgetten karakteriseerden de economische voedselomgeving en beïnvloedden het voedselaanbod binnen ziekenhuizen en langdurige zorginstellingen. De resultaten laten hiermee zien dat voor het ontwikkelen en implementeren van effectieve maatregelen voor verbeteringen in de voedselomgeving het essentieel is om met verschillende vormen van zorg rekening te houden, evenals patiënten, medewerkers en bezoekers, en om naast gezondheid ook duurzaamheid te waarborgen, hetgeen vaak nog onderbelicht was.

Hoofdstuk 3 biedt een uitgebreid, collectief erkend inzicht in de systeem dynamieken onderliggend aan de voedselomgeving in langdurige zorginstellingen in Nederland. Stakeholders van vijf verschillende langdurige zorginstellingen in Nederland namen deel aan twee GMB workshops. Perspectieven van stakeholders over het proces en de voortgang van het implementeren van acties werd geëvalueerd tot één jaar daarna. De ontwikkelde systeemkaart (causale loop diagram) illustreert de onderliggende factoren en complexe structuren van de voedselomgeving in langdurige zorginstellingen. De factoren in de systeemkaart kunnen onderverdeeld worden over vier subsystemen, namelijk 1) de patiënt; 2) de zorginstelling; 3) aankoop, inkoop en budget; en 4) landelijk bestuur en beleid. Op basis hiervan identificeerden de deelnemers in totaal 40 acties die kunnen bijdragen aan een gezonde en duurzame voedselomgeving voor patiënten, medewerkers en bezoekers. De follow-up na een jaar liet zien dat daadwerkelijke implementatie van acties en systeemverandering een blijvende uitdaging vormde en een langere follow-up vergt. Dit illustreert dat het veranderen van de voedselomgeving een langzaam en langdurig proces is en dat dit betrokkenheid van alle stakeholders van de zorgsetting vereist om een impactvolle transitie in gang te zetten, inclusief de systeem architecten (bv. beleidsmakers, leveranciers) en eindgebruikers (bv. medewerkers).

Hoofdstuk 4 geeft inzicht in factoren die de implementatie van een gezonde en duurzame voedselomgeving in de ziekenhuissetting beïnvloeden. Drie deelnemende ziekenhuizen aan het landelijke Nederlandse programma 'Goede Zorg Proef Je' (GZPJ) werden hiervoor bevraagd. GZPJ, een initiatief van de Alliantie Voeding in de Zorg, ondersteunt ziekenhuizen en zorginstellingen in het realiseren van een gezond en duurzaam voedingsaanbod via onder andere een lerend netwerk en stappenplan. Deze drie ziekenhuizen, behorend tot de groep voorhoedeziekenhuizen van GZPJ, committeerden zich aan het bereiken van een gezonde en duurzame voedselomgeving in 2022. Semigestructureerde interviews met een verscheidenheid aan stakeholders (bijv. facilitair

medewerkers, zorgmedewerkers, projectcoördinatoren en raad van bestuur) in deze drie ziekenhuizen lieten zien dat meerdere factoren, zowel intern als extern, van invloed zijn op de implementatie van een gezonde en duurzame voedselomgeving in het ziekenhuis. Dit varieerde van beschikbare interne (financiële) middelen tot richtlijnen opgesteld door externe overheidsinstanties en van de persoonlijke drive van invloedrijke stakeholders tot maatschappelijk momentum voor verandering. De uiteenlopende belangen en ervaringen van stakeholders bevestigen dat het veranderen van de voedselomgeving in de ziekenhuis setting complex is. Dit onderstreept het belang van het motiveren en het *op één lijn brengen* van alle stakeholders in de gehele organisatie bij het realiseren van een gezonde en duurzame voedselomgeving.

De implementatie van acties voor een gezonde en duurzame voedselomgeving in verschillende GZPJ ziekenhuizen en langdurige zorginstellingen werd onderzocht in **Hoofdstuk 5**. Ziekenhuizen en langdurige zorginstellingen die deelnemen aan het landelijke Nederlandse programma GZPJ en die zich gecommitteerd hebben aan het hebben van een gezonde en duurzame voedselomgeving in 2025 werden gemonitord en er werd verkend in welke mate acties waren geïmplementeerd na één jaar toewijding aan het GZPJ programma. Na één jaar lieten de resultaten zien dat de grootste verbeteringen in de voedselomgeving van ziekenhuizen en langdurige zorginstellingen plaatsvonden in beleidsacties die de totstandkoming van een gezonde en duurzame voedselomgeving ondersteunen (bijv. het hebben van een voedingsvisie). Na één jaar follow-up werd er echter nog weinig implementatie van de GZPJ acties waargenomen die impact hebben op het daadwerkelijke voedingsaanbod (bijv. een gezonder voedingsaanbod). Ook was het opvallend dat er vooral actie was ondernomen op de voedselomgeving van patiënten, maar minder op de voedselomgeving voor medewerkers en bezoekers. De bevindingen onderstrepen dat voor daadwerkelijke realisatie van een gezonde en duurzame voedselomgeving voor patiënten, medewerkers en bezoekers meer tijd nodig is en aanvullende inspanning, evenals continuering van de monitoring van de implementatie.

Hoofdstuk 6 biedt een reflectie op de resultaten van de gepresenteerde studies in de voorgaande hoofdstukken, in termen van de bijdrage aan kennisontwikkeling en de inbedding van de bevindingen in de bredere wetenschappelijke literatuur. In aanvulling daarop worden methodologische overwegingen, aanbevelingen voor praktijk en beleid en prioriteiten voor toekomstig onderzoek besproken.

Concluderend laat dit proefschrift zien dat de voedselomgeving in de zorgsetting uniek en complex is en substantieel varieert binnen en tussen ziekenhuizen en langdurige zorginstellingen. Er is vooruitgang geboekt richting een gezonde en duurzame voedselomgeving in de zorgsetting, maar een verdere verschuiving blijft noodzakelijk. Om impactvolle verandering naar een gezonde en duurzame voedselomgeving in het gehele

Nederlandse zorglandschap te bevorderen, is het essentieel om door een systeemlens te kijken, alle type ziekenhuizen en zorginstellingen mee te nemen en alle stakeholders te betrekken. Daarnaast is het belangrijk dat niet alleen de voedselomgeving voor patiënten, maar ook die voor medewerkers en bezoekers aandacht krijgt, met daarbij focus op zowel gezondheid als duurzaamheid. Voor een systeemverandering van de voedselomgeving in de zorg zijn structurele maatregelen en continue monitoring vereist, om de zorgsetting te ontwikkelen tot een daadwerkelijk gezondheidsbevorderende omgeving.

Acknowledgements (Dankwoord)

Acknowledgements (Dankwoord)

Heel veel dank aan iedereen die mij de afgelopen leerzame en leuke jaren heeft geholpen en gesteund bij het maken van dit proefschrift! Een aantal mensen wil ik graag in het bijzonder bedanken.

Natuurlijk begin ik bij mijn begeleidingsteam, mijn promotoren **Maartje** en **Emely** en co-promotor **Sanne**. Bijzondere dank voor de leerzame en waardevolle tijd, betrokkenheid, fijne feedback, kansen en jullie vertrouwen dat ik dit onderzoek samen met jullie mocht doen. Dank voor jullie steun, geduld en hulp!

Graag wil ik de leden van de promotiecommissie, **prof. dr. Matty Crone**, **prof. dr. ir. Ellen Kampman**, **prof. dr. Koen Joosten** en **prof. dr. Carry Renders** hartelijk danken voor jullie tijd en toezegging voor het lezen en beoordelen van mijn proefschrift en het opponeren tijdens mijn verdediging.

Dank aan **de Regio Deal Foodvalley** voor het mogelijk maken van dit project.

De **Alliantie Voeding in de Zorg**, veel dank voor de fijne samenwerkingen de afgelopen jaren en de toegang tot jullie netwerk en mooie beweging. In het bijzonder dank aan **Menrike**, **Gerda**, **Iris**, **Leonie**, **Laura** en **Eva**.

Dank voor de leuke en leerzame samenwerkingen in de verschillende onderzoeken van mijn proefschrift, **Coosje**, **Femke**, **Ellemijn**, **Menrike**, **Gerda**, **Iris** en **Tamika**. Dank voor al jullie hulp, fijne overleggen, kritische blik en het delen van jullie kennis!
Anne van de PlaatPraters, dank voor al jouw mooie visualisaties!

Dank aan alle professionals van de meewerkende ziekenhuizen en zorginstellingen voor jullie inzichten, kennis en vertrouwen waardoor dit onderzoek mogelijk was! Extra dank aan **Coralie** en **Jolanda** voor jullie support.

Dank aan CHL (Consumption & Healthy Lifestyles) voor de fijne groep en werkomgeving, in het bijzonder **Ayla**, **Merije**, **Frédérique**, **Harm**, **Vera**, **Evy** en **Alexandra**.
Dank aan alle mede PhD'ers voor de gezelligheid, hulp en steun, in het bijzonder **Tamika**, **Lisanne**, **Sofia**, **Thirza**, **Yolie**, **Iris**, **Anouk** en **Reinoud**!
Veel dank **Monique** en **Annemien** voor jullie interesse, steun en advies, tijdens en ook al even voor mijn PhD!
Dank in het algemeen aan de WUR voor alle leerzame jaren, fijne universiteit en stad.

Dank voor alle interesse, vertrouwen en steun van mijn lieve **familie**, **familie van Maarten**, **vrienden**, en **hockeyteam**!

Dank lieve **pap**, **mam**, **Roselot**, **Robin**, **oma** (en **Hilda**)!

'Last but not least', dankjewel lieve **Maarten**!

About the author

About the author

Joline Johanna Wierda was born on 26 May 1994 in Utrecht, the Netherlands. She grew up in Kampen, where she completed her gymnasium education at Almere College in 2012. Her final-year research project (profielwerkstuk), which explored whether chewing gum can help reduce stress, received the audience award of the 'Jan Kommandeur prijs' from the University of Groningen. In 2015, Joline completed the bachelor Nutrition and Health at Wageningen University & Research (WUR). In 2018 she completed the master Nutrition and Health, specialization Epidemiology and Public Health, also at the WUR. She did her internship at the 'Cool 2B Fit' program, a combined lifestyle intervention for children with overweight. She conducted her thesis within the Physiodom project, a nutritional telemonitoring intervention for older adults. Her thesis was nominated for the V&VN e-health thesis award. In 2018, she started to work as a program officer within the Prevention Programme of ZonMw, a Dutch organization that funds health research and promotes the use of knowledge to improve health and healthcare.

In September 2020 Joline had the great opportunity to start her PhD at the Consumption and Healthy Lifestyles chair group of Wageningen University & Research. Her PhD project was part of the Regio Deal Foodvalley, a collaboration between the Dutch national government and regional parties, aimed at accelerating the transition towards a healthy and sustainable food system. Joline her PhD research examined the food environment in hospitals and long-term care facilities in the Netherlands and identified which factors, mechanisms, and actions, contribute to shifting towards a healthy and sustainable food environment for patients, staff, and visitors. The results are described in this thesis. During her PhD she followed several courses, was involved in teaching and supervising students, and she had the opportunity to present her work at national and international conferences. Her work was awarded with a place in the FOOD100 of 2024, a list with hundred food change leaders who are committed to make the Dutch food system healthier, more sustainable and more socially responsible.

List of publications

Publications in this thesis

Wierda, J. J., de Vet, E., Troost, E., & Poelman, M. P. (2024). Characterizing food environments of hospitals and long-term care facilities in the Netherlands: a mixed methods approach. *BMC Health services research*, *24*(1), 31.

Wierda, J. J., Dijkstra, S. C., Wopereis, T. M., Djojosoeparto, S. K., & Poelman, M. P. (2025). Identifying mechanisms that shape the food environment in long-term healthcare facilities in the Netherlands: a participatory system dynamics approach. *BMC Public Health*, *25*(1), 372.

Wierda, J. J., van Nassau, F., Djojosoeparto, S. K., & Poelman, M. P. (2025). Which factors influence the transition towards a healthy and sustainable food environment in Dutch hospitals? A qualitative view from stakeholders. *BMC medicine*, *23*(1), 45.

Submitted for publication

Wierda, J.J., Pot, G.K., Djojosoeparto, S.K., de Koning, I., de Vet, E., Poelman, M.P. Implementing the Dutch national program 'A Taste of Excellent Healthcare' for shifting towards a healthier and more sustainable food environment in healthcare settings: monitoring results after one-year follow-up. *Under review*.

Publications not included in this thesis

Wopereis, T. M., Dijkstra, C., **Wierda, J. J.**, Rongen, F. C., & Poelman, M. P. (2024). Systems thinking for local food environments: a participatory approach identifying leverage points and actions for healthy and sustainable transformations. *Health Research Policy and Systems*, *22*(1), 101.

Metze, T., Coma-Cros, N., Ingram, V., de Roo, N., Schwarz, A.F., Starke, J.R., Student, J.R., **Wierda, J.J.**, Wertheim-Heck, S. Puzzling and powering in transdisciplinary research: Experimental Sustainability Governance. *Under review.*

Interviews

Interview published in professional journal 'FMT Gezondheidszorg', editie 2, April 2024. 'Onderzoek naar de voedselomgeving in ziekenhuizen en zorginstellingen'.

Interview published in 'Het Financieele Dagblad', 5 August 2024. 'Voeding in de zorg kan ook gezond en lekker zijn'.

Joline Johanna Wierda
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
A1 Managing a research project			
WASS Introduction Course	WASS	2020	1.0
Writing research proposal	CHL, WASS	2021	3.0
Research data management	WUR Library	2021	0.45
Project and time management	WGS	2021	1.5
Efficient writing strategies	Wageningen in'to Languages	2022	1.3
'What factors shape food environments in health care institutions? A systems dynamics approach'	International Society of Behavioral Nutrition and Physical Activity Annual Conference, Uppsala, Sweden	2023	1.0
A2 Integrating research in the corresponding discipline			
Research Methodology: From topic to proposal	WASS	2020	4.0
Transformative and participatory qualitative research approaches and methods	WASS	2022	4.0
Scientific publishing	WGS	2021	0.3
Co-creation workshop: designing and conducting action research	VU Amsterdam	2022	2.8
Writing retreat	WASS	2022	1.0
Healthy and sustainable diets: synergies and trade-offs	VLAG	2021	0.8
Group model building demonstration	Radboud University	2022	0.1
B) General research related competences			
B1 Placing research in a broader scientific context			
Pre-conference workshop at ISBNPA conference: Network of Early Career Researchers and Students of ISBNPA	International Society of Behavioral Nutrition and Physical Activity Annual Conference	2023	0.1
Academic publication and presentation in the social sciences	WASS	2023	4.0
Part of incubator team. Output: co-author on submitted paper, '*Puzzling and powering in transdisciplinary research: Experimental Sustainability Governance*'	WCSG	2022-2024	2.0
B2 Placing research in a societal context			
Organising kick-off Regio Deal project, work-package 2	Regio Deal Foodvalley	2020	1.0
'De voedselomgeving in ziekenhuizen en zorginstellingen: hoe staan we er voor?'	Dutch Working Group on Food Habits, 'Werkgroep Voedingsgewoonten'	2022	1.0

'Een systeem benadering voor het in kaart brengen van de voedselomgeving in zorginstellingen'	VoedingNL	2023	1.0
'Een systeembenadering voor het in kaart brengen van de voedselomgeving in de zorg'	5e landelijke congres Goede Voeding in de Zorg'	2024	1.0
C) Career related competences/personal development			
C1 Employing transferable skills in different domains/careers			
Start to supervise BSc & MSc thesis students	Education Support Centre	2020	0.1
Posters and pitching	WASS, CHL	2022	1.0
Reviewing a scientific manuscript	WGS	2023	0.1
Teaching assistant several MSc courses and supervision two MSc theses students and one MSc internship student	CHL	2020-2023	4.0
Total			**36.55**

*One credit according to ECTS is on average equivalent to 28 hours of study load

Authorship statement

PhD candidate's name :	**Joline Wierda**
First promotor :	**Dr Maartje Poelman**
Title of PhD thesis :	**The food environment in hospitals and long-term care facilities** **Shifting towards a healthy and sustainable food environment** **for patients, staff, and visitors**
Date of public defence :	**2 July 2025**

Chapter 1 *General introduction:* I wrote an initial draft of the General introduction section chapter after which Emely de Vet, Maartje Poelman and Sanne Djojosoeparto provided three rounds of feedback. The project was part of the larger Regio Deal Foodvalley project, therefore, the main aim of my research project was drafted in the grant proposal by my promotors.

Chapter 2 *Characterizing food environments of hospitals and long-term care facilities in the Netherlands: a mixed methods approach:* Together with co-authors Emely de Vet and Maartje Poelman, I designed this study. Together with co-author Ellemijn Troost, I collected, coded and interpreted the qualitative data. I collected the quantitative data. I analysed the qualitative and quantitative data. I drafted the initial manuscript. Co-authors Emely de Vet and Maartje Poelman were major contributors and editors in writing the manuscript and provided the manuscript with multiple rounds of feedback.

Chapter 3 *Identifying mechanisms that shape the food environment in long-term healthcare facilities in the Netherlands: a participatory system dynamics approach:* Together with co-authors Coosje Dijkstra and Maartje Poelman, I designed this study. Together with co-author Tamika Wopereis, I drafted the scripts for the workshops. I organized the sessions and all co-authors were present and participated in the sessions. I conducted the interviews, I analysed the data, and I wrote a draft of the manuscript. Co-authors Tamika Wopereis, Coosje Dijkstra, Sanne Djojosoeparto and Maartje Poelman were major contributors and editors in writing the manuscript and provided the initial manuscript with multiple rounds of feedback.

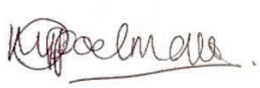
Chapter 4 *Which factors influence the transition towards a healthy and sustainable food environment in Dutch hospitals? A qualitative view from stakeholders:* Together with co-authors Femke van Nassau and Maartje Poelman, I designed this study. I conducted, coded and analysed the interviews. I wrote a draft of the manuscript. Co-authors Femke van Nassau, Sanne Djojosoeparto and Maartje Poelman were major contributors and editors in writing the manuscript and provided the initial manuscript with multiple rounds of feedback.

Chapter 5 *Implementing the Dutch national program 'A Taste of Excellent Healthcare' for shifting towards a healthier and more sustainable food environment in healthcare settings: monitoring results after one-year follow-up:* Together with co-authors Sanne Djojosoeparto, Emely de Vet and Maartje Poelman, I designed this study. I analysed the data that were collected by The Nutrition and Healthcare Alliance. I drafted the initial manuscript. Co-authors Gerda Pot, Iris de Koning, Sanne Djojosoeparto, Emely de Vet and Maartje Poelman were major contributors and editors in writing the manuscript and provided the manuscript with multiple rounds of feedback.

Chapter 6 *General discussion:* I wrote an initial draft of the General discussion section chapter after which Emely de Vet, Maartje Poelman and Sanne Djojosoeparto provided three rounds of feedback.

Date: 8th of March, 2025

Signature PhD candidate



Signature promotor for agreement

Colophon
The research described in this thesis was financially supported by the
Regio Deal Foodvalley, grant number 162135.
Financial support from Wageningen University for printing this thesis is gratefully acknowledged.

Cover design by Anne Zeegers from De PlaatPraters
Layout by Eefke Meilink from Proefschriftmaken.nl
Printed by Proefschriftmaken.nl on FSC-certified paper