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Healthy and sustainable **nutritional interventions** in the healthcare system

Literature review: what works in practice

RIVM report 2026-0048



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interventions in the healthcare system**
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Colophon

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Synopsis

Healthy and sustainable nutritional interventions in the healthcare system

Literature review: what works in practice

The healthcare sector should reduce its CO₂ emissions and promote the health of patients, staff and visitors. One way of doing so is for care institutions, such as hospitals, to offer healthy and sustainable food. The National Institute for Public Health and the Environment (RIVM) has mapped out which measures are effective according to scientific literature. RIVM also describes the measures that healthcare institutions are already taking in practice to provide healthier and more sustainable food. The results are intended primarily for managers, coordinators and researchers in the healthcare system.

It turns out that scientific research has to date focused largely on ways for care institutions to reduce food waste. This appears to be possible, with patients still maintaining a sufficient intake of energy and protein, both of which are important for their recovery. One effective method is to let patients decide what they want to eat and when. Ways of doing this include ordering meals electronically or offering them an increased number of smaller portions. Patients then leave less food uneaten. Another possibility is to support patients during mealtimes, for example by removing packaging or actually feeding them.

Research also shows that staff and visitors are more likely to choose meals containing plant based proteins when these options are placed more prominently and given appealing names. This is referred to as nudging. Another promising measure is to make vegetarian and healthy dishes, such as falafel and vegetable wraps or lentil soup, the standard option. Staff tend to be more accepting of these changes when they are given information about healthy and sustainable eating and why that is important.

In practice, many healthcare institutions are already working on providing healthier and more sustainable food. One example is a hospital that has expanded its range of vegan, vegetarian and whole grain products for staff and visitors. Healthier products such as fruit and vegetables are also cheaper than less healthy alternatives. In another hospital, patients can choose high protein meals and are offered smaller portions more frequently throughout the day.

Keywords: green deal, protein transition, healthcare institutions, food, healthcare sector, staff, patients, visitors, nudging, healthy, sustainable

Publiekssamenvatting

Gezonde en duurzame voedingsinterventies in de zorg

Literatuuronderzoek: wat werkt voor de praktijk

De zorgsector moet minder CO₂ uitstoten en zich inspannen voor de gezondheid van patiënten, medewerkers en bezoekers. Dat kan onder andere door in zorginstellingen, zoals ziekenhuizen, gezonde en duurzame voeding aan te bieden. Het RIVM heeft in kaart gebracht welke maatregelen hiervoor volgens de wetenschappelijke literatuur effectief zijn. Ook beschrijft het RIVM welke maatregelen zorginstellingen in de praktijk nemen om gezonder en duurzamer voedsel aan te bieden. De resultaten zijn vooral bedoeld voor managers, coördinatoren en onderzoekers in de zorg.

Er blijkt vooral wetenschappelijk onderzoek te zijn gedaan naar manieren hoe zorginstellingen minder voedsel kunnen verspillen. Dat blijkt mogelijk te zijn, waarbij patiënten ook genoeg energie en eiwitten binnenkrijgen. Dat is belangrijk voor hun herstel. Een effectieve manier is patiënten zelf te laten bepalen op welk moment van de dag ze wat willen eten. Dat kan bijvoorbeeld door eten elektronisch te bestellen, of hen meer kleinere porties aan te bieden. Hierdoor laten ze minder eten staan. Een andere mogelijkheid is om patiënten te helpen bij het eten, bijvoorbeeld door verpakkingen te verwijderen of ze eten te geven.

Verder blijkt uit onderzoek dat medewerkers en bezoekers vaker voor maaltijden met plantaardige eiwitten kiezen als deze producten meer in het zicht worden aangeboden met aantrekkelijke namen (nudging). Een andere veelbelovende maatregel is vegetarische en gezonde mogelijkheden als de standaard aan te bieden, zoals een wrap met falafel en groenten of linzensoep. Medewerkers hebben hier meer begrip voor als ze informatie krijgen over gezond en duurzaam eten en waarom dat belangrijk is.

In de praktijk is te zien dat zorginstellingen werken aan gezondere en duurzamere voeding. Een voorbeeld is een ziekenhuis met een groter aanbod aan vegan, vegetarische en volkoren producten voor medewerkers en bezoekers. Ook zijn gezondere producten zoals groente en fruit er goedkoper dan ongezondere producten. In een ander ziekenhuis kunnen patiënten kiezen voor maaltijden met veel eiwitten en krijgen ze op meer momenten op de dag kleinere porties eten aangeboden.

Kernwoorden: green deal, eiwittransitie, zorginstellingen, voeding, zorgsector, medewerkers, patiënten, bezoekers, nudging, gezond, duurzaam

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Summary

The healthcare system can become more sustainable and realise health gains by providing healthier and more sustainable nutrition. This report offers managers, coordinators and researchers in the healthcare system a summary of what is currently known about the effectiveness of nutritional interventions that promote both health and sustainability for patients, residents, employees and visitors. We also describe several practical examples of how healthcare institutions are working to deliver a healthier and more sustainable nutritional offer.

The literature review showed that the healthcare system can tackle food waste and increase the energy and protein intake of patients by offering them a more varied menu and by adapting the way patients choose their meals by introducing various forms of electronic ordering. Providing additional nutritional assistance can also help, as can offering employees educational and training programmes to help them provide such assistance. Another effective way of reducing food waste is providing multiple smaller portions.

When it comes to employees and visitors, there are indications in the literature that nudges (subtle hints given by adapting the environment) can encourage them to choose meals based on plant-based proteins. Further research is required to confirm this. Nudges aimed at employees and visitors that increase the availability and attractiveness of sustainable options are a promising way of promoting healthy and sustainable choices in healthcare institutions. Increasing the prominence of healthy and sustainable products is another promising way of promoting healthy and sustainable options in hospital restaurants. Other nudge types have proved to be an effective way of promoting healthy and sustainable options in other settings, and are thus also promising in healthcare environments. Examples include offering a vegetarian or healthier option as standard, making healthy and sustainable options more accessible and visual, taste-related and touch-related adaptations. It is also important to motivate and inspire employees and to generate broad support for interventions, so that they are willing to implement adaptations and learn what healthy and sustainable nutrition means.

1 What works: an analysis

In the first chapter, 'What works: an analysis', the interventions to promote healthy and sustainable nutrition in healthcare institutions identified in the literature review are divided into categories of effectiveness: what works, what is promising, and interventions for which the effect is uncertain or unknown. The interventions are explained in brief.

Chapter 2 describes practical examples of how institutions have implemented effective interventions.

The in-depth section of the report begins in Chapter 3. Chapter 3 describes the background to this study. Chapter 4 describes the methodology. Chapters 5 and 6 discuss the nutritional interventions mentioned in Chapter 1 in greater detail. Chapter 5 focuses on patients and residents (including clients), while Chapter 6 covers employees and visitors. Each chapter begins with an extensive summary of the interventions that are effective, promising, or for which the effect is uncertain or unknown. The interventions in each category are then explained. The conclusions (Chapter 7) summarise the most important results, including guidance on how to interpret them.

Section 1.1 discusses the interventions that work, are promising or for which the effect is uncertain or unknown for patients and residents.

Section 1.2 discusses interventions aimed at employees and visitors.

1.1 Healthy and sustainable nutrition for patients and residents

What works

- **Adaptations to the meals service:**
 - o The implementation of an **electronic ordering system**, compared to a traditional paper ordering system, reduces costs and leads to higher food consumption, higher energy and protein intake and improved patient satisfaction. The implementation of an **ordering system with a verbal explanation of the menu**, compared to traditional methods such as a paper ordering system, leads to a reduction in food waste, higher energy and protein intake and improved patient satisfaction.
 - o The implementation of **a bulk trolley**¹, compared to a tray-based meal service, leads to a reduction in food waste.
 - o The implementation of **room service models**, in which patients can order meals that are delivered within a set time period, compared to traditional methods (frequently a paper ordering system that often requires patients to choose a meal more than 24 hours in advance), results in a reduction in food waste and costs.
 - o A choice of **various menu options**, compared to a limited selection, results in lower food waste, higher energy and protein intake and improved patient satisfaction. Compared to a trolley-based concept, the Free Choice Menu concept, which

¹ A food trolley that contains a fridge and heating element, for example. The trolley is rolled to where the patient is. The patient can then choose a meal.

allows patients to order 24 hours a day, results in lower food waste but no change in energy and protein intake.

- **Employees and organisation:**
 - **Extra nutritional assistance** during meals, and associated education and training programmes for employees, can reduce food waste and overproduction. In studies that examined energy and protein intake, these also improved.
- **Adaptations to portion size and/or frequency:**
 - Providing **multiple small, high-energy portions** results in lower food waste compared to standard hospital meals.
 - Providing **smaller portions** results in less food waste and sometimes in lower energy intake, which means it is important to provide more snacks between meals and/or high-energy food.

Promising interventions

- **Adaptations to the meals service:**
 - Measures that focus on providing more **patient-focused meals and advice** by ensuring that the choice of meal is agreed with the patient result in lower food waste, lower costs, improved energy and protein intake and increased patient satisfaction.
 - **Cooking to order**, which resembles the Free Choice Menu concept, results in a reduction in overproduction and thus also in food waste.
 - **Steamplicity**, which involves packaging food in such a way that it can be steam-cooked in the microwave, results in lower food waste and higher consumption, but also lower energy intake and comparable protein intake.
 - Implementing **room service models**, compared to traditional methods, often but not always results in increased energy intake. Most but not all studies also identified higher or comparable protein intake.
- **Employees/volunteers and organisation:**
 - Having **volunteers help during mealtimes** can prevent food waste and increase energy and protein intake.
 - Having **employees open packaging** can reduce food waste and increase food consumption.
 - **Employing a dietitian who helps patients choose a suitable menu** can reduce food waste and increase consumption. Employing a **food service dietitian** (with additional tasks alongside those of a standard dietitian, who coordinates the medical and nutritional needs of patients and identifies how this should be reflected in how food is prepared in the kitchen) results in lower food waste and lower costs.
- **Portion size and frequency:**
 - Providing **five meals instead of three** reduces food waste and results in improved or comparable energy intake.
- **Meal composition and presentation:**
 - Providing **minced meals** results in lower food waste compared to mixed meals processed with a blender. Providing

minced and moulded meals² results in lower food waste and higher consumption.

- o **Improving the presentation/ambiance of meals** by presenting them more attractively or by adding a colour serviette, or by improving the quality, temperature, taste and smell, contributes to reducing food waste and can increase food consumption. Using high-quality **ingredients** (natural ingredients that are easy to swallow and packaged in such a way that they remain fresh for longer) results in lower food waste, higher energy intake and lower costs compared to standard blended meals without pieces.
- **Procurement:**
 - o Making the food procurement process more sustainable by employing **short supply chains** reduces the environmental impact. Sustainable procurement also contributes to reducing food waste.
- **Plant-based meals:**
 - o Providing **plant-based meals as standard** instead of meat-based meals results in lower food waste and a lower environmental impact.

Interventions for which the effect is uncertain or unknown

- **Adaptations to the meals service:**
 - o The implementation of **self-service**, in which patients can indicate their food preferences themselves using a mobile device, results in the same level of patient satisfaction as with the traditional method.
 - o **Protected mealtimes** (periods in which non-clinical activities are stopped so that patients can eat uninterrupted and employees can provide support), the opposite of the Free Choice Menu concept, resulted in a comparable energy intake to the control group. The effect on protein intake was mixed, comparable and in some cases lower. The effect on food waste has not been studied.
 - o Providing **buffet-style meals combined with changes to the eating environment**, such as seasonal decoration, tablecloths and background music and training for nursing assistants, results in lower food waste compared to the traditional tray method.
- **Portion size and frequency:**
 - o Providing **high-energy foods** results in higher energy and protein intake. The effect on food waste has not been studied.
- **Employees/volunteers and organisation:**
 - o Having **trained volunteers provide nutritional advice** results in higher energy and protein intake. The effect on food waste has not been studied.

² Smooth, blended foods are thickened and poured into a three-dimensional mould so that the food resembles its natural shape.

1.2 Healthy and sustainable nutrition for employees and visitors

Promising interventions

- **Placement nudges:**
 - o **Nudges that increase the availability** (for example by replacing meat and fish options on the menu with vegetarian options) of more sustainable food are a promising way of promoting healthy and sustainable choices in healthcare institutions.
 - o **Strategically placing healthy and sustainable options** is an effective way of promoting healthy and sustainable choices in various settings.
 - o **Increasing the availability and visibility of sustainable options** is effective in various settings.
 - o Increasing **visibility through more prominent presentation** (for example by highlighting sustainable and healthy dishes with large and colourful signs) is a promising way of promoting healthy and sustainable food options in hospital restaurants.
 - o Offering a vegetarian or healthier option as **standard** results in the desired choices being made more often.
 - o **Accessibility and proximity nudges** are promising in various settings. The results for accessibility nudges (reducing barriers and increasing the accessibility of healthy and sustainable nutrition) are mixed and product dependent. Proximity nudges such as placing healthy options closer can be effective, although more research into the specific effects on sustainable and healthy choices in healthcare institutions is needed.
 - o Using **social norms** (for example '80% of visitors choose plant-based meal options') leads to inconsistent results in various settings, although they are potentially effective.
- **Property nudges:**
 - o Providing **information about sustainable and healthy food options** (for example a poster with information about the relationship between food production and climate effects) leads to mixed results in various settings. The results of studies into the use of such posters to promote consumption of healthy food are promising.
 - o **Reducing portion sizes** leads to positive results in various settings and is an effective way of promoting sustainable food consumption.
 - o **Visual, taste-related and touch-related adaptations** (hedonistic adaptations) are a promising way of promoting healthy and sustainable options, although the effects of music and smell are unknown.
 - o **Descriptive labels** (such as 'juicy Italian fish fillet') and **evaluative labels** (such as a star rating that indicates how healthy and sustainable a product or meal is) show mixed effects, but are a promising way of promoting healthy and sustainable options. These effects have been studied in various settings, but not specifically in the healthcare system.
 - o **Giving dishes more attractive names** (such as 'sweet, velvety soup with kale' instead of 'vegetable soup with kale')

is a promising way of promoting desirable food consumption patterns.

- **Combined nudges/interventions:**
 - Using a **combination of nudges that focus on changing the placement** of healthy options and **increasing the visibility** of healthy food option is a promising way of promoting desirable consumption patterns. Adding information amplifies the identified effect.
 - Implementing **various measures** in hospitals, including **more sustainable procurement and intensifying communications about reducing food waste**, is a promising way of reducing food waste and greenhouse gas emissions.
 - **Combined interventions**, in which various interventions such as **labelling, pricing policy and information nudges** are used together, are a promising way of promoting healthy and sustainable options in hospitality environments, work environments and supermarkets.

2 Practical examples

This chapter describes three practical examples of hospitals that have implemented effective interventions: Radboud university medical center with the Food for Care concept, Gelderse Vallei Hospital with the Zorg met Goede Voeding (Care with Good Nutrition) concept and Amsterdam UMC with the Zorg op het Bord (Care on the Plate) nutrition programme. Further practical examples of healthcare institutions that work with sustainable and healthy nutrition can be found at rivm.nl/duurzamezorg (in Dutch).

Practical example – Radboud university medical center

Food for Care concept

Radboud University Medical Center is committed to providing healthy and sustainable nutrition for patients and employees. The hospital has increasingly focused on sustainability in recent years.

The objective is to offer patients an appropriate, sustainable menu that contributes to a faster recovery and improved well-being.

For warm meals, patients can choose from a number of small dishes from their hospital bed. Radboud university medical center employs the Food for Care concept. During each round (with a maximum of seven), a nutrition assistant presents small, attractively prepared dishes. This allows patients to see and smell the food, which encourages them to eat. Keeping the portions small avoids patients being put off by a large plate of food.

The nutritional intake of patients (energy, protein and liquid) is recorded in their electronic patient file. By consulting the (electronic) patient file and specific dietary needs, the nutrition assistant determines what the patient needs, gives advice and encourages the patient to make the correct choice. Nutrition assistants are offered an extensive range of training opportunities.

Research into Food for Care demonstrated that this nutrition concept improves the protein and energy intake of patients, which in turn reduces complications and shortens hospital stays (1).

Practical Example – Gelderse Vallei Hospital

Zorg met Goede Voeding concept

Gelderse Vallei Hospital (ZGV) in Ede aims to provide good and sustainable nutrition for employees, patients and visitors with the [Zorg met Goede Voeding](#) concept. The concept is based on At Your Request® (2). Gelderse Vallei Hospital's objective is to achieve health gains by providing good-quality care that devotes attention to lifestyle, prevention and accelerating recovery. The hospital strives to comply with the Dutch dietary guidelines published by the Health Council of the Netherlands and the Richtlijn Eetomgevingen (Guideline on Eating Environments) published by the Netherlands Nutrition Centre. Gelderse Vallei Hospital also aims to provide a more sustainable nutritional offer. The Zorg met Goede Voeding concept allows patients to order from an à

la carte menu throughout the day. The food is brought to them within 45 minutes.

This means there are no longer fixed mealtimes. This encourages patients to eat more, which means less food is thrown away. Offering à la carte ordering also reduces food waste. Eliminating fixed mealtimes, introducing variation in portion sizes and allowing patients to order at any time has reduced food waste by a third.

To tackle waste and undernourishment, a trained food service assistant gives patients advice and/or help with ordering meals. Attention is also devoted to hospitality and experience. The room service assistants who bring meals to patients also offer bedside services, such as peeling an egg or buttering a sandwich. Greater attention is also devoted to training to generate support for these measures among employees and to help them support patients with healthy eating. Examples include training in nutrition, dietetics and hospitality.

The mission of the Zorg met Goede Voeding programme at Gelderse Vallei Hospital (ZGV) is to create a healthy nutritional environment that contributes to the well-being and recovery of patients, and also the well-being of employees and visitors. When it comes to employees and visitors, the following steps have been taken:

- The route and buffet presentation in the restaurants have been adapted. For example, fruit is now placed at the front as a subtle encouragement (nudge) to choose a healthy option.
- Freshly cooked meals with regional and seasonal products also play a key role in promoting sustainability in the restaurants. The same applies to the protein transition: a greater range of vegetarian and vegan options are offered and promoted.
- Both restaurants employ an 80/20 ratio: eighty percent of the nutritional offer consists of healthy options and twenty percent consists of less healthy options.
- The treats policy has also been amended. For example, fresh strawberries from a local farmer are offered when in season, rather than cakes. The meat croquettes in the standard offer have been replaced with a mushroom-based alternative.
- The visitors' restaurant is run by an external caterer. The hospital works closely together with the caterer and plays an active role in agreeing the nutritional offer, presentation and route.

Practical example – Amsterdam UMC

Zorg op het Bord nutrition programme

Zorg op het Bord is Amsterdam UMC's healthy and sustainable nutrition programme. The hospital's mission is to improve the quality of patient nutrition while promoting sustainability. Patients at Amsterdam UMC have access to a menu with high-protein meals, which are available at various moments throughout the day. The motivations for the measures described below include promoting healthy eating habits, increasing protein intake and reducing food waste:

- **Additional mealtimes:** the nutrition expert visits more frequently: 6 times a day rather than 3 times, in accordance with the Goede Zorg Proef Je (You Can Taste Good Care) standard. In

addition to bread-based meals, an extra dish is offered daily to provide additional proteins.

- **Portion size:** portions have been reduced from 500 grams to 350 grams. Smaller portions can be provided because there are multiple mealtimes throughout the day. This ensures that patients leave less food on their plate.
- **Meal presentation:** Attention is devoted to protein consumption from warm meals at both the VUmc location and the AMC location. Food for Care provides warm meals at the AMC location. Warm meals are served in a small pan and are attractively presented. The high-protein parts of the meal are placed on top, so that patients eat most of them.
- **Menu:** The menu, which is available digitally and on paper, explains the importance of healthy eating and consuming sufficient protein.
- **Vegetarian:** This is the standard option. Meat is not offered every day.
- **Protein targets:** The target is that snacks should contain at least 5 grams of protein, that cold meals should contain at least 20 grams of protein and that warm meals should contain at least 25 grams of protein. Tools and courses have been developed to share knowledge about protein quality and amino acid composition. These are available not just to the Amsterdam UMC, but also to other hospitals and users:
 - o Calculate the protein digestion and the amino acid profile of a meal with the [AminoFit tool](#).
 - o Use the [eiFIT](#) tool to determine whether someone eats enough protein.
 - o [Protein table](#) with the number of grams of protein per meal.
 - o [Course](#) for healthcare professionals on protein needs, protein quality and the protein transition.

Various partners at the hospital were involved with the development of the Zorg op het Bord nutrition programme, including facility management employees, dietitians and other practitioners. Measures to improve nutrition for patients, employees and visitors include training, as well as defining and monitoring guiding principles. The factors that ensured that the nutrition concept attracted broad support include:

- Having enthusiastic individuals in key positions: these people are very important for the success of the project. Their personal conviction and commitment make all the difference.
- Involving both top-down and bottom-up structures with the implementation: the executive board plays a crucial role, but it is also important to involve employees and the client council.
- Repeatedly explaining why particular choices are made: regular meetings and tasting sessions can help keep everyone involved and informed.
- Persevering and taking small steps: it is important to be patient and to make progress step-by-step.
- Regularly monitoring and evaluating the nutrition concept.

3 Background

Our society faces major environmental and health-related challenges. Alongside urgent issues such as environmental pollution, climate change and loss of biodiversity, there is an alarming growth in the number of overweight and obese individuals. To tackle these problems, targets have been set and agreed both nationally and internationally, including the United Nations' Sustainable Development Goals (SDGs), the Paris Climate Agreement, the European Green Deal and the WHO Acceleration Plan to Stop Obesity. Agreements made in the Netherlands include the Climate Agreement, the National Prevention Agreement (NPA), the Integrated Care Agreement and the Green Deal on Sustainable Healthcare 3.0.

Food production and consumption have a major impact on the environment. This sector is responsible for up to 30% of global greenhouse gas emissions (3). The agricultural sector also consumes more water than any other: 70% of all water extracted across the globe is used for irrigation (4). Around 40% of our planet's surface is used for agriculture. This is a major cause of deforestation and a threat to animal species (5, 6). The growing global population also makes it increasingly challenging to keep everyone fed. It is essential that we adopt a sustainable diet. The United Nations Food and Agriculture Organization (FAO) employs the following definition: "*Sustainable Diets are those diets with low environmental impacts that contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources.*" (7).

In general, research shows that foods of animal origin have a higher environmental impact than plant-based foods (8, 9). Clune et al. (2017) conclude in their systematic review that meat from ruminants (including cows) generates the highest greenhouse gas emissions, while grains, fruit and vegetables result in the lowest emissions per kilogram (10). For foods consumed in the Netherlands, the greenhouse gas emissions for, for example, meat, are approximately 4 to 33 kg CO₂eq (equivalent) per kg, and 0.30 to approximately 4 kg CO₂eq per kg for grains, fruit and vegetables (11). Reducing the consumption of animal products, particularly meat from ruminants, can substantially reduce the environmental effects, particularly in western countries (9, 12-15). In the Netherlands, more than half (54%) of food-related greenhouse gas emissions originate from the consumption of animal products such as meat, dairy and cheese. The average daily meat consumption per person of 87 grams is also responsible for more than a quarter (27%) of all food-related greenhouse gas emissions (16).

The consumption of plant-based foods, such as fruit, vegetables, pulses, unsalted nuts and wholemeal grain products, is associated with positive health effects, including lower blood pressure and a reduced risk of cardiovascular diseases, type 2 diabetes and various types of cancer

(17-22). Reducing overconsumption also lowers the impact on the environment and climate, given that energy intake is related to environmental impact: the more we eat, the greater the impact (23). Refraining from eating more than necessary is therefore recommended, except for those with higher energy requirements, such as some patients.

To make the food system sustainable and to improve public health, the Dutch Ministry of Agriculture, Fisheries, Food Security and Nature (LNVN) and the Ministry of Health, Welfare and Sport (VWS) have agreed the joint objective that residents of the Netherlands should consume as much plant-based protein as protein of animal origin by 2030 (24). The most recent Food Consumption Survey, which was carried out in 2019-2021, identified that 41% of protein consumed in the Netherlands was plant-based and 59% was of animal origin (16). Another policy objective is to reduce food waste by 50% in 2030 compared to 2015 (24). To achieve these targets, it is important that all sectors contribute.

The healthcare sector has a role to play in achieving the national climate targets and reducing health risks due to climate change. The Dutch health care system is responsible for 7% of the Netherlands' CO₂ emissions (25). Sustainable healthcare that produces minimal greenhouse gas emissions and has a minimal impact on the living environment is an important objective for the sector. Sustainable nutrition is an important part of achieving this, given that 5.8% of CO₂ emissions from health care come from food production and consumption (25).

The signatories to the [Green Deal on Sustainable Healthcare 3.0](#) have committed to five topics to be addressed in 2023-2026. In this context of this report, topic 1 (Promotion of health), topic 2 (Promotion of awareness and understanding) and topic 4 (Medicines) in particular are important from the perspective of healthy and sustainable nutrition and tackling waste. Topics 1 and 2 concern healthy and sustainable nutrition (26). Topic 1 specifically focuses on promoting health by integrating sustainable and healthy nutrition into the procurement policies of healthcare providers in line with the National Prevention Agreement (27) and the *Richtlijn Eetomgevingen* published by the Netherlands Nutrition Centre (28). The target of a nutritional offer consisting of 40%/60% animal/plant-based proteins for employees and visitors has been set for 2030, with an intermediate step of 50%/50% in 2026. When it comes to the percentage of animal/plant-based proteins in the nutritional offer for clients/patients, the healthcare providers aim to achieve a better balance within medically responsible limits. Topic 2 focuses on increasing knowledge and raising awareness, while topic 4 concerns circularity and limiting the consumption of raw materials and other materials, and in particular sustainable and circular food procurement and reducing food waste.

In response to the Green Deal on Sustainable Healthcare 3.0, Dutch hospitals were asked about their sustainable nutrition strategy in early 2024 (29). This survey revealed that the integration of sustainable nutrition is well under way. Most hospitals have made agreements, which are yet to be developed in detail and implemented. Around half of

the Dutch hospitals surveyed indicated that they had integrated the Green Deal into their vision and policy (29) by integrating the guidelines in the Green Deal on Sustainable Healthcare 3.0 into their nutrition policy (based on the *Richtlijn Eetomgevingen* (28)). The hospitals also indicated that they are transitioning towards providing patients with more plant-based proteins and fewer animal proteins.

The *Gezondheids-organisaties voor een gezonde voedseltransitie* (Healthcare Organisations for a Healthy Food Transition) charter (30) identifies five steps that healthcare organisations can take. These include actively expressing the ambition to offer at least 60% plant-based protein, formulating targets and integrating them into policies, seeking connections with existing initiatives, coalitions and alliances, working together to share and develop knowledge and skills in relation to sustainable and healthy diets and focusing on the eating environment.

Healthcare institutions have devoted attention to providing healthy nutrition for some time, including through the ambitions set out in the National Prevention Agreement (27). The previous Green Deals on Sustainable Healthcare addressed healthy nutrition, but did not devote specific attention to sustainable nutrition. The Green Deal on Sustainable Healthcare 3.0 focuses on healthy and sustainable nutrition in the healthcare system (26). See Table 1 for a summary of the national agreements for health and sustainability in the healthcare system.

Table 1 Summary of national agreements, initiatives and tools

National agreements	Description
Green Deal on Sustainable Healthcare 3.0 (2022)	The signatories in the Netherlands committed to work together to achieve results in the period 2023 to 2026 inclusive in relation to five topics (Promotion of health, Promotion of awareness and understanding, CO ₂ reduction, circularity and medicines) (26).
Local and regional Prevention Agreements (since 2019)	These agreements transform the ambitions set out in the National Prevention Agreement (NPA) into measures and policies at the local level (31).
National Prevention Agreement (NPA) (2018)	With this agreement, the Dutch government and more than 70 signatories have committed to ensuring that the percentage of smokers, overweight individuals and problem drinkers falls in the period up to 2040 (27).
Healthy and Active Life Agreement (GALA)	With this agreement, local authorities, Municipal Public Health Services, care insurers and the Dutch Ministry of Health, Welfare and Sport have committed to promoting healthy and active life for everyone. The agreement describes how a healthy generation will grow up in 2040 in a healthy environment with a strong social network, and also the steps to be taken to achieve this objective (32).

National agreements	Description
Integrated Care Agreement (IZA)	With this agreement, which was signed in 2022, the Dutch Ministry of Health, Welfare and Sport and many healthcare providers have agreed to provide more appropriate, prevention-oriented, sustainable and digitalised care. The agreement states that, in 2030, the nutritional offer for patients, clients and residents of institutions will be based on the <i>Richtlijn Eetomgevingen</i> (and diet-specific where necessary).

National initiatives	Description
<i>Goede Zorg Proef Je</i> (GZPJ)	The <i>Goede Zorg Proef Je</i> [®] (GZPJ) programme helps hospitals and care institutions transition towards healthier and more sustainable nutrition. This best practice published by the NPA also supports the IZA and the Green Deal on Sustainable Healthcare 3.0. Various working groups support initiatives to improve the nutritional offer. In 2020, 20 hospitals committed to the target of providing a fully healthy nutritional offer by 2022. By 2024, almost all hospitals provided a nutritional offer that complied with the Dutch dietary guidelines (29, 33). By March 2025, 65 of the 70 hospitals and more than 35 (long-term) care institutions in the Netherlands were affiliated with the GZPJ. Based on the GZPJ standard, this national programme provides tools to help participants meet the minimum requirements for the nutritional offer and policy for patients, employees and visitors (34). Moving from a vision for nutrition to the implementation of a healthy and sustainable offer can be achieved with a step-by-step plan (35).
Sustainable Nutrition in Hospitals	The Netherlands Federation of University Medical Centres (NFU) has signed the Green Deal on Sustainable Healthcare 3.0 and has set up a working group on sustainable nutrition in hospitals to put the corresponding implementation plan into practice (36).
<i>Gezondheids-organisaties voor een gezonde voedseltransitie</i> charter (2024)	This charter has been signed by a large group of health care organisations and professionals. They have committed to promoting a healthy and sustainable diet (30).
Better Offer, Better Food	This project focuses more on sustainability and implementing the new <i>Richtlijn Eetomgevingen</i> at a wide range of healthcare institutions. The project aligns with the objectives of the NPA and the ambition of providing a healthy and sustainable nutritional offer for patients, employees and visitors in all hospitals by 2030. The Dutch Ministry of Health, Welfare and Sport has financed this project since 2024 (37).

Tools	Description
Alpha-Tool	The Alpha-Tool is a scientifically validated instrument used to determine the protein quality in (plant-based) meals (38, 39).
AminoFit	AminoFit is an instrument that optimises the amino acid profile of meals. Once the user has chosen a meal type and entered products, the tool calculates the protein and amino acid content.
FutureProof	FutureProof presents a summary of existing measurement instruments and is intended as tool for communication between different departments in the supply chain (innovation, procurement tenders), between healthcare organisations and for policy development. The summary consists of criteria for the relevant aspects of sustainable nutrition: procurement, production and waste streams, operational management, product range, organisation, employees, clients and patients (40).
Care Environment Thermometer version 7	Version 7 (January 2025) of the Healthcare Environment Thermometer from the Healthcare Environment Platform (MPZ) shows how healthcare institutions devote attention to sustainable operational management. This version also contains a nutrition module.
Sustainable Nutrition in Healthcare toolkit	This toolkit, which was developed by Radboud university medical center, covers four topics (food waste, CO ₂ emissions, sustainable nutrition for employees and visitors, sustainable nutrition for patients). Each topic addresses 'why', 'how' and 'in practice' and contains practical tips and examples (41).

This report identifies effective interventions for healthy and sustainable nutrition in healthcare institutions, with practical examples of institutions that have implemented it in practice. It is written for managers and coordinators in the healthcare system, and also researchers and other interested parties. It builds on previous research by the National Institute for Public Health and the Environment (RIVM) into effective nutritional interventions in the healthcare system as described in the Green Deal on Sustainable Healthcare report on nutritional interventions in the healthcare system (42).

4 Methodology

The information on which this report is based was sourced from scientific literature, and from reports and policy documents that have not been published in scientific journals (known as grey literature). A search for scientific literature was carried out using Embase.com, a combination of the Medline databank and the Embase databank in early 2024. The search was limited to systematic reviews, meta-analyses and studies from the past 10 years (in Dutch and English) and focused on comparable countries, i.e. developed countries. The search strategy used varying combinations of the following terms: bedside, employees, environmental impact, food labelling, food waste, healthcare setting, healthy and sustainable food, hospital food, nudging, nutritional status, obesity, patients, planetary health, plant-based food, protein intake, seasonal or local foods/products, sustainable diet, vegetarian menu and visitors. The search resulted in 162 publications. Based on the titles and abstracts of these publications, it was assessed whether the publications concerned one or more nutrition concepts for healthy and sustainable nutrition in healthcare institutions. It was also important that the interventions had been implemented in healthcare institutions, such as hospitals, care homes, nursing homes and mental health institutions. Organisations such as home care providers, general practitioners and dentists were not included. Publications on interventions for older people who live at home were also not included.

As it became apparent that most studies of healthy and sustainable nutrition in the healthcare system focused on patients, broader settings were also considered for employees and visitors. Interventions that are effective in other settings may also be effective in healthcare institutions. The selection process ultimately resulted in approximately 50 publications for both target groups. An additional search was also carried out at Embase.com in late 2024 with the same inclusion and exclusion criteria and search terms as the search carried out in early 2024, but with additional terms in the search strategy, including plate waste, portion size and amount of food left. This additional search resulted in 124 new publications. These publications were assessed in the same way based on their titles and abstracts. Five publications ultimately remained, which were added to the publications found during the first search. In addition to the searches carried out at Embase.com, additional publications and grey literature were identified using literature lists and the knowledge of colleagues. A total of approximately 40 publications were used for Chapters 5 and 6.

The Green Deal on Sustainable Healthcare report on nutritional interventions in the healthcare system (42) focused exclusively on health. In this report, we consider interventions that focus on both healthy and sustainable nutrition. This report does not address the scale of the impact of each intervention on specific outcome measures, such as the quantitative reduction in greenhouse gas emissions. Various conversations and an exploratory needs assessment identified that the Dutch Ministry of Health, Welfare and Sport and healthcare organisations are looking for good practical examples to help them take

specific steps on the work floor to become sustainable and contribute to improving health outcomes. We therefore specifically chose to focus on studies that considered the practical implementation of sustainable and healthy nutrition in healthcare organisations. The report does not cover what exactly constitutes sustainable and healthy nutrition, nor the relative quantitative impact of the interventions. The report does however include studies that considered the best ways to ensure that sustainable and healthy nutrition for patients, clients, employees and visitors in healthcare institutions is promoted, offered and accepted, and also which interventions have proven to work, are promising or for which the effect is uncertain or unknown. The report distinguishes between interventions as follows:

- **What works:** most of the identified studies show that the intervention is an effective way of promoting (healthy and) sustainable nutrition in the healthcare setting.
- **What is promising:** the studies show that the interventions are generally effective, but only a few studies were identified. This category includes interventions that are effective in a setting other than the healthcare setting and/or interventions that may be effective in the healthcare setting.
- **What is uncertain or unknown:** interventions for which insufficient research has been carried out to allow a conclusion to be drawn, or for which the results are ambiguous. This includes studies that did not study the effects on the most important outcomes.

Two researchers independently assigned the results of the interventions to these categories. This process assigned a higher weighting to the results of review studies than the results of individual studies.

In this report, healthy nutrition is understood to mean diets that reduce the risk of chronic illnesses, that ensure that sufficient nutrients are consumed and that ensure that your energy intake is not too low or too high, based on the Dutch dietary guidelines or international equivalents (43, 44). Specific nutritional guidelines may apply to individual patients and clients, depending on their illness or disorder. Sustainable nutrition is understood to mean a diet that minimises the effects on the environment, climate and living environment, including food waste. Healthy and sustainable nutrition generally go hand in hand, although not always. When it comes to the outcomes of interventions, the environmental impact such as greenhouse gas emissions, food waste, food consumption, energy and protein intake and plant-based protein impact were considered. For more background information about what sustainable nutrition is and the environmental effects of existing diets in the Netherlands, please see www.rivm.nl/en/food-and-nutrition/sustainable-food and the most recent report on the environmental impact, protein intake and protein ratio of food consumption in the Netherlands (16).

5 Healthy and sustainable nutrition for patients and residents

5.1 Introduction

This chapter covers healthy and sustainable nutrition for patients and residents (including clients) in (long-term) healthcare institutions such as hospitals, care and nursing homes, mental health institutions and disability care institutions. Healthy nutrition is important for good health. Healthcare institutions have a responsibility to set a good example by offering healthy nutrition (45). A healthy nutritional offer contributes to patients' recovery. Undernourishment results from an insufficient intake and reduced absorption of, and/or an increased need for, energy and nutrients (46). The effects include a slower recovery from illness and increased complications (47). Patients and residents in healthcare institutions are not fully free to choose what they eat. This means these institutions can help patients and residents make healthy and sustainable choices about what they eat (48). There are already recommendations for nutrition in healthcare institutions alongside the Dutch dietary guidelines (43), including the ESPEN guideline (49). This guideline contains evidence-based recommendations for nutritional care in hospitals, rehabilitation centres and nursing homes to reduce the risk of undernourishment and protect the general safety of patients.

The transition from a diet that is high in animal products to a more plant-based diet is crucially important for both the climate and environment and for public health. Plant-based foods such as (wholemeal) grain products, vegetables, fruit, pulses and nuts generally have a lower environmental impact than animal products and are recommended as part of a healthy diet. Proteins, which are an essential part of a healthy diet, play an important role in this transition to a more sustainable diet and thus also in the transition to a more sustainable healthcare system. Producing animal proteins has a greater environmental impact than producing plant-based proteins.

Proteins perform various essential functions in the body: they are the building blocks for muscles, they play a role in the immune system and are used to transport substances within and between cells. Proteins also supply energy. The Health Council of the Netherlands (2021) states that a healthy person requires 0.83 grams of protein per kilo of body weight (50). For sick individuals, this requirement raises to 1.2 to 1.5 grams per kilogram of body weight (51). This means protein intake is extremely important in healthcare institutions, where patients often have an increased protein requirement to promote tissue recovery and immune function.

Proteins consist of various building blocks, which are known as amino acids. Animal foods generally contain a wider spectrum of amino acids than plant-based foods. To obtain the same quantity and diversity of amino acids from plant-based sources, it may be necessary to consume more and/or various combinations of plant-based foods. Healthcare institutions must therefore carefully select plant-based protein sources

that meet patients' nutritional needs to optimally promote their health and recovery.

In addition to an increased protein requirement, patients may also have an increased energy requirement. Reducing the energy intake of the population as a whole is generally seen as beneficial to health and an effective way of reducing the impact on the environment and climate, given that energy intake correlates with environmental impact (23). However, this does not apply to patients to the same extent, as they have an increased energy requirement. Reducing the energy intake of this group can cause negative effects, which means a trade-off must be made between health and sustainability.

There are also health benefits to reducing the consumption of red meat and processed meat, as an excessive intake of these meats increases the risk of strokes, diabetes, colorectal cancer and lung cancer (43). Consuming foods that are high in plant-based proteins, such as wholemeal grains, nuts and pulses, helps prevent obesity and illnesses such as type 2 diabetes, cardiovascular diseases and various types of cancer (43). By lowering the intake of animal proteins and increasing the intake of plant-based proteins, we can reduce the environmental impact and contribute to better health and thus also reduce the pressure on the healthcare system.

5.1.1 *Effects of nutritional interventions*

Extensive research has been carried out into nutritional interventions in healthcare institutions, particular with regard to healthy nutrition (see the Green Deal on Sustainable Healthcare report on nutritional interventions in the healthcare system (42)). Studies of nutritional interventions that focus on sustainability primarily consider reducing food waste. These studies generally focus on 'plate waste', i.e. 'food that is served but not consumed by patients' (52). This is avoidable food waste.

Food waste is generally measured by weighing the total meal and subtracting the weight of the meal that has been consumed. The reasons why patients leave food on their plate include a lack of appetite, the poor quality of the food provided (including appearance, taste, portion size) and a limited number of options on the menu (52, 53).

Little research has so far been carried out into interventions that are both healthy and sustainable in healthcare institutions. The studies that did consider this were of varying quality. Nevertheless, several interventions related to healthy and sustainable nutrition for patients show promising effects.

The interventions for patients and residents are categorised into the following groups:

- Adaptations to the meals service
- Employees/volunteers and organisation
- Portion size and frequency
- Meal composition and presentation
- Food procurement
- Plant-based meals

A description of the identified results and interventions is given below. The descriptions are preceded by a short introduction and summary of the identified results. The results of the studies are then presented.

5.2 Adaptations to the meals service

This section gives an extensive summary of the interventions that consist of changes to the meals service that are effective, promising, or for which the effects is uncertain or unknown. The interventions covered by the identified studies are explained in greater depth in the subsections after this summary.

The interventions that consist of changes to the meals service were generally implemented and studied in hospitals. It is customary for patients in Dutch hospitals to select a daily or weekly menu in advance. A meals service can be adapted in various ways. Frequently mentioned approaches include electronic meals ordering, an ordering system with a verbal explanation of the menu, a room service model, giving patients the freedom to choose from many options at any time and patient-focused meals and patient-focused advice. Four review studies describe electronic meals ordering, one review study describe an ordering system with a verbal explanation of the menu, two review studies examined bulk trolleys, three review studies and a single individual study examined room service models, four review studies cover giving patients the freedom to choose from many options at any time and a single review examined patient-focused meals and patient-focused advice. These review studies and individual studies primarily considered the difference between the traditional way of ordering on paper or from a trolley and new methods. The studies primarily considered the effects on food waste, energy and protein intake and patient satisfaction. See also the **practical example at Gelderse Vallei Hospital** in Chapter 2 (page 17), where the *Zorg met Goede Voeding* concept allows patients to order from an à-la-carte menu throughout the day.

The identified studies show that implementing an electronic ordering system, an ordering system with a verbal explanation of the menu, bulk trolleys, room service models and giving patients the freedom to choose from many options at any time are effective. Implementing an electronic ordering system, compared to a traditional paper ordering system, reduced costs and led to higher consumption, energy and protein intake and improved patient satisfaction (see Chapter 5.2.1). Only two studies considered the effect on food waste. The results were mixed: one study did identify a reduction in food waste, but the other did not. More research into the effect of the electronic ordering system on food waste is therefore required.

Implementing an ordering system with a verbal explanation of the menu, compared to traditional methods such as a paper ordering system, led to a reduction in food waste, higher energy and protein intake and improved patient satisfaction (see Chapter 5.2.2). Implementing a bulk trolley, compared to a tray-based meal service, led to a reduction in food waste (see Chapter 5.2.4). In studies that also considered the effect on energy and protein intake of using bulk trolleys, the energy and protein intake remained largely the same. Implementing room service models, compared to traditional methods, resulted in a

reduction in food waste and costs (see Chapter 5.2.5). However, the effect on energy and protein intake was mixed, which means further research is required.

The effects on energy and protein intake varied depending on the specific circumstances and implementation at different hospitals. Many studies identified an increased energy intake, but one study identified a decrease. The majority of the studies also identified an increased or comparable protein intake, but a single study identified a decreased protein intake. One study specifically considered a room service model based on snacks between meals. Although this method resulted in a reduction in both food waste and costs, the energy and protein intake remained largely the same and the patient and employee satisfaction level dropped. Room service models are an effective way of reducing food waste and are a promising way of increasing energy and protein intake. However, additional research is required to clarify the effect on energy and protein intake.

Various measures that gave patients the freedom to order from many options at any time were compared. This revealed that offering a more extensive menu at any time can reduce food waste and either increase energy and protein intake or maintain them at existing levels (see Chapter 5.2.6). A choice of various menu options, compared to limited options, resulted in lower food waste, higher energy and protein intake and improved patient satisfaction. The Free Choice Menu concept, which allows patients to order 24 hours a day, resulted in lower food waste and comparable energy and protein intake to the trolley concept (see Chapter 5.2.6).

The identified studies show that patient-focused meals and advice, cooking to order and Steamplicity (a food preparation method) are promising interventions. Measures focused on providing more patient-focused meals and advice by ensuring that the choice of meals is agreed with the patient resulted in lower food waste, lower costs, improved energy and protein intake and increased patient satisfaction (see Chapter 5.2.7). This is examined in only two studies and shows promising results, although more research is required to confirm the effects. Cooking to order, which resembles the Free Choice Menu concept, resulted in a reduction in overproduction (see Chapter 5.2.8). Only one study considered this intervention. Although the results were promising, more research is needed to confirm them. Steamplicity, which involves packaging food in such a way that it can be steam-cooked in the microwave, resulted in lower food waste and higher consumption, but also lower energy intake and comparable protein intake (see Chapter 5.2.8). Little evidence is available for this intervention, and as such further research is required. It also involves a different cooking technique. It is important to study whether this technique is indeed more sustainable.

The identified studies show that the effect of implementing self-service, protected mealtimes and buffet-style meals with adaptations in the eating environment and help from nursing assistants is unknown. Implementing self-service, in which patients can indicate their food preferences themselves using a mobile device, has only been studied in relation to the effect on patient satisfaction (see Chapter 5.2.3). This

revealed that patient satisfaction remained comparable to the traditional method. However, as only a single study was included, there is little evidence. The effect on food waste and the environmental impact has not been studied. Protected mealtimes, the opposite of the Free Choice Menu concept, resulted in a comparable energy intake to the control group. The effect on protein intake was mixed: it remained comparable and was sometimes lower (see Chapter 5.2.6). The effect on food waste and the environmental impact has not been studied. Providing buffet-style meals combined with changes to the eating environment, such as seasonal decoration, tablecloths and background music and training to allow nursing assistants to provide the correct type and quantity of help, resulted in lower food waste compared to the traditional tray method (see Chapter 5.2.8). However, only a single pilot study was studied, which means further research is needed to confirm these results. An explanation of the identified results is given below.

5.2.1 *Electronic meal ordering*

The effect of implementing an electronic ordering system ('electronic bedside meal ordering systems': eBMOS) compared to a traditional paper ordering system in hospitals is described in four review studies (54-57). These reviews, some of which include overlapping studies, evaluated the impact on energy and protein intake, patient satisfaction, food waste and cost savings. An electronic ordering system differs from a traditional paper ordering system because it can show up-to-date patient data, including diet and allergies, at the time of ordering. It also makes it possible to order meals closer to the time of consumption, because data can be entered directly into an electronic system (54).

In general, the review studies show that the implementation of an electronic ordering system in comparison to a traditional paper ordering system can result in higher energy and protein intake, lower costs and improved patient satisfaction. The studies show that eBMOS results in significantly higher energy and protein intake compared to the traditional methods (54-57). Patients who used eBMOS consumed an average of up to 2000 kJ more energy and up to 25 g more protein per day (54). When it comes to food waste, only two studies were discussed in the review studies, with mixed results. The study by Barrington et al. (2023) found no significant difference in food waste between eBMOS and traditional methods (58), while McCray et al. (2018) reported a significant reduction in food waste (from 30% to 17%) where eBMOS was used (59).

5.2.2 *Ordering system with a verbal explanation of the menu*

The effect of an ordering system with a verbal explanation of the menu was analysed in a review study of nine individual studies (60). In the interventions, an employee discussed menu options with the patient, helped the patient select meals based on their dietary requirements and recorded the order using a mobile device. The results show that using a spoken menu led to an increase in energy and protein intake, a reduction in food waste and improved patient satisfaction compared to traditional methods such as a paper ordering system. In an Australian hospital, 98% of patients who were presented with a menu with a verbal explanation consumed at least half of their main meal, compared to 76% for a printed menu. Their energy and protein intake also increased

(8273 compared to 6273 kilojoules; 83 g compared to 66 g). Comparable results were reported for Canadian hospitals, with a 24% increase in food consumption. The increase in patient satisfaction for electronic bedside ordering is probably due to patients feeling well-informed and involved with the process, because they can ask questions and communicate their concerns to employees.

5.2.3 *Self-service*

An alternative ordering method – self-service – is described in a review study based on a single study (60). In this study, patients were given the option of ordering their meals from a menu on a mobile device. The study focused exclusively on measuring patient satisfaction. The results showed no significant difference between the satisfaction level for the self-service method and the traditional paper method, in which patients ordered their meals 24 hours in advance using a paper form.

5.2.4 *Bulk trolley*

The use of bulk trolleys is described in two review studies (57, 61). A bulk trolley is a food trolley that contains a fridge and heating element, for example. The trolley is rolled to where the patient is. The patient can then choose a meal.

A systematic review study by Carino et al. (2020) evaluated the use of bulk trolleys, which allows patients to select their meals from their bed (61). This approach led to a decrease in food waste compared to the traditional system of providing meals on plates.

The review study by Rinninella et al. compared the use of bulk trolleys with meals served on trays (57). In situations where patients are served meals on trays, they are often obliged to order 24 hours in advance. A reduction in food waste was observed (5.9% for bulk trolley ordering versus 11.6% for meals served on a tray), although the residual waste percentage from the trolley remained high (20.5%). Nutrient intake was comparable between the systems, although both remained under the recommended nutritional values.

5.2.5 *Room service models*

The effect of room service models on energy and protein intake, food waste and costs is described in three review studies (55, 57, 60) and a single individual study (62). Room service models, in which patients order meals that are delivered within a certain period of time, are receiving increasing attention due to their potential to increase intake, reduce waste, offer flexible mealtimes, increase patients' freedom of choice and improve the patient experience (62).

Comparisons between room service models and traditional methods are examined in three review studies (55, 57, 60). The traditional method was frequently a paper ordering system that often required patients to choose a meal more than 24 hours in advance. In most studies, providing room service resulted in a significant increase in energy and protein intake. For example, energy intake rose from 1306 kcal/day to 1588 kcal/day and protein intake from 52 g/day to 66 g/day in one study (57, 60). In a Danish study, energy intake increased but protein intake remained the same (60). However, a small Dutch study with 72

participants showed a slight decrease in both energy and protein intake for room service, which suggest that the effectiveness of room service can vary depending on the context (60). When it comes to food waste, the studies show that room service resulted in a substantial reduction, with a decrease in food waste from 40% to 15% and from 29% to 12%, and a decrease in production waste from 15% to 6% (55, 57). These studies also show that room service reduced meal costs, which suggests a more efficient use of resources (55, 57). Comparisons between room service and a cold-plating tray delivery system show improved nutrient intake, reduced food waste and costs and improved satisfaction scores (55).

In an intervention trial by Ellick (2024), a traditional trolley with snacks was compared with room service in the form of 'on demand' snacks. The results for patient satisfaction, energy and protein intake, waste and costs were positive (62). Patients are normally offered three snacks per day at standard times. The 'on demand' snack service allowed patients to choose snack options themselves at set times using a patient system or mobile app with help from nutrition assistants. The implementation of the 'on demand' snack service resulted in a reduction in food waste (23% vs. 21%), labour costs for the food service team (\$1650 for the trolley vs. \$926 for 'on demand') and waste costs (\$179 for the trolley vs. \$129 for 'on demand'), although energy and protein intake remained much the same (938 kJ and 6 g protein vs. 925 kJ and 6 g protein). However, the satisfaction level of patients and employees fell, which justifies further research into suitable implementation methods.

5.2.6 *Freedom to choose from many options at any time*

Three review studies describe the impact of various meal strategies, including multiple menu options, the Free Choice Menu (FCM) and protected mealtimes, on food waste and energy and protein intake (55-57).

A review study by Antasouras et al. (2023) describes the effect of menu options on food waste and energy and protein intake (55). Two studies included in this review study examined the difference between a menu with extensive options and a limited menu. The findings suggest that offering a menu with extensive options is a more effective way of reducing food waste and improving energy and protein intake than a limited menu (for example with only 1 or 2 options or the choices available from the trolley) (55).

The effect of the FCM concept is described in two review studies (55, 56), both of which discuss the same study. This study evaluated the implementation of the FCM concept, in which geriatric patients were given the freedom to choose their meals and mealtimes, compared to the trolley concept. Patients could order 24 hours a day from a menu with both warm and cold dishes. Although no significant difference in energy and protein intake between the two meal service concepts was found (trolley: 6124 kJ; 52.6 g and FCM: 5923 kJ; 47.1 g) over a period of three days, the lunchtime food waste was significantly lower for the FCM concept (15.6%) than for the trolley concept (26.1%).

The effect of protected mealtimes on energy and protein intake is described in the review study by Rinninella (57). Protected mealtimes are defined as periods in which all non-urgent clinical activities in a hospital department are stopped so that patients can eat uninterrupted and employees can provide support (57). The results of three included studies show that protected mealtimes did not increase energy and protein intake. One of the studies in fact identified a significant decrease in protein intake (14.0 g versus 7.5 g).

5.2.7 *Patient-focused meals and advice*

The effects of patient-focused meals and patient-focused advice on food waste were examined in two studies included in a review study (55). The first study, a literature review, analysed food waste in hospitals, with half of the studies having taken place in Europe. This study, which collected 760 records from various databases, was the first to quantify methods for reducing food waste. In the 92 studies that reported improvements in food waste, adapting food choices to individual patient preferences is the most commonly cited change that reduced food waste. The second study, a cross-sectional analytical study, evaluated the results of offering hospital patients a traditional food service model and a new, patient-focused model. This new model included à la carte menu options, improved food quality, high-protein and high-energy options, verbal bedside ordering, greater interaction with nutrition experts and hospital managers and, where necessary, preparation of meals in a culturally/ethnically appropriate manner. The study shows that the patient-focused model improved nutritional intake and patient satisfaction and reduced food waste and costs.

5.2.8 *Other interventions related to ordering systems*

In addition to the measures described above, other approaches that may have beneficial results are possible, although more research is required to formally prove their effectiveness.

An intervention study by Liwinski (2024) examined the implementation of the 'cooking to order' system. This resulted in a significant decrease in overproduction in the food service system (63).

The review study by Rinninella examined the Steamplicity system compared to the traditional cook-chill system (in which meals are cooked and then cooled rapidly to preserve them for longer) (57).

In the first study, the use of Steamplicity resulted in higher food consumption (282 g versus 202 g at lunch) and lower food waste (33% versus 49%). However, the second study reported a lower energy intake for Steamplicity, with no difference in protein intake.

In the review study by Antasouras, the implementation of a buffet-style meal service was the subject of a pilot study, in which residents with a nutritional risk could choose their own meals (55). This approach was combined with changes to the eating environment, such as seasonal decoration, tablecloths and background music and training to allow nursing assistants to provide the correct type and quantity of help. Compared to the traditional tray method, this resulted in a reduction in

food waste, although no significant changes in body weight or biometric markers were observed.

5.3 Employees/volunteers and organisation

This section gives an extensive summary of the interventions that consist of a change to the organisation of the nutritional care that are effective, promising, or for which the effect is uncertain or unknown. The interventions covered by the identified studies are explained in greater depth in the subsections after this summary. Most of the interventions in which the researchers focused on changes to the organisation of nutritional care took place in hospitals. This category includes interventions in which someone offered extra help during meals. This may be a carer, nutrition assistant or volunteer. There are various ways of offering extra help with eating, including removing packaging, cutting food into small pieces, bringing round trays with food and/or actually giving food (64). The target group for these interventions consisted of older people in many cases. See also the **practical example at Gelderse Vallei Hospital** in Chapter 2 (page 17), where a trained food service assistant is employed, and also the **practical example at Radboud university medical center** in Chapter 2 (page 17), where a nutrition assistant is employed as part of the Food for Care concept. In addition to studies of the effect of interventions, the literature review also showed that it is important to generate sufficient support for interventions. See page 38 & 39 for more information. See also the **practical example at Amsterdam UMC** in Chapter 2 (page 18), where various partners at the hospital were involved with the development of the *Zorg op het Bord* nutrition programme. Two review studies describe the deployment of volunteers, two review studies and one individual study describe the deployment of extra employees, and one review study and one individual study describe the deployment of (food service) dietitians.

The identified studies show that extra nutritional assistance during meals and better training of employees are effective. Providing extra nutritional assistance during meals, and associated education and training programmes for employees, can reduce food waste and overproduction (see Chapter 5.3.2). The studies that considered the effect on energy and protein intake conclude that extra help from employees with nutritional assistance and associated training programmes have a positive effect on nutrition intake.

The identified studies show that deploying volunteers, having employees help with opening packaging and employing dietitians and food service dietitians are promising interventions. Having volunteers help during mealtimes can prevent food waste and increase energy and protein intake (see Chapter 5.3.1). This is promising, although the researchers indicated that further research is required. Having employees open packaging may reduce food waste and increase food consumption (see Chapter 5.3.2). This was addressed by only two studies, and as such more research is required to confirm these results. Employing a dietitian to help with choosing a suitable menu can reduce food waste and increase consumption (see Chapter 5.3.3). The researchers indicated that more research into the effectiveness of these interventions is

required. Employing a food service dietitian, who coordinates the medical and nutritional needs of patients and identifies how these should be reflected in the food preparation in the kitchen, resulted in lower food waste and a cost reduction of 5% (see Chapter 5.3.3). Only one study considered the employment of a food service dietitian. Although the results were promising, more research is needed to confirm these results.

The identified studies show that effect of only issuing nutritional advice on waste and environmental impact is unknown. Providing nutritional advice resulted in an increased protein and energy intake. The effect on food waste has not been studied (see Chapter 5.3.2).

An explanation of the identified results is given on page 39 and 40.

Generating support among employees

Involving employees in the process of implementing healthy and sustainable nutrition in healthcare institutions is important to ensure that interventions are effective (65-69). In a review study, Taufik et al. (2020) examined facilitators and barriers among employees that affect the implementation of interventions that promote healthy and sustainable nutrition in the out-of-home environment and in the health care system (66). The results identified various facilitators, including knowledge of the intervention, understanding the benefits for the target group (for example health benefits) and having confidence that the intervention will result in a real change. The identified barriers included practical problems (shortage of time and labour and inflexibility in the food service system), lack of communication between/towards employees about the intervention and negative perceptions among employees about the intervention (for example lack of interest).

In the collaborative study on the implementation of nutritional interventions in inpatient healthcare institutions and hospitality, real-life research was carried out into ways of promoting healthier eating (70-72). This study focused on healthier eating, because sustainable food was less important at the time for the partners involved with the study. Based on scientific insights and most of all on their own practical day-to-day experience, interventions were developed, tested and evaluated in 11 case studies in inpatient healthcare institutions, hospitality facilities, child day care facilities and schools. The study examined the effects on the consumption of healthier food and the effects on employees who implement the interventions. Based on this study, recommendations were formulated for the successful implementation of policy for healthy and sustainable nutrition in healthcare institutions and hospitality facilities:

- Start providing healthy and sustainable food:
 - o Assume that healthy and sustainable food will result in a higher level of satisfaction among clients.
 - o Implement interventions that make it easier for clients to make healthy and sustainable eating choices.
 - o Work together and help, inspire and strengthen each other.
- Increase the motivation of food prepares and servers:
 - o Ask enthusiasts to take the lead.

- o Allow cooks/employees to contribute their own recipes and ideas.
- o Ensure that employees accumulate their own, positive experiences.
- o Ensure that the management provides support and communicates actively.
- Promote knowledge about healthy and sustainable food:
 - o Organise (inspiring and stimulating) training courses to increase confidence and knowledge.
 - o Transform healthy and sustainable food policy into practical guidelines for employees.
- Make it possible for employees to provide healthy and sustainable food:
 - o Create possibilities.
 - o Investigate whether healthy and sustainable food really requires additional capacity; practical experience has shown that this is often not the case.
 - o Exploring labour-saving solutions can help, such as pre-cut and pre-processed vegetables.

Three studies considered the challenges and opportunities of the transition to healthy and sustainable nutrition in healthcare institutions (67, 71-73). Hoefnagels et al. studied the perceptions of employees in nursing homes prior to this transition (67). They found that transparent communication and a common goal were facilitators, and that lack of knowledge about healthy and sustainable nutrition was a barrier. The study *Online Dialoog Voeding in de Zorg* involved more than 200 participants from various parts of the healthcare supply chain (73). It showed that awareness of the importance of sustainable and healthy nutrition in the healthcare system is still low, that administrators do not see it as a priority and that there is insufficient structural embedding. There are opportunities to be grasped by developing a clear vision, and promoting structural knowledge transfer and implementation across all layers of the healthcare system. A sustainable food supply chain can be realised by improving communications and fostering a greater sense of responsibility among users and producers. Bannenberg et al. interviewed stakeholders from hospitals who took part in the *Goede Zorg Proef Je* programme (71, 72). They identified various challenges, including communication about the transition, financial restrictions and lack of knowledge about plant-based nutrition. They identified opportunities to be grasped by developing a clear vision and plan, communicating effectively with employees and collaborating with healthcare institutions and knowledge institutes. These studies all emphasise the importance of communication, knowledge transfer and collaboration as crucial elements for a successful transition towards healthy and sustainable nutrition in the healthcare system.

5.3.1 *Extra help from volunteers*

The effect on energy and protein intake and food waste of deploying volunteers is described in two review studies (55, 57). Volunteers were deployed to assist patients during meals. A systematic review that was included in the review study by Antasouras reported that volunteers can improve patient care by helping them eat. This results in increased energy and protein intake, prevents undernourishment and reduces food

waste. The review study by Rinninella also shows that nutritional assistance from trained volunteers, compared to nurses, resulted in a substantially longer time being spent with the patient during the meal (12.3 minutes versus 4.7 minutes). The energy and protein intake of patients who were helped by a volunteer increased significantly, although the effect on food waste was not specifically studied (57).

5.3.2 *Extra help from employees*

Two review studies examined the effect of having employees provide extra help, for example with opening packaging or by giving nutritional advice (55, 57, 74).

Extra help from employees with opening pre-packaged food (e.g. packaged slice of cheese) and drinks (bottle of water) and encouraging older people to eat was analysed in two studies and one review study (55). The results show that providing extra help with opening packaging increased food consumption and reduced food waste. Despite the positive results for this strategy, this review study points out that there are also challenges to be overcome. These include insufficient time, that measures are not cost effective and that nurses do not always have sufficient experience with providing nutrition. However, it was pointed out that further research is needed and that attention should also be devoted to other elements of the food system, including storage, meal processing and meal distribution (55). A special dietitian (a food service dietitian) can play an important role in this respect.

The effect of having employees provide extra help, such as nutritional support and training programmes on nutritional assistance, is described in two review studies (55, 57). The review study by Antasouras shows that extra help from employees improved the nutritional intake of older hospital patients. It was also found that better training for nurses and carers about nutrition can reduce food waste (55). Rinninella reported that better training for employees about food waste and assistance with meal ordering resulted in a significant reduction of 20% in the quantity of food served each day, but that this did not affect the amount of food that was wasted (57). Further studies were analysed in the review study by Rinninella. Nutritional advice was provided in a single study. The group that received advice met the energy requirement (107%) and protein requirement (94%) for discharge. The percentages for the control group were 90% and 88% respectively (57).

5.3.3 *Employing dietitians*

Employing (food service) dietitians is discussed in one review study and was investigated in one individual study (55, 74).

Although the review study concludes that more research is required to demonstrate the effectiveness of this intervention, employing dietitians appears to contribute to reducing food waste and improving food consumption (55). The specialist knowledge of dietitians as nutrition experts may therefore contribute to reducing food waste in general. Employing dietitians to help patients choose suitable menu options and actively encourage them to eat can also help reduce food waste.

Employing a food service dietitian was the subject of one individual study (74). A food service dietitian coordinates the medical and nutritional needs of patients and identifies how these should be reflected in the food preparation in the kitchen. This means they are much more closely involved with the composition and provision of meals than a standard dietitian (74). A study by Yona et al. considered the effect of employing a food service dietitian in a hospital (74). This study examined factors including the percentage of food that was wasted and how this affects cost savings. They identified a reduction in food waste, which resulted in a 5% saving on the annual nutrition budget (annual saving of \$11,428). This was primarily due to improved communication between hospital departments, kitchens and distribution centres and checking the expiry date of medical nutrition. Other cost-saving factors resulting from the employment of a food service dietitian included avoiding providing meals to patients who do not consume them (for example because they are receiving parenteral or enteral nutrition), improved coordination and monitoring of food delivered to hospital departments and employees, and coordination of special meals based on the medical and nutritional needs of the patient.

5.4 Portion size and frequency

This section gives an extensive summary of the interventions that involve changes to portion sizes and frequency that are effective, promising, or for which the effect is uncertain or unknown. The interventions covered by the identified studies are explained in greater depth in the subsections after this summary. Three review studies describe smaller, high-energy portions, smaller portions and providing multiple meals. Three studies describe the effect of allowing patients to choose from various portion sizes. See also the **practical example at Amsterdam UMC** in Chapter 2 (page 18), where smaller portions are provided at multiple mealtimes throughout the day as part of the *Zorg op het Bord* nutrition programme.

The identified studies show that adaptations that involved providing multiple small portions are effective. Providing multiple small, high-energy portions resulted in a reduction in food waste (see Chapter 5.4.1). Providing smaller portions resulted in less food waste and sometimes in lower energy intake, which means it is important to provide more snacks between meals/high-energy food (see Chapter 5.4.1). Although the effect on the environmental impact has not been studied, reducing portion sizes also reduces the environmental impact.

It was also shown that providing five meals instead of three is a promising intervention. Providing five meals instead of three reduces food waste and results in improved or comparable energy intake (see Chapter 5.4.1). This was addressed by only two studies. More research is required to confirm these results.

As the effects of providing high-energy foods on food waste and environmental impact have not been studied, these effects are unknown. Research has shown that providing high-energy nutrients results in higher energy and protein intake (see Chapter 5.4.1). As this

was only examined in a single study, there is little evidence at present. The effect on food waste has also not been studied.

An explanation of the identified results is given below.

5.4.1

Reducing portion size and/or increasing frequency

Three review studies describe the effect of smaller, high-energy portions, smaller portions and providing multiple meals on food waste and energy and protein intake (55, 57, 61).

The review study by Antasouras analysed the effect of smaller, high-energy portions. The review study shows that offering multiple portions can result in a reduction in food waste compared to standard hospital meals (55). The systematic review study by Carino et al. shows that the combination of high-energy meals and smaller portion sizes resulted in a reduction in food waste (61). Rinninella only studied the effect of an integrated hospital menu with high-energy foods, in which the intervention group had a higher energy intake (132 kJ/kg/day versus 105 kJ/kg/day) and energy intake (1.4 g protein/kg/day versus 1.1 g protein/kg/day), with additional nutrition costs of £4.15 per participant per day (57).

The effect of providing smaller portions was analysed in the same two review studies by Antasouras and Carino. Antasouras examined the effect of smaller portions in three studies. Providing smaller portions was shown to result in a reduction in food waste, but sometimes also a lower energy intake. The authors therefore indicate that it will probably be necessary to give patients small, nutritious/high-energy snacks to meet their energy needs (55). The systematic review study by Carino et al. shows that most studies identified a significant relationship between portion size and food waste, with smaller portions resulting in less food waste (61).

One review study examined the effect of providing more meals than usual. Antasouras describes two studies of the effect of providing five meals instead of three. The results show that providing more meals led to a comparable energy intake or an improvement, and that it may reduce food waste (55).

5.4.2

Choice of multiple portion sizes

One review study (55) and two individual studies (63, 75) examined the effect of allowing patients to choose between two different portion sizes.

One review study shows that allowing patients to choose between two portion sizes resulted in a 30% reduction in food waste (55). Another study considered the effect of reducing the portion size of the provided meal and giving patients the option of receiving a larger portion (75). This was shown to result in a reduction in food waste (from 70% to 66%). An intervention study measured the effects of various interventions simultaneously, including reducing the portion size, with patients who required it given the option of ordering extra portions (63). Although the number of meals served increased by more than 3%, both the mass and costs of food waste decreased by almost 6%. A composite environmental impact score based on various indicators, including greenhouse gas emissions, land and water use, showed a reduction of more than 20%.

5.5 Meal composition and presentation

This section gives an extensive summary of the interventions that involve changes to the composition and presentation of meals that are effective, promising, or for which the effect is uncertain or unknown. The interventions covered by the identified studies are explained in greater depth in the subsections after this summary. The composition of meals can be changed by improving the texture, for example. The quality of the food offered is also important. For example, research has shown that the use of poor-quality food is an important variable affecting the amount of food wasted (53).

Two review studies and one individual study examined the effect of modifying texture and using better ingredients. Three review studies examined the effect of improving the presentation and visualisation of meals.

The identified studies show that modifying the texture and presentation of meals, making meals more visually attractive and using better ingredients are promising measures. Optimising the texture of food contributes to reducing food waste. Minced meals resulted in lower food waste compared to mixed meals processed with a blender. Minced and moulded meals resulted in lower food waste and higher consumption compared to minced meals that were not moulded (see Chapter 5.5.1). As this was examined in just one pilot study, more research is required to confirm these results. Improving the presentation of meals by adopting a more visually attractive composition or by adding a coloured serviette, or by improving the quality, temperature, taste and smell, contributes to reducing food waste and may increase food consumption (see Chapter 5.5.2). As these results were sourced from only a few studies, more research is required to confirm them. Further research into whether adding different ingredients and products such as serviettes are really more sustainable is also recommended. Using high-quality ingredients in meals results in lower food waste, higher energy intake and even lower costs (see Chapter 5.5.1). As this is examined in just one study, more research is required to confirm these results.

Although the aforementioned interventions show positive results when it comes to reducing food waste, the effect on the environmental impact was not examined and the evidence consisted of just a few studies.

An explanation of the identified results is given below.

5.5.1 Meal composition

The effect of meal composition on food waste, patient satisfaction and energy and protein intake is described in two review studies (56, 57) and a single individual study (76).

The review study by Rinninella examined the effect of three different meal textures on food waste and patient satisfaction (57). The meals consisted of rice or rice pudding with vegetables and a source of protein and were offered with the following textures: 1) fully blended, 2) minced (with soft-cooked vegetables and a finely chopped or ground source of protein), and 3) mixed porridge (in which the entire meal is cooked until

it is easy to chew). The results showed that blended meals resulted in the highest food waste (65%), followed by minced meals (56%), with the lowest food waste for mixed porridge meals (35%). Serving blended meals also resulted in more protein sources being wasted. Despite these results, patient satisfaction was highest for the blended meals, although the level of satisfaction was only marginally lower for the other meal types.

Two review studies also analysed the effect of presenting blended meals in moulded versus unmoulded form based on a single pilot study (56, 57). The results show that patients who received the minced meals in moulded form (smooth, blended foods are thickened and poured into a three-dimensional mould, so that the food resembles its natural shape, for example blended carrot in the shape of a carrot) showed a significant increase in food consumption of 1/4 to more than 3/4 of a meal. There was also a reduction in food waste of 126 g per plate compared to patients who received the minced meals in unmoulded form. Although this difference was not significant, it did represent a step in the positive direction.

An individual study by Crippa et al. (2023) considered whether adapted meals made from natural, high-quality ingredients that were easy to swallow and packaged to remain fresh for longer would affect nutritional intake and food waste among patients (67). The results show that patients who received these adapted meals had a significantly higher energy intake and wasted less food than patients who received the standard blended meals without pieces. Patients also gave the adapted meals higher scores for aspects such as taste, texture and ease of use. The costs per adapted meal were notably lower than those for the standard meal.

5.5.2 *Meal presentation*

Three review studies describe the effect of meal presentation on food consumption and waste, although they contain only a limited number of relevant studies, varying from one to two per review (55-57).

The review study by Rinninella discusses a study that evaluated the effect of an improved lunch presentation on food consumption and waste among adult hospital patients (57). In this study, the control group was given a standard lunch, while the intervention group was given a lunch that was presented in a more visually attractive way. Both groups received identical meal components. The results show a 19% increase in food consumption and a reduction in waste of high-starch components and main courses. This suggests that an improved meal presentation can promote food consumption and reduce waste. Patients in the intervention group left less high-starch foods such as potatoes, rice, bread and pasta on their plate, although the group consumed a comparable volume of vegetables as the control group. In addition, patients in the intervention group rated their meals as better tasting than the patients in the control group.

The effect of improving food presentation by adding a coloured serviette is discussed in the review study by Manimaran (56). The use of coloured serviettes (orange in this case) resulted in a 17.6% increase in food

consumption and significantly higher satisfaction, although no specific data about energy and protein intake were provided.

The effects of improved food presentation, quality and temperature are discussed in the review study by Antasouras (55). The positive perception of the food provided rose from 18% in 2002 to 48.3% in 2006 due to improved presentation and quality. This review study suggests that optimising the presentation and temperature of food has the potential to increase food consumption and reduce waste. Three additional studies also show that improving the quality, taste and smell of the food served to patients can increase the attractiveness and acceptance of food and can also reduce food waste. They state that these approaches may deliver comparable results, but that more research is required (55).

5.6 Food procurement

This section gives an extensive summary of the interventions related to food procurement that are effective, promising, or for which the effect is uncertain or unknown. The interventions covered by the identified studies are explained in greater depth in the subsections below. Hospitals purchase a lot of food. As such, influencing food procurement can accelerate the transition towards greater use of plant-based food (77), which makes it a promising approach to achieving a more sustainable food system (78). It makes it possible to determine which food is purchased (for example more plant-based, healthy foods), where it is sourced (for example from local, small and medium-sized food producers) and how products are made (for example production that protects sustainability and biodiversity (77, 78)). The purchase and consumption of sustainable and healthy food can also have an indirect positive effect by setting standards and by inspiring people to eat more plant-based foods at home, for example (78, 79). When implementing sustainable healthy food in healthcare institutions, it is important that there is support from the management. It is also important that employees know how to implement sustainable and healthy food (80). See page 40 for research into barriers and facilitators related to food procurement.

A review study and an individual study describe the effect of short supply chains and sustainable procurement (see Chapter 5.6.1). The identified studies show that sustainable food procurement is a promising development. Making food procurement more sustainable with short supply chains reduces the environmental impact, and sustainable procurement also contributes to reducing food waste and achieving a lower environmental impact. While the results are promising, this was only examined in a single review study and a single individual study, which means further research is required to confirm these results.

An explanation of the identified results is given below.

5.6.1 Sustainable procurement

The effect of food procurement at institutions is discussed in one systematic review study and was investigated in one individual study (61, 63).

The systematic review study by Carino et al. emphasises that initiatives that focus on short food supply chains, for example supplying straight from the farm to the hospital without intermediaries, can be a particularly effective way of generating economic benefits and reducing the environmental impact (61).

A three-year intervention study by Liwinski implemented various measures in a hospital environment, including sustainable procurement (63). The results of this study suggest that procuring food from sustainable sources is a crucial strategy that aligns with the organisation's environmental targets. Liwinski reported a significant reduction of almost 6% in food waste and a 20% reduction in a composite environmental impact score (based on various indicators such as greenhouse gas emissions, land use and water consumption) (63). However, it is difficult to determine which specific components in this intervention were responsible for the desired effects.

Barriers and facilitators related to food procurement

A study by Djojoseparto et al. focused on understanding the barriers and facilitators experienced by public and semi-public organisations such as governments, universities, schools and hospitals during the process of implementing the transition to procuring more plant-based foods (81). Interviews with experts and stakeholders at these organisations revealed that the ambitions of hospitals are held back by the range of products offered by suppliers, which often contain unhealthy foods and vegetarian options that are too salty and contain insufficient nutrients. New foods, including foods made from seaweed, are unavailable due to European public procurement rules and agreements with suppliers. Other barriers that are holding back the transition to a more plant-based food offer include limited budgets and a focus on the lowest price rather than sustainability. The study also identifies facilitators, including imposing mandatory measures for the food offer at public organisations and the use of food concepts such as Farm Kitchen, which promotes collaborations between local farmers and chefs. It is essential to develop a specific vision of what a healthy and sustainable food offer should be, so that the procurement policy can be adapted accordingly.

5.7 Transition to more plant-based foods

One review study and one individual study describe the effect of offering plant-based meals as standard. The identified studies show that offering plant-based meals as standard is a promising development. Providing plant-based meals as standard instead of meals with meat resulted in lower food waste and a lower environmental impact (see Chapter 5.7.1). Although described in just two studies, the results are promising. However, more research is required. The effect on energy and protein intake has not been studied. An explanation of the identified results is given below.

5.7.1 Offering plant-based meals as standard

The effect of transitioning from traditional meals to plant-based meals was examined in one study (82) and is described in one review study (57).

One study examined the effect of transitioning from a traditional meal to a plant-based meal on food waste and greenhouse gas emissions (82). In this study, patients were given a vegetarian meal during the first 24 hours of their hospital stay as standard. After the first 24 hours, patients were given the option of changing their choice of meal and choosing a meal that contained meat. The results show that food waste (-11%) and greenhouse gas emissions (-45%) were lower for the vegetarian meals than for the meat-based meals.

A review study discusses just one study in which adaptations were made that involved plant-based meals (57). This study examined the effect of providing vegetarian meals for seven days compared to meals with meat. The total food waste was significantly higher for the patients who consumed meals with meat than for vegetarians (293 g/plate vs. 259 g/plate; 11%). Significant differences in food waste were observed between categories. For meals with meat, vegetables were wasted most. For vegetarian meals, grains and vegetables were wasted most.

6 Healthy and sustainable nutrition for employees and visitors

6.1 Introduction

This chapter covers healthy and sustainable nutrition for employees and visitors in healthcare institutions such as hospitals, care homes and nursing homes.

Sustainable and healthy nutrition for employees and visitors in healthcare institutions plays an important role in promoting health and well-being and reducing the impact on the environment and climate.

Promoting sustainable and healthy food includes promoting the consumption of fewer animal products and more plant-based food. Protein intake is also important for employees and visitors, although to a lesser extent than for patients. It is essential to find a balance that takes account of the needs of the target group.

In general, a more sustainable and healthier diet means eating more plant-based foods, eating less meat, avoiding overconsumption and choosing foods with a lower environmental impact (83). It is also possible to choose organic and seasonal products and to avoid wasting food. These choices contribute to healthier nutrition and a smaller ecological footprint.

There are various initiatives that focus on improving the eating environment in healthcare institutions. Generally applicable guidelines, such as the Wheel of Five and the Dutch dietary guidelines, already help consumers make healthy and more sustainable choices.

The Nutrition & Healthcare Alliance has published a factsheet on [providing healthier nutrition in hospitals and other healthcare institutions](#) (45). This factsheet, which is published as part of *Goede Zorg Proef Je*, is intended as a tool for healthcare institutions to implement a good nutritional offer for patients, visitors and employees. The Nutrition Centre also offers tools to assist with implementing the [Richtlijn Eetomgevingen](#) to improve the food offer for employees and visitors, including the corresponding checklist and web-based training courses for caterers. (38). For example, the *Richtlijn Eetomgevingen* contains the recommendation that a healthy alternative should be offered in every product group and to promote healthy options by presenting and pricing them attractively. Free water points can also promote water consumption. The effect of these interventions based on the *Richtlijn Eetomgevingen* is unknown, but is probably comparable to the healthy company restaurant intervention. This intervention (a randomised controlled trial) focused on encouraging employees to make healthier nutritional choices in company restaurants. It proved to be an effective way of promoting the sale of healthier sandwiches, fruit and healthier fillings (84). See also the **practical example at Gelderse Vallei Hospital** in Chapter 2 (page 17), which creates a healthy food environment for employees and visitors and is primarily based on the *Richtlijn Eetomgevingen* and the Dutch dietary guidelines. There is also

a handbook from the World Research Institute, which offers food providers the latest strategies to create eating environments that encourage consumers to choose sustainable, plant-based dishes (85). However, this handbook covers a wider scope than just the healthcare setting.

It is relevant to point out that interventions may be aimed at various target groups and may address a variety of aspects. For example, visitors generally interact less frequently with the food facilities in healthcare institutions than employees, which may affect the effectiveness of and approach to interventions for these groups.

6.1.1 *Effects of nutritional interventions for employees and visitors*

The literature review revealed that limited research has been carried out into the effectiveness of interventions that focus on healthy and sustainable food for employees and visitors in healthcare institutions. Interventions that focused on healthy and sustainable food choices in other settings, including workplaces, hospitality facilities, schools, supermarkets and canteens, were therefore also included. These studies primarily examined the effectiveness of nudging on healthy and sustainable food choices (see Section 6.3). Nudging is a method that involves adaptations to the environment or communication, for example. The objective is to change the behaviour in a predictable way, or to encourage particular behaviour. This approach avoids prohibiting options or using economic stimuli to influence behaviour (86).

There are several interventions related to healthy and sustainable nutrition for employees and visitors that show promising effects. The interventions are categorised into the following groups:

- Adaptations to choice architecture
 - Placement nudges
 - Property nudges
- Combinations of interventions

A description of the identified results and interventions is given below. The descriptions are preceded by a short introduction and summary of the identified results. The results of the studies are then presented.

6.2 **Adaptations to choice architecture**

This section gives an extensive summary of the interventions that involved adaptations to the choice architecture (the design of the environment in which a particular choice is made) that are effective, promising, or for which the effect is uncertain or unknown. The interventions covered by the identified studies are explained in greater depth in the subsections after this summary.

Nudging strategies can be subdivided into placement nudges and property nudges (87). Placement nudges aim to increase the prominence, availability and accessibility of products and to influence the observed social norms in a specific environment. They include nudges that relate to placement, visibility, standard options, accessibility, proximity and social standards. The studies identified in this report show that only placement nudges have been studied in

healthcare institutions. The other category of nudging strategies consists of property nudges. This nudge type emphasises product information or changes the design of products, including hedonistic modifications (for example taste). It also includes nudges related to attractiveness. This study shows that this category is not used in the context of healthcare institutions; as such, several studies in other settings are discussed below.

Two identified studies show that nudges aimed at increasing the availability (see Chapter 6.2.1) and prominence (see Chapter 6.2.2) of sustainable food in healthcare institutions are a promising way of promoting healthy and sustainable options.

Three review studies and an intervention study describe placement nudges that focused on positioning, visibility and availability in various settings. The identified studies show that strategically placing healthy and sustainable options is effective (see Chapter 6.2.1), although the evidence is limited to a single study. Increasing the availability and visibility of sustainable choices is effective in various settings, although this has not been specifically studied in healthcare institutions. The results are therefore promising.

An identified study that involved increasing 'prominence' (saliency) through presentation shows that this is a promising way of promoting sustainable and healthy options in hospital restaurants (see Chapter 6.2.2). However, these results were based on just one study, which means more research is required to confirm this effect.

Two identified review studies of the implementation of standard options show that these nudges are promising. Offering a vegetarian or healthier option as standard resulted in the desired choices being made more often (see Chapter 6.2.3).

Two identified review studies show that accessibility and proximity nudges produce promising results in various settings. The results for accessibility nudges were mixed and product dependent (see Chapter 6.2.4). Proximity nudges such as placing healthy options closer can be effective, although more research into the specific effects on sustainable and healthy choices in healthcare institutions is needed.

Two review studies describe nudges related to social norms in various settings. The identified studies show that nudges related to social norms produce inconsistent results, although they have the potential to be effective (see Chapter 6.2.5). To be successful, these nudges must be used for the correct purpose and in the correct context. They can enhance the effectiveness of other interventions.

Three review studies describe the effect of property nudges, such as providing information and adapting portion sizes. Although they were only studied in other settings, the results are promising. The identified studies show that adapting information leads to mixed results (see Chapter 6.2.6). Providing information about sustainable food choices shows mixed effects when it comes to promoting sustainable food consumption. In contrast, adapting portion sizes led to positive results and is an effective way of promoting sustainable food consumption.

An identified literature review shows that hedonistic visual, taste-related and touch-related adaptations are promising, although the effects of music and smell are unknown. These adaptations can encourage sustainable and healthy food choices (see Chapter 6.2.7).

The two identified review studies show that descriptive labels (with specific product information) and evaluative labels (with an evaluation, for example of how sustainable a product is) are promising in various settings. While they can promote the sale of sustainable and healthy products, the results are mixed and depend on the product type and context (see Chapter 6.2.8).

One study involved giving dishes more attractive names in canteens in work environments. One identified study shows that using more attractive names leads to an increase in food consumption, which means this is a promising nudge (see Chapter 6.2.8). However, the effect is dependent on the location and is based on just one study, which means more research is needed.

Because few studies examined the healthcare setting, the scope was extended. The literature review identified results from other contexts (see Chapter 6.1.1). The interpretation of these results must take account of contextual differences, given that they may not be directly realisable in healthcare institutions. This emphasises the importance of further research into the feasibility and/or validation of these measure in the healthcare setting.

An explanation of the identified results is given below.

6.2.1

Placement nudges: adaptations to placement, visibility and availability

The effect of availability nudges in hospital restaurants was studied in two experiments (88, 89). In one study, the availability of plant-based foods was increased and additional information was provided (88). One meat and fish menu option was replaced by a vegan menu option each day, and information was provided once about the importance of nutritional practices for climate change and health, including a link to vegan recipes online, CO₂ labelling and product categorisation (88). A small, non-significant increase was observed in the degree to which the intervention group adopted a diet that aligned with the goal of planetary health compared to the control group. No difference in greenhouse gas emissions was observed between the groups.

Another study examined factors including the effect of varying availability and increasing the availability of sustainable and healthy dishes in three hospital cafeterias (89). The outcome measure was the purchase of sustainable dishes. The results show that changing the availability of sustainable dishes can influence food choices. The extent to which consumers are likely to choose a sustainable option depends on the number of sustainable options on the menu. Sales of sustainable dishes rose from 39% to 48% and availability rose from 67% to 86%.

Placement nudges were also studied in other contexts. The effect of placement nudges in university canteens was examined in a systematic review study and meta-analysis (89). An intervention study examined the effect of improving visibility in work and school canteens (91) and

two review studies discuss improving visibility and availability in various settings (92, 93).

A systematic review study and meta-analysis carried out by Pandey examined the effect of placement nudges in university canteens (90). This study shows that strategically altering the placement of vegetarian meals by placing the vegetarian option first can be an effective way of promoting sustainable choices. An increase in sales of vegetarian meals of 2.3% at dinner time was observed, although no effect was observed at lunchtime.

An intervention study by Langen examined various nudging interventions in canteens in workplaces and schools, including improving the visibility of sustainable choices (94). The results show that, in the first round, only the top menu position led to a significant increase in sustainable food choices (+22.5%). In the second round, all nudge interventions proved to be effective, including the best position on the counter (11.6%), the top menu position (+6.9%) and label plus information (+15.9%). These results suggest that nudges must be adapted to the specific context for maximum effectiveness. Vandebroele also focused on the visibility of products at the point of sale and found that products at eye level attract greater attention and that consumers consider buying them more often (92). The availability of sustainable products can also influence purchasing intention. Increasing the percentage of healthy products offered can increase sales of these products, although challenges remain when it comes to the positioning of sustainable products, particularly for vegetarian options or products with evaluative labels. Reinders also studied the effectiveness of visibility and availability nudges in hospitality facilities and work environments through a literature review (93). All studies that focused on the visibility and availability of products in hospitality facilities successfully increased sales of healthy options and the consumption of fruit and vegetables, although sustainability was not specifically studied. Adding extra information was not effective, which emphasises the importance of visual and physical cues in influencing consumer behaviour. In work environments, availability nudges also proved to be an effective way of promoting sustainable choices, with most studies being successful (93).

6.2.2 *Placement nudge: increasing prominence (salience)*

The effect of increasing prominence in hospital restaurants was examined in a single experimental study (89).

One experimental study, which also considered availability, examined the effect of presentation on the purchase of sustainable and healthy dishes in hospital restaurants (89). The prominence of sustainable dishes was increased through a combination of changes: sustainable dishes were emphasised with large and colourful signs; the signs for sustainable dishes contained the text "Eat Well" in the bottom left corners, centred within a plate-and-cutlery symbol; and physical displays for non-sustainable dishes were removed from the warm counter, so that only the sustainable dishes were shown. In this study, an increase in prominence was associated with a significant uptake

of/increase in sustainable and healthy dishes. The effect disappeared as soon as the nudge was removed.

6.2.3 *Placement nudge: standard options*

The effect of standard options, or default nudges, was examined in two review studies that describe various settings (92, 93). One intervention study considered standard options in a restaurant setting (95).

With a specific focus on sustainability, a vegetarian option was presented as standard in a Dutch restaurant (95). This led to a substantial increase in the number of customers who chose vegetarian options, with the number of customers who chose the bean option rising from 8.6% to 80% and the seaweed option from 16.1% to 58.3%.

Offering healthier options as standard was studied in a restaurant setting and other environments. The results show that restaurants that placed healthy options on their menu as standard experienced an increase in healthy orders (92). Although nudging with standard options can promote sustainable choices, nudges are not intended to restrict choices (92). Reinders also found that a standard option was successfully used in the hospitality setting in a single study, in which the ratio of margarine sales to butter sales changed by a factor of seven by swapping their positions (93).

6.2.4 *Placement nudges: adaptations to accessibility and proximity*

The effect of adaptations focused on accessibility and/or proximity in the work environment and various setting was examined in two review studies (92, 93). Accessibility nudges increase the accessibility of healthy and sustainable nutrition and reduce barriers to choosing healthy and sustainable nutrition. Proximity nudges make it easier or more attractive to choose healthy and sustainable nutrition by placing this option physically closer, for example by placing healthy snacks at eye level or within reach in a canteen, and placing unhealthy snacks further away or in a less visible place.

Research into choice architecture suggests that improving access to sustainable and/or healthy food choices and making less sustainable and/or unhealthier choices less easily accessible leads to mixed results (92, 93). For example, Vandenbroele showed in a literature review that strategically placing fruit and vegetables at the start of a buffet increases the portion sizes of these products without lowering sales of other meals (92). Making high-energy products less accessible in a cafeteria led to an increase in sales of low-energy alternatives. However, moving wholemeal bread to a better location had no effect, which suggests that the effectiveness of accessibility interventions is product dependent. Reinders also carried out a literature review that focused on accessibility nudges in the work environment and concluded that there were mixed results for accessibility nudges in this setting. For example, changes to the choice architecture were not always successful (93).

Placing healthy or unhealthy options closer was the subject of a literature review (92). The results show that placing products closer increased the consumption of the closest product. In various contexts,

including workplaces and snack vending machines, placing unhealthy snacks such as crisps further away can discourage their purchase.

6.2.5 *Placement nudge: influencing social norms*

The effect of influencing social norms and/or influences in various contexts is described in two literature studies and one systematic review study and meta-analysis (92, 93, 96).

Social norms play an important role in encouraging sustainable consumer behaviour (92). Social norms can be either descriptive or injunctive. Descriptive norms describe what others do, while injunctive norms indicate what is socially acceptable or unacceptable. An example of a descriptive norm is: '80% of visitors choose a plant-based meal option'. An example of an injunctive norm is: 'For many visitors, it is important to choose a meal that is both healthy and sustainable'. While both norm types can be effective, their effectiveness depends on how they are used. This implies that the context and how they are implemented are crucial for the success of these norms.

However, the results of studies of the effect of social norms are inconsistent. Some studies, including that by Pandey, suggest that social norms can in fact have a negative effect on the promotion of climate-friendly choices (90). This indicates that social norms alone may be insufficient and that they may require additional support or a specific context to be effective. In the work environment, social norm nudges can enhance the effect of other nudges, such as coloured stickers (93). This suggests that a combination of various approaches may be a more successful way of encouraging sustainable and healthy food choices.

6.2.6 *Property nudge: providing information and adapting portion size*

Providing information and adapting the portion size were studied in two literature reviews (92, 93) and a systematic review and meta-analysis (90).

Research into providing information about sustainable food choices as a nudging strategy showed mixed results (90). One example is providing information on a poster that explains the relationship between food production and the consequences for the climate, for example that meat and dairy production result in a much higher kg CO₂eq than vegetables, supported with illustrations of a specific example. Of the twelve studies, four showed a significant effect, with medium effect sizes, while other studies did not show a significant effect. The effect of this nudging strategy was generally not significant.

The same systematic review study and meta-analysis shows that reducing portion sizes had proven to be an effective way of reducing food waste and that it can be a useful strategy for promoting more sustainable consumer behaviour (90). The review study by Vandenbroele also shows that portion size interventions are an effective way of reducing the consumption of products with a high environmental impact, such as meat (92). Experimental studies show that offering smaller portions in restaurants and cafeterias results in lower consumption, while larger portions of vegetables can increase the intake among children. The perception of portion size is affected by

presentation: horizontal presentation makes the portion appear larger. While larger plates often lead to increased consumption, some studies report no effect or an increased vegetable intake. Portion size labels also affected decision-making behaviour, with consumers preferring medium-sized options (92). The study by Reinders et al. show that reducing plate sizes or invitations to make meals smaller in the hospitality setting are effective ways of reducing food waste and lowering the number of calories consumed (93).

6.2.7 *Property nudge: hedonistic nudges*

One literature review studied the effect of hedonistic adaptations (92). Hedonistic interventions aim to stimulate the senses, so that foods become attractive by appealing to the senses of taste, sight, smell, hearing and touch (92).

A literature review studied various interventions that focused on the effect of visual adaptations, or adaptations to appeal to the senses of taste, touch, hearing and smell, to promote sustainable and healthy food choices in various settings (92).

Visual packaging characteristics and attractive descriptions have a significant influence on consumer expectations and the perception of sensual characteristics, particularly with sustainable products (92). Using specific terms, such as 'fresh seasonal risotto primavera' can increase sales of vegetarian products. Presenting healthy food as junk food can positively affect the perception of how it tastes. In-store tastings proved to be an effective intervention to make sustainable products more attractive, particularly among hesitant consumers, while emphasising the origin of products, such as Italian pasta, enhances the perception of quality. Allowing consumers to touch products has a positive effect on appreciation and buying intention, although it can also invite negative responses if the same products are touched by others. The effect of musical elements in shopping environments depends on the context; specific music can promote sales of products such as French wine, while slower music causes customers to move more slowly through the store, which has a positive effect on sales. Smell plays a role in improving product perceptions and enhances the shopping experience. However, the impact on food choices and sustainable product choices and the effect in other settings, such as restaurants, remains unclear and requires further research.

6.2.8 *Property nudge: labels*

The use of descriptive and evaluative labels and improving naming were generally studied in other settings. One review study considered labelling and descriptive labels in hospitality and work environments (93), one experiment improved the naming of dishes in a company restaurant and one review study examined the use of descriptive and evaluative labels in various settings (92).

An extensive review study by Vandenbroele concludes that consumers showed an increased interest in product characteristics such as origin, ingredients and production processes, which led to an increase in the use of descriptive labels (92). Sustainability-related labels, such as 'local', 'organic' and 'fair trade' influence consumer perceptions and purchase decisions by providing information about sustainability,

seasonality and certifications. These labels can attract attention in competitive market environments and positively affect taste perceptions and willingness to pay more. However, the effectiveness of these labels varies depending on personality characteristics and environmental awareness (92). In the hospitality setting in particular, descriptive labels (with specific product characteristics with a mix of geographic, nostalgic and sensory elements, such as 'juicy Italian fillet of fish') are an effective way of reducing food waste and increasing sales of specific food products (93). The importance of giving plant-based foods attractive names (for example 'sweet, velvety soup with kale' instead of 'vegetable soup with kale') was also confirmed in the review study by Papiés et al., in which attractive naming was shown to increase sales (97). However, Reinders found that calorie labelling in this setting was generally ineffective, and that adding evaluative labels in the form of coloured traffic lights resulted in mixed effects (93).

Evaluative labels, such as star ratings or colour codes, are another way of helping consumers understand sustainable products. Research has shown that these labels can promote sales of sustainable products, particularly if they are perceived to be healthy (92). Colour coding, with green labels for more sustainable products, can be effective, although the results vary depending on the product type. However, there were mixed results for the effectiveness of evaluative labels. There were indications that these may result in compensative behaviour, with consumers possibly choosing less sustainable products. For example, consumers who choose a sustainable and/or healthy main course may choose a less sustainable and/or healthy side dish to compensate (unconsciously) for the chosen main course. Mixed results were found for evaluative labels in the work environment. Coloured labels were more effective than calorie labels (93).

Adopting more attractive names for dishes has been studied in self-service restaurants in workplaces in various cities across the globe (98). The results show that attractive names increased the quantity of food per plate by 43.9% compared to basic names, with a significant increase of 7% in the actual number of grams of food per plate. This effect was specifically observed in English-speaking countries and there was no substitution effect between plant-based and meat dishes. These results suggest that attractive dish names can be a scalable and cost-effective strategy to encourage consumers to choose more plant-based and sustainable options.

6.3 Combinations of interventions

This section gives an extensive summary of the combinations of interventions that are effective, promising, or for which the effect is uncertain or unknown. The interventions covered by the identified studies are explained in greater depth in the two subsections below. Integrated intervention strategies are also employed to make the healthcare system more sustainable. Or, in other words: multiple interventions are used together instead of a single intervention. Although only limited research has been carried out in this specific setting, the results of studies in other environments indicate that

combined interventions to promote healthy and sustainable nutrition are promising.

One intervention study examined the effect of various measures on factors including food waste and greenhouse gas emissions in a hospital. The identified study shows that an integrated approach is a promising way of reducing food waste and greenhouse gas emissions in hospitals (see Chapter 6.3.1). Only one study examined this, and the extent to which the measures contributed to reducing food waste and greenhouse gas emissions is unknown.

Two review studies and three experimental studies describe a combination of various nudges and interventions in settings other than care institutions.

One systematic review study and meta-analysis describes a combination of nudges in other settings. The identified study shows that using a combination of nudges that focus on changing the placement of healthy options and increasing the visibility of healthy options is a promising way of increasing the desired consumption, and that adding information enhances the identified effect (see Chapter 6.3.2). This was not specifically studied in relation to sustainability or in healthcare institutions, which means more research is required to confirm these effects.

One review study of combined interventions that focused on promoting healthy and sustainable choices in both hospitality and work environments shows that this combination is promising (see Chapter 6.3.2). However, the effect of these interventions in the hospitality setting was inconsistent, which suggests that their success is strongly dependent on the specific combination and context. In work environments, combined interventions appear to be more successful than single interventions, which emphasises the potential of a multidimensional approach. However, it is difficult to determine which specific components of these interventions were responsible for the desired effects. As such, further research is required to identify which combinations and elements are most effective and in which circumstances they function optimally.

The effect of combined interventions was studied in three experiments in supermarket environments. The identified studies show that, in (online) supermarket environments, combined interventions are a promising way of promoting healthy and sustainable choices (see Chapter 6.3.2). The studies show that a multidimensional approach, in which interventions such as labelling, pricing policy and information nudges are combined, can be an effective way of promoting healthier and more sustainable purchasing behaviour. These approaches increase sales of healthy products and encourage consumers to choose more environmentally friendly products. Although the results are positive, further research is required to identify the optimal combinations of interventions and the circumstances in which they are most effective, and to identify and study whether the results in (online) supermarket environments can be achieved in the context of healthcare institutions.

An explanation of the identified results is given below.

6.3.1 *Integrated approach*

One intervention study examined the effect of an integrated approach on food waste and environmental impact in hospitals.

A three-year intervention study by Liwinski, which is also discussed in Chapter 5.2, implemented various measures in a hospital environment, including sustainable procurement, more intensive communications about the goal of reducing food waste and selling surplus food. Unsold food was sold in the employees canteen at half the original price 30 minutes before the restaurant closed. The results of this study suggest that the measures together resulted in a significant reduction of almost 6% in food waste and a 20% decrease in a composite environmental impact score (based on various indicators such as greenhouse gas emissions, land use and water consumption) (63). It is unclear which measures were most effective.

6.3.2 *Combinations of various nudges and interventions*

The effect of combining interventions in various settings was examined in two review studies (90, 93) and three experimental studies in a supermarket environment (99-101).

The effect of combining placement and property nudges on healthy food choices was examined in a systematic review study and meta-analysis (90). These show that implementing multiple nudges by changing the placement of healthy options and making them more visible resulted in a 200% increase the consumption of wholemeal bread and a 50% increase the consumption of raw vegetables. Simple information about the benefits of healthier nutrition was also added, which encouraged positive choices and reduced food waste. This suggests that a holistic approach, which addresses both the placement and the visibility of food, can result in significant behavioural changes.

The effectiveness of combined interventions in the hospitality setting was studied by Reinders (93). In the hospitality setting, combined interventions aimed at promoting healthy and sustainable choices show mixed results. Effective interventions often combine elements such as providing information, taste testing and various nudge types, including social norms, messenger nudging and priming nudging (nudges based on visibility, availability and/or accessibility). These approaches can successfully encourage healthier purchasing decisions, as specific programmes have shown. However, not all combinations of measures result in behavioural changes. Some interventions, even those that involved extensive strategies such as financial incentives and point-of-purchase prompts, had little or no impact on customer behaviour. This indicates that the effectiveness of such interventions is strongly dependent on finding the right combination of measures in the context in which they are implemented.

Combined interventions were also studied in work environments (93). This revealed that interventions with multiple components are more successful than single interventions. However, it is difficult to determine exactly which interventions were responsible for the desired effects.

Three experimental studies examined the effect of various interventions on healthy and sustainable purchasing behaviour in the supermarket context (99-101). It is important to be aware that food choices in this context are less affected by impulsive processes than in situations where the food offer is presented directly, such as a buffet in a (company) canteen, where automatic and affective systems play a dominant role. In the supermarket context, De Bauw et al. studied a combination of product recommendation agents (which determine the interests or preferences of individual users and make appropriate recommendations), product scores (Nutri-Score and Eco-Score), a real-time average impact score for the shopping basket and personalised social norms (99). The results indicate that showing a combined Nutri-Score and Eco-Score at product level leads to improved nutritional quality, but not to improvements in environmental indicators. Behavioural changes in relation to environmental indicators did however arise when recommendation agents were added. Showing the average impact score and social norms did not result in additional improvements, which suggests that a combined Nutri-Score and Eco-Score labelling system can be effective, provided that it is supported by an environment that emphasises both scores. In an online supermarket setting, Vellinga studied the effects of increasing the price of meat by 30%, an information nudge that emphasised the environmental impact of meat production and a combination of both (100). The combination of a price increase and information nudge resulted in a significant reduction in meat purchases of 36% compared with the control condition, while the price increase alone resulted in a non-significant decrease and the information nudge alone had no effect. This indicates that the combination of pricing policy and an information nudge is the most effective way of reducing meat purchases. Katare et al. studied the effects of giving products in an online shopping environment coloured CO₂ labels, categorising plant-based products and a combination of both (101). Labelling increased sales of plant-based products by 37%, categorising by 25% and the combination of both by 32%, which suggests that both labelling and categorising are effective ways of promoting the purchase of plant-based foods, with labelling being the most effective intervention.

7 Conclusions

This report provides a summary of what is currently known about the effectiveness of interventions in the healthcare system that promote a healthy and sustainable nutritional offer. It also describes several practical examples of how healthcare institutions are working to deliver a healthy and sustainable nutritional offer. The interventions focus on tackling food waste and overconsumption, offering more plant-based and fewer meat-based sources of protein and nudges such as influencing choices with labelling.

Preventing food waste delivers environmental benefits. The following are effective ways of tackling food waste:

- Giving patients a great deal of flexibility to choose what to eat (limited choice versus menu with many options) and when to eat.
- Adapting the way that patients choose what to eat (traditional versus new methods, such as electronic ordering methods, an ordering system with a verbal explanation of the menu, bulk trolley, room service model).
- Offering extra nutritional assistance during meals and providing associated education and training programmes for employees.
- Providing multiple smaller high-energy portions and smaller portions.

Some of these measures are also effective ways of increasing patients' energy and protein intake:

- Giving patients a great deal of flexibility to choose what to eat.
- Adapting the way that patients choose what to eat with methods such as electronic ordering methods and an ordering system with a verbal explanation of the menu.
- Offering extra nutritional assistance during meals and providing associated education and training programmes for employees.

Healthy and sustainable options that focused on patients and residents also resulted in a higher reported level of satisfaction among patients. It therefore appears that patients are willing to accept these changes. In some cases, the interventions also delivered cost savings, although this aspect was not studied for many of the interventions.

For employees and visitors, the use of nudges based on visibility, availability and/or accessibility (priming nudges) or influencing choices with, for example, labelling (salience nudging) is a promising way of promoting sustainable food choices. It is also important to include employees in the process of implementing a healthy and sustainable food offer and motivating them to learn what healthy and sustainable nutrition is. It is also important to give this sufficient priority and to make sufficient space and time available to implement healthy and sustainable nutrition (see page 38 & 39 in Chapter 5).

This report is based on an extensive literature review, in this case a scoping review. It should be pointed out that some studies may have been missed. In addition, some of the identified review studies are

based on studies of low or average quality, with small numbers of participants or short intervention times. These studies were included in the literature review, although these aspects were taken into account when classifying interventions as effective, possibly effective, or with effects that are uncertain or unknown.

The literature review revealed that a considerable number of studies focused on the effects of interventions on protein intake in the healthcare sector and in hospitals (see Chapter 5). In contrast, relatively few studies explicitly considered the difference between plant-based and animal protein sources. A few studies that focus on protein quality in healthy populations and athletes have recently been published (102, 103). However, there is still a lack of studies that evaluate protein quality among patients. The intervention studies also made little distinction between different patient types and their protein needs.

Many measures related to healthy and sustainable nutrition have been implemented in the Dutch healthcare system in recent years, but these are not yet reflected in the literature. As far as we are aware, studies of the food environment in the healthcare system primarily focus on hospitals. Studies in long-term care institutions such as nursing homes and care homes are much less common. It is just as important to promote healthy and sustainable nutrition in long-term care institutions as in hospitals, given that patients/clients spent long periods there. This is confirmed by the study by Wierda et al., which analysed the food environment in hospitals and long-term care institutions in the Netherlands and identified differences by conducting interviews with and sending questionnaires to employees in hospitals and long-term care institutions (104). This study showed that hospitals currently lead the way in optimising the food environment and pointed out that it is important that other healthcare institutions adopt the same course. The interventions in the identified literature also focused on a wide range of patient groups. It is therefore unknown whether interventions are equally effective for specific patient groups.

Little research into a more sustainable and healthy food offer for employees and visitors has been carried out in any of the healthcare institution types. The few studies that focused on a more sustainable and healthier food offer in the healthcare sector did not distinguish between visitors and employees. Because few of the identified studies focused on employees and visitors in the healthcare sector, this report also includes studies that we identified during our literature review that had been carried out in other settings, such as schools, restaurants and supermarkets. It may be possible to generalise these effects to include the healthcare setting. It is also relevant to emphasise that interventions may be aimed at various target groups and may address a variety of aspects. For example, visitors come into contact with food facilities in healthcare institutions less frequently than employees. This may affect the effectiveness of and approach to interventions for these groups. It is also apparent that Dutch hospitals employ the *Richtlijn Eetomgevingen* (28) for eating and drinking facilities for employees and visitors more than long-term care institutions (28, 104), probably because the NPA/GZPJ originally focused on hospitals and only later on long-term care.

A limited volume of literature that specifically considers the connection between healthy and sustainability in the healthcare sector is currently available. Most of the studies focused on food waste. This is an important issue, given that it is preventable and imposes an unnecessary environmental burden, including greenhouse gas emissions, land use and water consumption. The environmental impact of nutrition can be analysed using environmental indicators such as the Life Cycle Analysis (LCA) food database from RIVM (11). One example is the study by Bannenberg et al., which analysed greenhouse gas emissions from hospital menus (71). Such analyses provide valuable insights that help hospitals and healthcare institutions reduce their ecological impact. They can also serve as a foundation for the development of healthier and more sustainable nutritional strategies in the future.

In addition, limited literature was found about pricing measures in the healthcare sector, a measure that previous research has shown to be effective (in combination with other measures). Pricing measures do not apply to patients, as they do not pay directly for the nutrition they receive. This may be an effective measure for employees and visitors in restaurants in the healthcare sector, as previous research has shown that pricing measures that promote or in fact discourage specific food purchases are an effective way of influencing nutritional choices and that they have the potential to promote the acceptance of healthy and sustainable nutrition (105-109). These studies show that lowering the price of healthy nutrition results in higher sales and availability.

8 Recommendations

Various healthcare institutions offer sustainable and healthy nutrition, although this is not yet the standard (110). Further research is desirable to ensure wider and effective implementation. We also recommend:

- That interventions that have only been studied in a hospital setting should also be deployed and studied in a wider setting, including long-term care institutions such as care homes.
- That further research should be carried out into promising interventions to confirm that these interventions are effective (in the healthcare setting).
- That further interventions should be developed and implemented and that research should be carried out into the effect of interventions on environmental impact in a wider sense than just food waste, including greenhouse gas emissions, land use, water consumption and biodiversity.
- That more interventions should be developed and implemented and that research should be carried out into the effects of providing more plant-based food in healthcare institutions, including protein quality and patient recovery.
- That the effect of interventions should be monitored and evaluated in practice to allow their implementation to be optimised.

More binding agreements (policy) can also contribute to ensuring that a healthy and sustainable food offer becomes the standard in healthcare institutions. It is important that organisations define targets for the implementation of sustainable and healthy nutrition and that they include these targets in their policy plans to ensure that a healthy and sustainable food offer becomes the standard (110, 111). An important next step is to quantify the effects of implementing healthy and sustainable nutrition in healthcare institutions, in terms of environmental benefits, improved health, lower costs and other organisational impacts.

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