Cost-benefit analysis of dietary treatment

seo economic research

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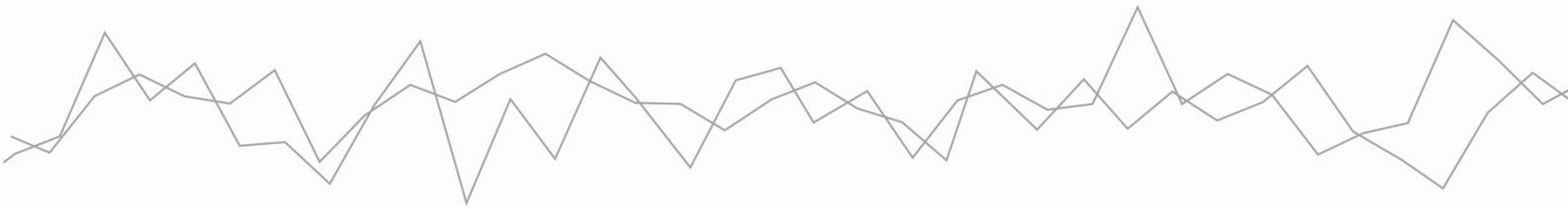

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*In a previous version (October 2012) we assumed that 55% of the patients of the dietitian is overweight and has a comborbidity such as diabetes, hypertension and/or hyperlipidaemia/hypercholesterolaemia. In this version we assume that 45% of the patients of the dietitian belong to this group. This percentage agrees with numbers from the 2010 LIPZ-data.

Summary

Treatment by the dietitian has various social benefits. The health of the patient (and his family) improves, such that costs of health care can be avoided and the production of the patient increases. The treatment of patients with obesity and obesity-related diseases creates social benefits of € 0.4 to € 1.9 billion over a period of five years. For every € 1 spend on dietary counseling of these patients, society gets a net € 14 to € 63 in return: € 56 in terms of improved health, € 3 net savings in total health care costs and € 4 in terms of productivity gains.

Motivation for this report

Although the positive effects of dietary advice are well described in the scientific literature, the total (monetary) benefits of a specialized dietary treatment have not yet been calculated. Benefits can take the form of a higher quality of life of patients, fewer hospitalizations, lower costs of medications and a higher productivity. The Dutch Association of Dietitians therefore asked SEO Economic Research to calculate the social costs and benefits of treatment by the dietitian. Benefits are calculated for the group of patients who are not only overweight but also suffer from diabetes, a high blood pressure (hypertension), and/or high cholesterol levels (hypercholesterolemia/hyperlipidemia).

Care provided by the dietitian

Care for patients with (multiple) medical conditions

The medical diagnoses of the patients treated by the dietitian vary widely: from underweight to overweight and from cancer to COPD. The needs of the patients of the dietitian are often complex: the majority of patients who were treated by a dietitian in 2010 have more than one medical or dietetic diagnosis.

The dietary treatment: focus on the individual and focused on self-management

An important feature of the dietary treatment is that the dietitian considers the personal situation of the individual. The dietitian sets achievable goals, such that patients are better motivated to adapt their eating behaviour in the long run (Dalle et al 2005; Provencher et al 2007; Teixeira et al 2004). Another feature of the treatment is that the dietitian strives for a situation in which the patient can make informed (food related) decisions themselves. The treatment comprises more than just giving advice about how to choose and eat healthy products.

Treatment by the dietitian cannot be substituted by advice from other careproviders

Advice from a general practitioner does not provide a good alternative for treatment by the dietitian: GPs say they lack the time and knowledge to provide patients with the appropriate dietary advice. In addition, several studies show that treatment by the dietitian is more effective (in terms of weight loss and a decrease in the cholesterol level) than care provided by the GP. Advice from a so-called 'weight consultant' or participation in a support group such as weight watchers only provides an alternative for people who are moderately overweight, but are not

diagnosed with other risk factors or comorbidities such as hypertension, hypercholesterolemia or diabetes.

Effects of treatment by the dietitian

Increase in physical health
As a result of treatment by the dietitian, the physical health of the patient improves. On average, patients lose 4-6 kilos, 12 months after start of treatment. At the end of treatment, patients have a lower blood pressure, lower cholesterol levels and a lower blood glucose level.

Increase in mental health
A dietary treatment by a dietitian leads to an increase in the mental health of the patient. The increase in mental health can have various causes: the dietitian contributes to an increase in the mental health of the patient directly by paying attention to the patient. In addition, following weight loss and better physical health, social and emotional problems of the patient decline.

Prevention of medical conditions
A dietary treatment ensures that fewer people develop diabetes. A relatively small weight loss of five percent of the body weight is associated with a reduction in blood pressure and a reduction of cholesterol levels. Because a diet can prevent medical conditions (or dealy the start of a medical condition), the mortality of patients is considerably lower ten years after being treated by the dietitian.

Benefits of treatment by a dietitian

Higher quality of life
As a dietary treatment causes the health of the patient to improve, the patient experiences a higher quality of life. In some cases the family of the patient also benefits: for example, because the whole family eats healthier or because a patient with gestational diabetes gets advice on proper nutrition for the infant.

Savings in health care costs
The increase in quality of life of the patient and his family is not the only benefit of a dietary treatment: health costs for hospital care and medication are avoided. Because the savings in health care costs are higher than the cost of the dietary treatment, there is a net saving on the total costs of care. More specifically: every € 1 spent on a dietary treatment saves € 4 in terms of other health care costs (hospitalization, medication). Treatment by the dietitian more than pays for itself.

More productive workers
The employer of the patient benefits from a healthier worker: the productivity of the patient increases and the number of sick days decreases. These are also benefits from treatment by a dietitian.

Total net benefits € 0.4 - € 1.9 billion

Due to the low cost of dietary advice (€ 58 per hour) and high benefits, every € 1 spend on dietary counseling presents society with net benefits of € 14 to € 63 over a period of five years. In other cost-benefit studies conducted by SEO Economic Research € 1 spend on a (medical) intervention approximately returns a net € 3 to € 5. Dietary advice is very cost effective, especially compared to other medical treatments.

The total benefits of the treatment of patients with obesity and comorbidities such as diabetes, hypertension, hyperlipidaemia/hypercholesterolaemia are € 0.4 to € 1.9 billion. This means that the treatment of patients with obesity and comorbidities by the dietitian yields € 0.4 to € 1.9 billion over a period of five years.

Contents

1 Introduction

Dietitian-led management is a relatively inexpensive way of promoting good health. This report provides an overview of the costs and benefits of dietary advice for overweight patients who suffer from one or several related comorbidities: diabetes, hypertension and hyperlipidemia/hypercholesterolemia.

1.1 Motivation for this study

Every year, some 360,000 patients in the Netherlands receive treatment from a dietitian.[1] The medical conditions suffered by these patients are very diverse, ranging from overweight to malnutrition and from COPD to cancer. The dietitian is the most appropriate professional to formulate individual management plans centred on nutrition and behaviour on the basis of personal consultations and knowledge of patients' medical problems.

Dietitians are relatively inexpensive care providers: one hour of dietary advice costs €58 (www.zorgcijfersdata.cvz.nl), while a standard 10-minute consultation with a GP costs €28 (Hakkaart-van Roijen, 2010). According to the Healthcare Budgetary Framework (*Budgettair Kader Zorg*), €42 million, or 0.067 percent of total care costs, were spent on dietetics services in the Netherlands in 2011 (Ministerie van Volksgezondheid, Welzijn en Sport, 2011). This low-cost treatment leads to a demonstrable improvement in the health of patients receiving dietetics intervention: for example, a healthy diet that takes the patient's clinical condition into account can lower blood cholesterol and glucose levels. The initial development and the progression of diseases such as diabetes and certain forms of cancer can thus be prevented.

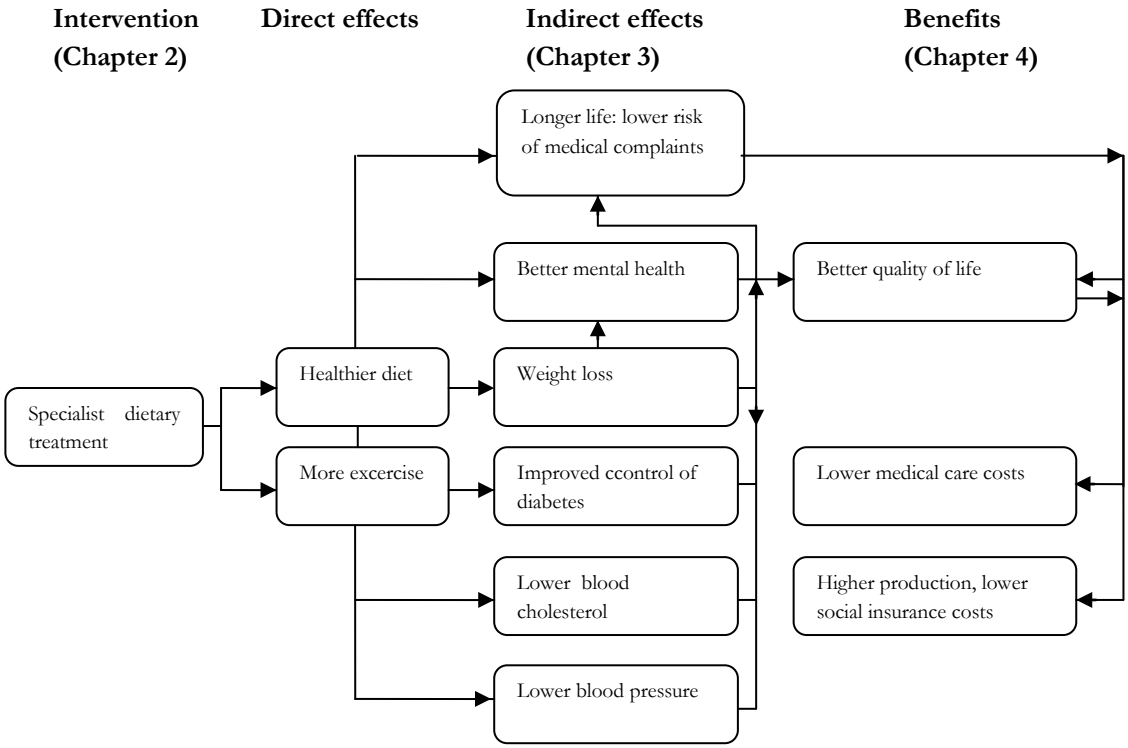
Although the positive effects of dietary advice are well described in the scientific literature, the full benefits of specialist dietetics treatment have not been calculated. These include a higher quality of life for patients, fewer hospital admissions, lower medication costs and less sickness absence from work. The Dutch Association of Dietitians has therefore asked SEO Economic Research to evaluate the societal benefits of dietitian-led management. It has been decided to assess the benefits for those patients who are not only overweight but who also suffer from diabetes, high blood pressure (hypertension) and/or high cholesterol (hypercholesterolaemia/ hyperlipidaemia). There is no valid alternative to treatment by a dietitian for these patients: care providers such as GPs, nutritional consultants or self-help groups such as Weight Watchers generally only provide benefit for those patients who are moderately overweight and do not suffer from other medical conditions. This cost-benefit analysis therefore compares the benefits of treatment by a dietitian with those of the provision of reading material about healthy eating and exercise. In addition, it demonstrates the benefits for the various parties involved (patient, family, dietitian, healthcare insurers, employers and premium payers). The results of the analysis are presented in this report.

[1] Judgement of the District Court of The Hague, case No. 413984. Decision in the summary proceedings of 20 March 2012 brought by the Dutch Association of Dietitians (NVD) and the Dutch Federation of Cancer Patients (NFK) against the State of the Netherlands.

1.2 Reader's guide

Figure 1.1 shows a schematic overview of the structure of this report. Chapter 2 describes the patient population managed by dietitians, the range of their medical problems and the treatment (intervention) provided. Chapter 3 gives an overview of the scientific evidence for the effects of dietetics treatment. The efficacy of dietitian-led management is also compared to dietary advice provided by GPs or self-help groups such as Weight Watchers. The benefits of dietitian-led management are quantified in Chapter 4. The report finishes with conclusions and recommendations in Chapter 5.

Figure 1.1 Effects and benefits of specialist dietary management provided by dietitians



Source: SEO Economic Research

2 Care provided by the dietitian

Dietitians provide patients with advice about diet and behaviour related to health and disease. These patients often require complex care, since most of them have several medical and other conditions. Dietitians are able to respond to patients' individual situations thanks to their direct personal contact with the patient combined with knowledge of the medical problems involved and the techniques available for changing behaviour.

2.1 Care for patients with single or multiple medical conditions

Nearly three-quarters of a dietitian's patients are overweight (see Table 2.1). Not all patients suffer from this condition, however. Underweight and malnutrition are also regularly encountered. In addition, the dietitian offers specialized treatments for such conditions as food allergies, chronic constipation and lactose intolerance. Patients with kidney complaints or cancer also consult the dietitian for advice on how to make a sensible choice of diet from the enormous range of foods available.

The dietitian's patients often have complex care requirements: most of the patients who consulted a dietitian in 2010 were diagnosed with more than one complaint. This also applies to overweight patients who consult a dietitian: 61 % of them had another complaint as well (see Table 2.2). Frequently occurring comorbidities include diabetes, high blood pressure (hypertension) and high cholesterol levels (hypercholesterolaemia). This is not a coincidence: people who are overweight have an increased risk of these conditions (National Institutes of Health, 1998). In view of the large size of the target group, it was decided in the present study to quantify the effectiveness of dietary counselling for patients consulting a dietitian who were not only (a) overweight but also (b) suffered from type 2 diabetes, hypertension, hypercholesterolaemia and/or hyperlipidaemia.[2]

Table 2.1 Most of the patients who consulted a dietitian or are still being treated by a dietitian in the Netherlands in 2010 have been diagnosed with more than one condition

Diagnoses made by the dietitian	2010
Multiple diagnoses	53.2%
Overweight in adults	72.8%
Diabetes mellitus	26.2%
Hypercholesterolaemia	17.5%
Hypertension	15.7%
Weight loss/malnutrition	6.5%
Overweight in children	5.0%
Irritable bowel syndrome (PDS)	5.1%
Chronic obstructive pulmonary disease (COPD)	1.6%

Source: Calculations by SEO Economic Research based on Tol et al. (2011a).

[2] The term 'hyperlipidaemia' covers people with high cholesterol levels (hypercholesterolaemia) as well as those with high blood triglyceride levels.

Table 2.2 Sixty-one per cent of overweight patients have more than one dietary diagnosis

Conditions diagnosed by the dietitian	% of overweight patients
Overweight in adults & diabetes mellitus	15.1%
Overweight in adults & hypertension	7.5%
Overweight in adults & hypercholesterolaemia	6.8%
Overweight in adults & diabetes mellitus & hypercholesterolaemia	6.2%
Overweight in adults & diabetes mellitus & hypertension	5.4%
Overweight in adults & hypertension & hypercholesterolaemia	3.3%
Overweight in adults & other comorbidity	16.7%
TOTAL	61.0%

Source: Calculations by SEO Economic Research. The total percentage of 61% applies to the period 2006-2011 (Tol et al. 2011b), and the other data to 2010 (Tol et al. 2011a; using data obtained from C. Leemrijse and K. Valentijn at NIVEL – the Netherlands Institute for Healthcare Research in Utrecht).

2.2 Overweight and related conditions

Overweight

Nearly half of the Dutch population is overweight

More than 40 per cent of the Dutch population aged four or older is overweight and nearly 10 per cent is seriously overweight (obese); see Table 2.3. The number of obese people in the Netherlands has more than doubled during the past thirty years (CBS, 2012a).

Table 2.3 More than 40 per cent of the Dutch population aged 4 or older is overweight

Age range (years)	Underweight (BMI < 18.5)	Normal weight (18.5≤BMI<25)	Moderately overweight (25≤BMI<30)	Seriously overweight (Obese) (BMI≥30)
≥ 4	2.2	56.1	31.9	9.8
≥ 20	1.5	50.3	36.8	11.4

Source: CBS (2012b) report on lifestyle, preventive examination and personal characteristics. The data apply to 2011. The Body Mass Index is calculated by filling in height and weight in the formula $BMI = \frac{weight\ in\ kg}{(height\ in\ m)^2}$. Values of the Body Mass Index of BMI<14 and BMI>45 are excluded from the data.

Overweight leads to severe health risks

The World Health Organization estimates that at least 2.8 million people die each year as a result of being overweight. Overweight is the fifth most common cause of death globally. This is hardly surprising, since overweight or obese adults are at increased risk of getting diabetes, cardiovascular diseases and various forms of cancer, among other things (PON, 2010; WHO 2012). A person who is overweight is in addition more likely to suffer from mobility problems (gout or arthritis), shortness of breath and respiratory complaints, and mental health problems such as depression and poor self-image (Van Wezel, 2000). Moderately (seriously) overweight people are likely to have 2(5) fewer healthy life years than those with a healthy weight, while this figure rises to 5 for people with obesity. It may be mentioned for the sake of comparison that excessive alcohol intake and a sedentary life lead to the loss of 1 healthy life year, while smokers have 4.5 fewer healthy life years than non-smokers (Hoeymans and Van Baal, 2010). Overweight

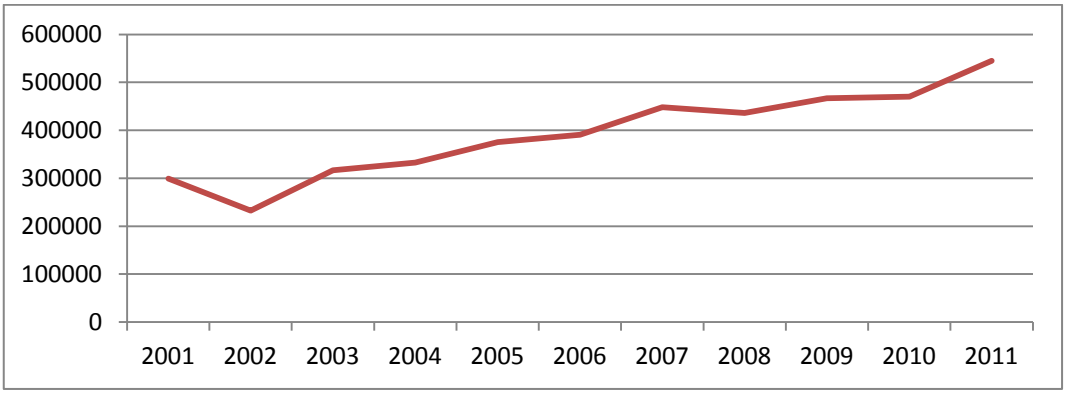
also leads to increased costs: 2 per cent of all disease-related costs are due to overweight (De Hollander et al. 2006).

Related conditions

Type 2 diabetes mellitus

Patients with type 2 diabetes (DM2) do not produce enough insulin, and their body makes less efficient use of the insulin they do produce; as a result, their blood sugar level is elevated.[3] People with DM2 often exhibit symptoms such as thirst, fatigue, itching and infections. They are also at increased risk of bladder infection, and any wounds they have tend to heal slowly (Van de Burg-Sleutjes et al. 2006). More than 600,000 people in the Netherlands have DM2. This number is increasing: Figure 2 shows that the number of people with DM2 in the Netherlands has doubled during the past decade. In the worst case, diabetes can lead to death. A total of 2,756 people died in the Netherlands in 2011 with diabetes as the primary cause of death (CBS, 2012c). The Netherlands National Institute for Public Health and the Environment (RIVM) predicts that unless current policies are changed, the number of people with diabetes in the Netherlands will rise to 1.3 million in 2025 (Baan and Schoenmaker, 2009).

Figure 2 Number of people with type 2 diabetes mellitus in the Netherlands has doubled during the past decade



Source: CBS data derived from the POLS (Permanent Study of Living Conditions) survey and CBS population data, accessible via statline.cbs.nl. Calculation and data processing by SEO Economic Research. The figures refer to people aged 12 and over.

Hypertension

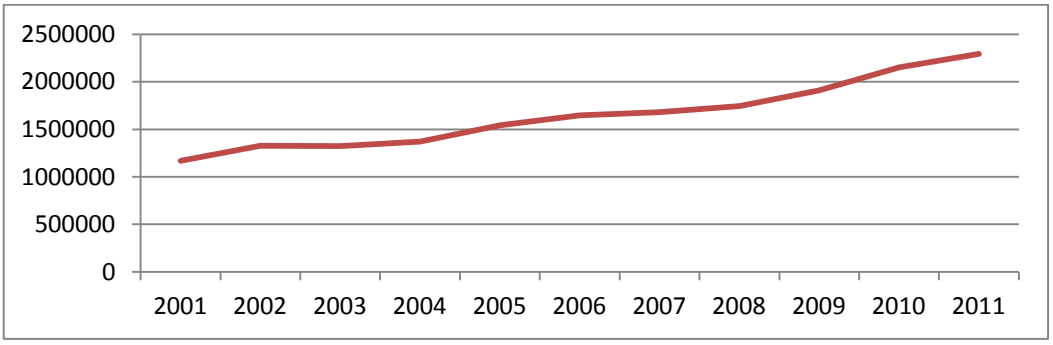
More than two million people in the Netherlands have high blood pressure, also known as hypertension.[4] The number of people stating that they suffer from high blood pressure has doubled during the past decade (see Figure 3). Hypertension does not usually lead to symptoms, though some patients may complain of headache and dizziness. Patients with a high blood pressure are at increased risk of cardiovascular diseases. A total of 38,132 people died in the

[3] Normal blood sugar levels lie between 4 and 5.6 mmol/l. In diabetic patients, the fasting blood sugar level is at least 6.0 mmol/l and the non-fasting blood sugar level is at least 11.0 mmol/l. The HbA1c (glycated haemoglobin) level is a useful measure of long-term (3-month) control of blood sugar levels. HbA1c levels of >8% are indicative of diabetes.

[4] The diagnosis of hypertension is made when the diastolic blood pressure is at least 90 mm Hg and/or the systolic pressure is at least 140 mm Hg (in adults aged < 60). Different values apply to older or negroid patients (Beitsma and Ensing, 2010).

Netherlands in 2011 with cardiovascular disease as the primary cause of death, making this group of diseases the second most common cause of death in the Netherlands (CBS, 2012c).

Figure 3 Number of people with high blood pressure in the Netherlands has doubled during the past decade



Source: CBS data derived from the POLS (Permanent Study of Living Conditions) survey and CBS population data, accessible via statline.cbs.nl. Calculation and data processing by SEO Economic Research. The figures refer to people aged 12 and over.

Hyperlipidaemia

Hyperlipidaemia is the collective name for a variety of disorders of fat metabolism. Patients with hyperlipidaemia have abnormally high blood levels of cholesterol (hypercholesterolaemia) and/or triglycerides.[5] About a quarter of Dutch adults aged between 35 and 70 have severely elevated cholesterol levels (Verschuren et al. 2008). Prolonged elevation of the cholesterol level can cause the blood vessels to be clogged with cholesterol. Like overweight and high blood pressure, high cholesterol is a major risk factor for cardiovascular disease.

2.3 Approach to the treatment

Nearly 90 per cent of the patients treated by Dutch dietitians are referred by their GP or another physician (Tol et al. 2011a, referring to data for 2010). The remaining 10 per cent approaches the dietitian on their own initiative. Until 1 August 2011, patients who approached the dietitian on their own initiative still had to bring a referral letter from their doctor. After that date, no referral is necessary for treatment by a dietitian.

No matter whether patients come on their own initiative or are referred by their doctor, the dietitian will always start by checking whether there is a need for his services. During the first and maybe the second session of the treatment, the dietitian will collect all the information needed for personalized dietary treatment and lifestyle counselling, if required. Many factors affect the treatment, and these vary from one patient to another[6]:

- **Current situation.** What kind of work does the patient do? Does he often eat in the canteen at work, or does he travel a lot? How big is his food budget? What is his current pattern of food consumption and exercise? The current situation forms the point of departure for the dietary treatment that is formulated.

5 Hyperlipidaemia is diagnosed if two or more blood tests show mean cholesterol levels of 8 mmol/l or more *or* mean triglyceride levels higher than 4 mmol/l (Tump, 2007).

6 After http://www.dieetbehandelingsrichtlijnen.nl/richtlijnen/00ZK_werkwijze_diëtist.html (these dietary treatment guidelines can only be accessed with the necessary user ID and password).

- **Patient's motivation and expectations.** Some patients are not highly motivated to change their dietary pattern, or they don't realize what they can change in their current pattern. Others may be too enthusiastic in cutting down their fat intake and have to be encouraged to eat more. The patient's dietary knowledge and insights, and the extent to which he is in a position to change his current dietary pattern, determine the approach to be taken to the treatment. Such factors as the patient's attitude towards various forms of dietary treatment – and his previous experience of dietary counselling and diet-related diseases – can also play a role here.
- **Medical data.** The dietitian needs to know not only what medication the patient is currently taking and what treatment he is receiving from other healthcare professionals, but also his medical history and details of any dietary advice he has previously received by word of mouth and/or in writing. In addition, he needs to check which of the patient's complaints may be diet-related. If necessary, the dietitian will measure the patient's height and weight, and will request details of other medical data such as blood pressure, blood sugar and blood cholesterol levels.

Individual treatment

A common approach to the dietary treatment of overweight patients is to advise them to follow an energy-restricted diet, that is one that contains 600 kilocalories less than the patient has been used to consume (PON, 2010).[7]

One important feature of the treatment offered by dietitians is that it is individualized. Individual treatment has a number of benefits compared with general dietary advice. First of all, the dietitian has the medical knowledge needed to tailor the treatment to the patient's medical needs. For example, he will take relevant contraindications into account. One case in point is the replacement of kitchen salt by certain mineral mixtures for patients with high blood pressure. This measure is not recommended for patients with kidney problems or who are taking certain medications. Patients with diabetes need to have the number of meals they eat a day adjusted to suit the medication they are taking. Secondly, the dietitian can adapt the treatment to match the patient's personal and social characteristics. For example, there may be a history of cardiovascular disease in the family, as a result of which the patient may be afraid that he is at risk of getting this disease. What influences the patient's eating behaviour? Does he eat because he is lonely, or does he enjoy eating in company? Thirdly, the dietitian can set achievable goals in consultation with the patient. Patients who are set achievable goals will be better motivated to change their eating behaviour (and other forms of behaviour) in the long run (Dalle et al. 2005; Provencher et al. 2007; Teixeira et al. 2004).

Striving for self-management

Another important feature of the treatment offered by dietitians is that self-management is the ultimate goal. The basic idea is that the patient bears responsibility for his own eating behaviour. The task of the dietitian is to provide the patient with the information he needs to make the right choices. Giving the patient insight into the nutrients contained in various food products and his day-to-day dietary requirements frees him from slavish adherence to a limited number of prescribed meals and snacks. In this way, the patient is made self-sufficient enough to adapt his

[7] It is recommended that 55-60% of the energy provided should come from carbohydrates, 30-35% from fats and 10-15% from protein. Care should also be taken to include sufficient fluid, vitamins and minerals in the diet.

diet to changing circumstances and to make considered use of his diet to remedy his medical complaints as far as that is possible, now and in the future.

Not just dietary advice

While a dietitian is specialized in the provision of dietary advice, he may give the patient other forms of advice during the treatment. In particular, he will often point out the importance of taking enough exercise. Here again, the recommendations will be tailored to the patient's individual circumstances: an overweight building labourer who cycles to work will not get the same advice as an older woman who is confined to her house with arthritis.

2.4 Duration and intensity of the treatment

The basic medical insurance package will cover three hours of dietary counselling with effect from 2013

Until 1 January 2012, the basic medical insurance package in the Netherlands reimbursed the costs of up to four hours of treatment by a dietitian per year. Extramural dietary treatment was then temporary removed from the basic medical insurance package as part of the wide-ranging programme of cuts in healthcare expenditure. It was decided however that dietary counselling for people receiving coordinated multidisciplinary care for COPD, diabetes or the risk of cardiovascular disease should still be covered by the basic medical insurance package. General dietary advice such as that provided by GPs would also remain covered by the insurance in 2012. This measure was partially abolished on 21 June 2012. As a result, dietary treatment will once again be covered by the basic medical insurance package starting in 2013, but the maximum number of hours of treatment per calendar year for which the costs are reimbursed will drop from four to three.

Three hours of treatment is probably not enough for many patients

Nearly 35 per cent of the patients who received primary treatment from a dietitian in 2010 were treated for more than three hours in that year (Tol et al. 2011a). Nearly 12 per cent had a treatment time of more than four hours. The dietitians considered that 21 per cent of the patients they treated in the period 2005-2009 needed more than four hours of treatment per year. The patients requiring more than four hours of treatment included many who were overweight, were diagnosed with multiple conditions or had a combination of overweight and hypertension (Tol et al. 2012).

The indications for the duration of treatment as laid down in the guidelines for dietitians also show that three hours of dietary counselling per year is not enough for many patients. These indications are divided into four groups on the basis of the number of consultation units (CU) required, where 1 CU = 30 minutes. The care requirements for different classes of patients are given in Table 2.4, which once again reflects the greater need of care for patients with multiple diagnoses. [8]

[8] The guidelines for dietary advice given by physicians (NVD, 2010) divide the care levels into six groups. The suggested duration of treatment for overweight patients and those with diabetes mellitus, hypertension and hypercholesterolaemia given in these guidelines are practically identical with those laid down in the guidelines for dietitians.

Table 2.4 Indication of the number of hours of dietary counselling required by patients with different diagnoses

Care level I (6 CU)	Care level II (10 CU)	Care level III (15 CU)	Care level IV (unrestricted)
Hypertension	Diabetes mellitus*	Aids/HIV*	Eating disorders
Osteoporosis	Hyperlipidaemia	COPD*	Kidney failure
Diabetes in pregnancy	Overweight	Oncology*	(congenital) metabolic disorders

* Up to 5 CU extra should be allowed for periodic checks, to be held from 1 to 3 times a year. In the case of multiple diagnoses, the indication for the highest care level should be multiplied by 1.5.

It is recommended that overweight patients who also have diabetes, hyperlipidaemia (hypercholesterolaemia) and/or hypertension should have 6 to 8 counselling sessions in the first year. The dietitian needs 30-45 minutes for the first session, and 10-30 minutes for each of the follow-up sessions (Van Wezel, 2000). This is followed by a one-year maintenance phase during which the patient sees the dietitian every three months. Patients may need to be followed up after these two years; no guidelines are laid down for the duration of this follow-up (PON, 2010). The actual duration and intensity of the treatment will vary from case to case, and will depend on the complaints and complications suffered by the client, his ability to understand and follow the dietitian's recommendations, his motivation and the gap between his present diet and that recommended by the dietitian.

3 Effects of treatment by the dietitian

Treatment by a dietitian leads to improved mental and physical health: weight loss, reduced blood pressure and lower blood cholesterol and sugar levels help patients to feel better and give them a feeling of well-being. Patients are not only healthier but also live longer, since the risk of various medical complaints is sharply reduced by dietary treatment.

The direct effects of treatment by a dietitian for overweight patients with a comorbidity are (a) they eat healthier food, and they eat less; and (b) they take more exercise. Lifestyle changes improve patients' health: they lose weight, and their blood pressure and blood sugar (blood glucose) and cholesterol levels fall. Thanks to these health improvements, a wide range of medical complaints can be avoided or their onset can be delayed. As a result, people live healthier lives – and they live longer. This is because overweight increases the risk of conditions such as hypertension, hypercholesterolaemia and diabetes. This chapter presents an overview of the scientific evidence for the effectiveness of treatment by dietitians. Further details of a number of the studies cited are given in Appendix A.

3.1 Effectiveness of dietary treatment

Improved physical health

Weight loss

Various systematic reviews show that dietary treatment can lead to weight loss of 4 to 6 kg in about 12 months (Avenell et al. 2004a,b; Dansiger et al. 2007; Franz et al. 2007; Brown 2009)[9].

The maximum treatment time in many of the controlled studies was one year. The weight loss three years after the start of the treatment is half that at the end of year 1, and five years after the start of the treatment practically all the weight loss has disappeared. Patients regain weight more slowly if they are seen regularly by the dietitian after an intensive course of treatment than if they only receive written information after the treatment (Svetkey et al., 2008). There is also a positive correlation between the number of treatment sessions and the amount of weight lost (Dansiger et al., 2007; Finkler et al., 2012).

Lower blood pressure

Not only weight loss but also a drop in blood pressure is to be expected when an overweight patient with comorbidity is treated by a dietitian (Avenell et al., 2004a,b). Dietary treatment of adults with hypertension lowers both the systolic and the diastolic pressure (Siebenhofer et al., 2011). This is partly due to a positive relationship between weight loss and lowering of the blood pressure (Aucott et al., 2005; Gallardo et al., 2011) but also because the advice dietitians give is

[9] It is often stated in these studies that the guidelines used by the dietitians involved state that patients should be encouraged to adopt an energy-restricted diet (with about 600 kcal/day less than the normal pre-treatment diet). Dutch dietitians follow similar guidelines when treating overweight patients (PON, 2010).

specifically aimed at lowering the blood pressure (even in patients who are not overweight; Sacks et al. 2000).

Some patients no longer need to take medication to reduce their blood pressure, or can reduce their dosage, after they have changed their diet and started to take more exercise (Ho et al. 1994; Jones et al. 1999). The use of low-sodium diets can reinforce the action of antihypertensive medication in patients who still need to take such medication (Huggins et al. 2011).

Lower cholesterol
Treatment by a dietitian can lead to lower cholesterol levels (Avenell et al. 2004a,b), especially in patients who suffer from hypercholesterolaemia and/or hyperlipidaemia (see e.g. Delahanty et al. 2001, Sikand et al. 2000). The drop in cholesterol level is moreover found to increase with the number of visits to the dietitian (Sikand et al. 1998; Herbert et al. 1999).

Various medications are also available for control of the cholesterol level. However, medication combined with dietary treatment gives a greater reduction in cholesterol level than use of medication alone (Clemmer et al., 2001). Treatment by a dietitian can also delay the time when medication has to be used to reduce cholesterol levels (Sikand et al., 1998, 2000).

Lower blood glucose
Blood sugar (glucose) levels can also be reduced by dietary treatment (Pastors et al. 2003; Avenell 2004a,b; Coppell et al., 2010). As with weight loss and a reduction in cholesterol levels, an increase in the number of visits to the dietitian also leads to a bigger drop in blood glucose levels and hence a lower use of medication (Franz et al., 1995).

Better mental health

Treatment by a dietitian can improve patients' mental health (Wolf et al., 2004; Imayama 2011). There are various possible reasons for this. Firstly, the attention the dietitian pays to the patient can have a direct effect in improving the latter's mental health. Furthermore, weight loss and better physical health can help to reduce a patient's social and emotional problems.

Longer life

Lower chance of medical complaints
Overweight leads to a sharp increase in the relative risks of cardiovascular disease, cancer and diabetes (see e.g. Kouris Blazos et al., 2007; Kreijl and Knaap 2004, and Table 3.1).

Dietary treatment following the guideline that energy intake should be reduced by 600 kilocalories a day leads to a reduction in the number of people who develop diabetes (Brown et al. 2009). A relatively small weight loss of 5 per cent of body weight is further associated with a drop in blood pressure and in cholesterol level (Klein et al., 2004).

Dietary treatment can also prolong a patient's life by delaying or even preventing the onset of medical conditions. Take the case of patients with high blood pressure, for example: one of the recommendations a dietitian will make to such patients is to reduce the salt intake. The dietitian's

advice (ascertain the actual salt content of various types of food, monitor one's own salt intake and prepare low-salt meals) lead to an appreciable reduction in patients' mortality risk more than ten years after the treatment (Cook et al., 2007).[10] Diabetes patients who achieved weight-loss targets also reduced their mortality risk by 25 per cent up to ten years after they had lost weight (Poobalan et al., 2007).

Table 3.1 Overweight people aged 25-45 have a higher relative risk of contracting various diseases

	Normal weight (BMI < 25)		Moderate overweight (BMI 25-30)		Obese (BMI >30)	
	M	F	M	F	M	F
Heart attack	1.00	1.00	1.40	1.40	2.56	2.69
Other coronary heart disease	1.00	1.00	1.40	1.40	2.58	2.70
Stroke	1.00	1.00	1.13	1.14	1.42	1.44
Diabetes mellitus	1.00	1.00	2.60	3.06	8.98	12.38
Bowel cancer	1.00	1.00	1.15	1.15	1.33	1.33
Kidney cancer	1.00	1.00	1.36	1.36	1.84	1.84
Cervical cancer	1.00	1.00		1.59		2.52

Source: Kreijl and Knaap (2004).

3.2 Effectiveness of dietitians compared with other healthcare workers

Dietitians and other healthcare workers have different target groups

Specialist dietary treatment is not indicated for healthy people who are moderately overweight (BMI 25-30) and have no comorbidities such as diabetes or hypertension (PON, 2010; Zorgmodule voeding, 2012). After all, moderate overweight is not a disease. Nevertheless, a healthy diet is important for everyone, including this group. People who are moderately overweight can get advice from their GP, nurse practitioner or weight consultant, or join a self-help programme like Weight Watchers. There is thus a big difference between such clients of nurse practitioner or self-help groups (characterized by $25<BMI\leq30$ without risk factors and/or comorbidity) and people who need to consult dietitians (BMI>25 with risk factors and/or comorbidity).

GPs and nurse practitioners have neither the time nor the knowledge to give proper dietary treatment

In some cases, GPs or nurse practitioners will provide dietary counselling for overweight patients with one or more comorbidities. However, GPs do not really have enough time for proper dietary treatment and are not specialized in this form of care. When asked, GPs admit that lack of time and lack of nutritional knowledge make it difficult for them to give correct dietary advice (Nicholas et al., 2003). As a result, all that the GP can do is give general dietary advice. This can have a number of adverse effects; for example, there is a risk that the patient will not understand how the general dietary advice applies in his case. If for example the GP advises the patient to cut

[10] In this study, members of the intervention group received dietary treatment aimed at reducing salt intake for 18 months. The death rate in this group in the period from 12 to 17 years after the treatment was 25 per cent lower than in the control group (who only received folders containing dietary advice).

the amount of salt in his diet, the patient may replace the salt he used to add to the water when boiling potatoes with a stock cube, not realizing that the latter also contains appreciable amounts of salt.

Treatment by the dietitian leads to more weight loss and a greater reduction in cholesterol levels

Since dietitians are able to devote more time and attention to their patients and moreover have specialized knowledge of diet and behaviour in relation to sickness and health, it would seem reasonable to expect that treatment by a dietitian is more effective in improving health than dietary advice given by a GP. This expectation is confirmed by the results of a number of randomized controlled trials (see Table 3.2): overweight patients with one or more comorbidities lose more weight when treated by a dietitian (Delahanty et al., 2001; Willaing et al., 2004). Such treatment also leads to a greater reduction in blood cholesterol levels (Henkin et al., 2000; Thompson et al., 2009).

Weight Watchers are probably more effective than GPs, but less effective than dietitians

In a recent study published in the Lancet (Jebb et al., 2011), a group of overweight patients were given a standard treatment by a GP (one consultation a month). Another group of patients were allowed to attend a weekly meeting of Weight Watchers (WW) free of charge. Patients with a serious comorbidity such as insulin-dependent diabetes were excluded from this study, since they need treatment from a dietitian. The study showed that patients who attended the WW meetings lost twice as much weight on average than those who received advice from a GP.

Djuric et al. (2002) and Jen et al. (2004) compared treatment by a dietitian to attending weekly Weight Watchers meetings free of charge. Former breast cancer patients who were treated by a dietitian lost three times as much weight in 12 months. These authors further found that only a small proportion of the patients were disciplined enough to maintain attendance at the WW meetings: 73 per cent no longer attended the meetings after 6 months.

Table 3.2 More weight loss and greater reduction in cholesterol levels after treatment by a dietitian: evidence from randomized controlled trials

Author, year	Country	BMI	Comorbidity	Intervention	Results
Jebb et al., 2011	Australia, Germany, England (n=444)	27-35	Yes, but not serious	On average 2 or 3 visits to WW vs. 1 visit to GP (per month)	Weight -6.65 kg (WW) versus -3.26 kg (GP) after 12 months
Djuric et al., 2002. Jen et al., 2004	US (n=39)	30-44	Yes, (former) breast cancer patients	WW vs. telephonic consultation with dietitian once in 2 weeks + monthly group meetings	Weight -2.6 kg (WW) versus -8.0 kg (dietitian) after 12 months
Delahanty et al., 2001	US (n=90)	27 on average	Yes, high cholesterol (not on medication), and sometimes other comorbidity	GP vs. Dietitian 2-3 visits in first 3 months, repeated if necessary in second 3 months	Weight -0.0 kg (GP) versus -1.9 kg (dietitian) after 6 months. Cholesterol -2% (GP) vs. -6% (dietitian) after 6 months.
Willaing et al., 2004	Denmark (n=339)	33.2 on average	Yes, no exclusions on grounds of comorbidity	GP vs. dietitian repeated consultations for 12 months (30 min then 12 min GP, 60min then 30 min dietitian)	Weight -2.4 kg (GP) versus -4.5 kg (dietitian) after 12 months
Henkin et al., 2000	Israel (n=136)	27.5 on average	Yes, high cholesterol and no exclusions on grounds of any other comorbidity	GP vs. dietitian (2-4 consultations for 3 months)	Cholesterol -7% (GP) vs. -12% (dietitian) after 3 months. LDL cholesterol -5% (GP) vs. -9% (dietitian) after 3 months
Thompson et al.*, 2009	US and Canada, 4 RCTs	N/A (different studies)	Yes, high cholesterol and sometimes other comorbidity	GP vs. dietitian (variety of interventions)	Cholesterol level fell 4% more with dietitian

* This study is a systematic review of a number of investigations, including four random controlled trials (RCTs) comparing the effectiveness of treatment by GPs with treatment by dietitians.

4 Benefits of treatment by the dietitian

Dietary treatment of overweight patients with one or more comorbidities yields social benefits with a net worth of more than €1.9 billion over a five-year period in the Netherlands. Each €1 paid for treatment by a dietitian yields a net social return of from €14 to €63.

Better health has various benefits both for the patient and for the wider society. The patient will have a higher quality of life, allowing him to work more and harder. Production will increase, and fewer people will have to rely on benefit payments from the State. In addition, better health means less need for healthcare, for example because fewer patients will have to be admitted to hospital. As far as older patients are concerned, treatment by dietitians will reduce the need for care provided by relatives or friends and for other forms of care such as home help. These benefits will be quantified as far as possible in the present chapter.

4.1 Methodology

Costs and benefits presented in accordance with OEI guidelines

Social cost-benefit analysis (SCBA) gives an overall estimate of the costs and benefits of a given activity or project, seen both from the perspective of the individual stakeholders and from the perspective of society as a whole. The present cost-benefit analysis will follow the OEI guidelines (Eijgenraam et al. 2000). OEI (*Overzicht Effecten Infrastructuur* = Overview of Effects of Infrastructure) was developed by the CPB Netherlands Bureau for Economic Policy Analysis to provide a reliable basis for high-quality, comparable cost-benefit analyses in the Netherlands. One of the advantages of this methodology is that it avoids double counting of costs and benefits. It has become the methodology of choice for cost-benefit analysis in the Netherlands. Social cost-benefit analysis considers the costs and benefits applying to all stakeholders, and gives a picture of all relevant pros and cons of the activity in question (in the present case, treatment by dietitians) for all parties involved and not just for the patient.

One QALY is worth €100,000

The Quality Adjusted Life Year (QALY) is a widely used measure of both health and life expectancy. The quality of life is expressed as a number between 0 (death) and 1 (living for one year in perfect health). The use of QALYs has the advantage that it allows the effect of different treatments to be expressed in comparable units, thus facilitating comparison of their cost-effectiveness. Moreover, the QALY also implicitly includes benefits which are difficult to quantify, such as happiness or independence in the equation. The current social cost-benefit analysis follows the Netherlands National Institute for Public Health and the Environment (RIVM) and CPB by assuming a QALY to be worth €100,000 (see Box 1).

Box 1 A QALY is worth about €100,000

Hirth et al. (2000) carried out a literature study to determine the value of a QALY. They found values ranging from USD 24,777 to USD 428,286 (based on 1997 values of the US Dollar). It was concluded in a report by RIVM, with reference to this study by Hirth et al., that health has an independent economic value of at least €100,000 per QALY, without taking the contribution of increased production to the economy into account (De Hollander et al. 2006). CPB also used the value of €100,000 per QALY in a study of the costs and benefits of a smoking ban (Spreen and Mot, 2008).

Time horizon: costs and benefits calculated over five years

An important aspect of any cost-benefit analysis is the choice of time horizon (the number of years for which the costs and benefits in question are considered). Treatment by a dietitian does not just improve the patient's health during the treatment: it has been reported that weight loss and lower blood glucose levels are still found up to five years after the start of the treatment (Avenell et al. 2004a,b; Brown 2009). The costs and benefits of the treatment are therefore determined over a period of five years. That does not mean that the benefits of dietary treatment have completely disappeared after five years: even temporary weight loss can lead to a lasting reduction in the risk of medical complaints. Overweight-related medical conditions are often the result of years of unhealthy living. Even temporary improvements in lifestyle can help to prevent the onset and progression of disease.

4.2 The treatment considered in this study

The calculations of the costs and benefits of treatment by a dietitian given here are mainly based on the benefits of dietary treatment reported in the ICAN study (Wolf et al. 2004; 2007; 2009). In this study, 127 overweight patients (BMI ≥27) were randomly assigned to an intervention group and a control group. Many of the patients in this study also had a comorbidity such as elevated cholesterol level and/or hypertension (76 per cent of the participants used antihypertensive medication, Wolf et al. 2004).

Box 2 Reasons for using data from the ICAN study for this cost-benefit analysis

The target group in the ICAN study consists of overweight patients with diabetes. Some of these patients also had high blood cholesterol levels and/or high blood pressure. This group bears a close resemblance to the target group subjected to a cost-benefit analysis in the present report, namely overweight patients with one or more comorbidities from the list comprising diabetes, hypertension, hyperlipidaemia and hypercholesterolaemia.

A systematic review has shown that there is no systematic relationship between the type of comorbidity affecting overweight patients and the weight loss they achieve after treatment by a dietitian (Brown, 2009). There is thus no reason to assume that the effectiveness of dietary treatment is any different for patients who do not have diabetes but do have hypertension, hyperlipidaemia and/or hypercholesterolaemia. When calculating the overall costs and benefits, therefore, we also assigned the benefits calculated from the ICAN study to patients treated by a dietitian who had hypertension and/or hypercholesterolaemia (but not diabetes).

Another reason for using the results of the ICAN study in the present calculations is that these results permit the quantification of a very wide range of outcomes – not just medical effects like weight loss but also quality of life, reduced use of medication and reduced absence from work.

Total treatment time in first year 8.5 hours, no treatment in subsequent years

The cost-benefit analysis refers to an intensive course of treatment: the intervention group in the ICAN study was treated for a year by a dietitian, while the control group only received written information about a healthy diet and the benefits of exercise. The dietitian devoted about 8.5 hours to each patient during the first year. The breakdown of the treatment is shown in Table

4.1. Each patient had six individual sessions with the dietitian, giving a total time of four hours. Administration and preparation took slightly more than half an hour per patient. The dietitian also phoned each patient once a month to discuss progress and any problems encountered. The total time for these phone calls was three hours per patient (Wolf et al. 2007). In addition, patients attended six one-hour group sessions. At least ten patients took part in each group session. The hour spent on each group session + half an hour for administration and preparation comes to 90 minutes, or 9 minutes per patient.

The patients received no follow-up after the 8.5 hours of treatment in the first year. Nevertheless, the patients in the ICAN study did get more intensive treatment than the average overweight patient receives from a dietitian in the Netherlands. It has been calculated on the basis of data from the National Information Facility for Paramedical Care (LiPZ) accessed via the Netherlands Institute for Healthcare Research (NIVEL) that overweight patients in the Netherlands who completed their treatment in 2010 were treated for an average of 4.5 hours. Like in the ICAN trial, diabetes patients in the Netherlands do also receive both individual treatment and group treatment. It follows that the ICAN study shows what benefits can accrue to overweight patients with comorbidity who are receiving more intensive dietary treatment than is currently available from a Dutch dietitian.

Various systematic reviews conclude that increasing the number of sessions of treatment by a dietitian leads to greater weight loss (Dansiger et al., 2007; Finkler et al., 2012). It was shown in a randomized study by Herbert et al. (1999) that a weight loss of 0.41 kg was achieved without any visits to the dietitian (0 sessions), and that the weight loss rose to 1.71 kg after one or two sessions and 3.94 kg after three to four sessions. There thus seems to be a linear relationship between the weight loss and the number of visits to the dietitian. Similarly, the drop in cholesterol level is about doubled if the patient visits the dietitian twice as often (Sikand et al., 1998 in a randomized trial). It is therefore assumed that the benefits calculated on the basis of 8.5 hours of treatment are roughly double those obtained with the current treatment that only lasts 4.5 hours on average. The calculation of overall benefits given in section 4.4 is based on the current average treatment time of 4.5 hours for overweight patients. First, however, the benefits of more intensive treatment are presented in section 4.3.

Table 4.1 Breakdown of intensive dietary treatment of overweight patients with comorbidity

	Time in minutes (1)	Time in hours (2)
Individual sessions		
Treatment time	240	4
Time spent on admin., preparation etc.	33	0.55
Phone calls to check up on progress	180	3
Group sessions		
Treatment time	36	0.60
Time spent on admin., preparation etc.	18	0.30
Total	**507**	**8.45**

Source: Wolf et al. 2007. Because the group sessions (six sessions of one hour each) are followed by at least ten patients, the treatment time per patient in these sessions does not exceed six minutes per session or 36 minutes in all.

4.3 Breakdown of costs and benefits

Price and costs of dietary counselling

A dietitian in the Netherlands receives a fee of €58 per hour on average (www.zorgcijfersdata.cvz.nl). An intensive course of treatment lasting 8.45 hours spread over a year would thus cost 8.45 * €58 = €490. In the ICAN study, the costs of the dietary treatment were paid for out of the research funds. In the present calculation, however, it is assumed that the breakdown of the treatment costs reflects the Dutch situation.

Dutch insurers will reimburse the costs of a maximum of three hours of dietary counselling per annum with effect from 1 January 2013. That means that patients who start their treatment on 1 January will have three hours of treatment reimbursed that year. If however they start their treatment on 1 July, they could have three hours of treatment reimbursed in that calendar year and another three hours in the next calendar year. If it is assumed that the date on which patients start treatment is uniformly distributed throughout the year, on average patients will be reimbursed for four and a half hours of treatment, representing a total cost of 4.5 * €58 = €260. The other €230 of the total costs of the assumed intensive course of treatment will be paid by the patient himself or covered by supplementary medical insurance.[11]

Higher quality of life

An overweight patient with comorbidity will get a variety of benefits from treatment by a dietitian. On average, patients lose 4 to 6 kg more weight and 4.2 cm off their waist circumference after 12 months of treatment by a dietitian (Avenell et al., 2004a,b; Franz et al. 2007; Dansiger et al. 2007; Wolf et al. 2004).[12] These results lead to improved vitality and health, and hence a better quality of life, for the patient. Patients who were treated by a dietitian state that they perform better physically and socially after 12 months of treatment than the group of patients who only received written information. They were also in less pain, and their mental health was better. This translates into a health gain of €5,900 in the first year, according to the calculations given in Appendix B.

Little is known about the long-term effects of dietary counselling on the quality of life. However, a number of systematic reviews report that *weight loss* achieved after dietary treatment is retained for some time. The controlled dietary treatment in these studies had a maximum duration of one year.[13] Three years after the start of the treatment, patients will have regained about half the

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11 The costs of dietary counselling in the ICAN study were paid for by research funding. The patient themselves had nothing to pay. If it may be assumed that patients are more highly motivated if they have to pay for part of the treatment themselves, the overall effect of dietary counselling will be underestimated if the estimate of the effect is based on the results of the ICAN study.

12 Overweight patients treated by a Dutch dietitian lose on average 1.3 BMI points by the end of the treatment (Tol et al., 2011a). This corresponds to an average weight loss of 4.0 kg (assuming that all patients have the average heights for Dutch men and women; CBS 2012b). These results are based on measurements before and after the treatment, without correction for the patient's motivation to lose weight. It is difficult to estimate the actual weight loss in kg that can be ascribed to the effect of dietary counselling on the basis of the Dutch data.

13 Since the controlled environment in these studies only lasted for a year, for example, it is uncertain whether the effect of the intervention can still be measured three years later. However, the intervention and control groups can decide whether or not to stay in contact with the dietitian after the treatment has ended. Svetkey et al. (2008) showed in a randomized, controlled trial that patients who did continue to

weight they had lost (Avenell et al. 2004a,b; Dansiger et al. 2007; Franz et al. 2007), and by five years they will have more or less returned to their old weight (Avenell et al. 2004a,b). It is assumed that the patients' quality of life deteriorates when they put on weight. Weight loss is related to a drop in blood pressure (Aucott et al. 2005), cholesterol level (Poobalan et al. 2004) and blood glucose level (Gallardo et al. 2010). Weight loss also leads to an improved quality of life (Hakim et al. 2002). It may reasonably be assumed that gaining weight will have the opposite effect. The calculations given in Appendix B show that the overall health gain over five years amounts to €27,270.

Family members and others in the immediate vicinity of the patient such as friends will also experience an improved quality of life (because the person they care about is healthier). In addition, the whole family will often also benefit if one member of the family improves his or her eating habits. Not just because the meals put on the table are healthier, but also for example because the dietitian may give dietary advice for infants to patients with diabetes of pregnancy. However, no data that could be used as a basis for estimating the improvement in the quality of life of family members could be found in the literature. The fact that benefits may also accrue to relatives is therefore included as a reminder (pro memory or PM) in the cost-benefit analysis.

Savings on other care costs

Use of medication

A healthy diet is not the only way of combating high blood sugar, cholesterol or blood pressure. Many diabetes patients receive benefit from the hypoglycaemic drug metformin; about 88 per cent of diabetes patients in the Netherlands use this medication (Stichting Farmaceutische Kengetallen, 2011). If hypoglycaemic drugs do not have the desired effect, these patients are given insulin (once a day initially; this may be later increased to 2 – 4 times a day if necessary). A very large majority (90 per cent) of the patients in the ICAN study were also taking metformin at the start of the dietary treatment, while 33 per cent were given insulin. A year after the start of the treatment, the average amount of hypoglycaemic medication taken by the patients had fallen by 0.46 doses a day. In addition to hypoglycaemic medication, the patients in this trial were often also taking medication for high cholesterol level or high blood pressure. The daily number of doses of all medication taken was found to fall by 0.60 after treatment by a dietitian. Since it is not known which medicines are used less after treatment by the dietitian, it is assumed that the drug in question is the relatively inexpensive metformin.[14] This means that the savings of €10 on use of medication in the first year given in Table 4.2 are probably underestimated.

Hospital admissions

The largest saving in care costs is however represented by the fact that patients treated by a dietitian are admitted to hospital less often: in fact, these patients were not admitted to hospital at all on average during the year when they were treated by the dietitian, as compared with one day of hospital admission on average for the control group. On the other hand, patients treated by the dietitian visited the A & E department 0.25 days more on average.

visit the dietitian regularly after an intensive course of treatment still had more weight loss three years later than patients whose follow-up consisted only of written information (folders) or online information.

[14] A year's supply of insulin costs €270, while a year's supply of statin taken daily to control the blood cholesterol level costs €9.

Table 4.2 shows total savings of at least €460 on other direct medical costs during the year of intensive treatment. The savings peak in the second year, at €770, and then decline gradually. The calculations given in Appendix B show cumulative savings of €2,140 over a five-year period. The treatment costs of €490 are thus more than recouped from the savings on direct medical costs.

Other care costs

Other care costs such as visits to GPs and telephone consultations with the doctor were not investigated and hence cannot be quantified. It is likely, however, that patients who were treated by a dietitian generally feel healthier, and so visit the GP less often. In addition, older patients will need less care from relatives and friends and will have less need of other forms of care such as home help as a result of the treatment. The estimate of the total savings on care costs given here is thus probably an underestimate.

When patients are treated by a dietitian, healthcare insurers will have fewer extra care costs to reimburse. The net savings on health care costs represents a benefit for the insurance companies.

Table 4.2 Savings on medical costs amount to €462 during the year of treatment

	Costs per unit*	Number of units less per annum	Benefits per annum
	(1)	(2)	(1)x(2)
Costs of medication			
Lower medication costs	€15	0.60	€10
Other direct medical costs			
Day in hospital	€486	1.01	€490
A & E	€151	- 0.25	- €40
Total			**€460**

* The costs of medication are calculated per annum, on the basis of the average recommended doses. Since no information is available on which medication is used less, it is assumed that this is the relatively inexpensive metformin. The cost of one day in hospital is taken as the weighted mean price for a day in a general hospital and a teaching hospital, the shares in the total number of beds in each hospital being taken as the weights (Hakkaart-van Roijen et al. 2010; Deuning, 2006). Total benefits are €460, the figures in the table are rounded.

Lower healthcare insurance premium

In an efficient healthcare insurance market, the insurance companies do not make large profits. The treatment costs are covered by the insurance premium. If the costs of care fall, the premium will fall correspondingly. The difference in total care costs between the patient group treated by the dietitian and that without such treatment is passed on in the healthcare insurance premium. The insurance company simply acts so as to balance the equation: its total profits are equal to its operating costs. In other words, the net benefit for the healthcare insurance company is always 0. An increase (decrease) in the insurance premium thus represents a debit (credit) for society. On the basis of the figures given above, the difference in overall care costs is €2,140 - €490 = €1,650. Since the patient pays for a part (€230,-) of the treatment himself, the treatment by the dietitian leads to a *reduction in the healthcare insurance premium* of €1,650 + €230 = €1,880. This saving is spread out over all healthcare premium payers in the Netherlands.

Lower absenteeism and higher production

The improved health of patients during and after treatment by a dietitian leads to an increase in productivity at work. The drop in sick leave taken by existing workers is not the only factor of importance here. The number of patients able to work may also be expected to rise, those who are already in work can work longer hours, and the productivity during working hours will increase. The drop in sick leave taken by existing workers is the only one of these factors to have been studied in a randomized controlled trial (Wolf et al. 2009). Participants in the study answered the following question before, during and after treatment by the dietitian: "How many days have you taken off work during the past four months due to sickness related to your weight or diabetes?". Patients treated by a dietitian took an average of 0.92 days of sick leave related to their condition during the treatment year, while those who only received written information took an average of 3.49 days. That is a difference of 2.58 working days in a year.

The loss of production has been estimated to be worth €30 per hour on average (Hakkaart-van Roijen et al. 2010). This comes to 8 * €30 = €240 per day for an 8-hour working day. The annual production gain for each patient treated by a dietitian in the above-mentioned study is thus 2.58 * €240 = €620 in the first year. The total production gain over five years is €2,860 for a working patient. However, not all adult patients treated by the dietitian work. Calculations given in Appendix B show that the average production gain taking this fact into account is €1,720.

4.4 Total costs and benefits

Costs and benefits of 8.5-hour intensive treatment by a dietitian

Table 4.3 gives an overview of the costs and overall social benefits of *intensive* treatment of an overweight patient with comorbidity by a dietitian. It will be seen that the treatment is very cost-effective. The costs of the intensive treatment are €490. The net benefits (total benefits - costs) of the treatment over a five-year period are €30,640. The total benefits of the intensive treatment by the dietitian are thus €490 + €30,640 = €31,130. This represents a net yield of about 30,640/490 = 6,300 per cent: each €1 spent on the treatment yields a net gain of €63 over the five-year period considered. The benefits peak in the second year, since the health gain due to the treatment is still rising in the treatment year. After the treatment (at the start of the second year), the maximum health gain has already been achieved.

Table 4.3 Benefits (+) and costs (-) of **intensive** (8.5 hour) treatment of overweight patients with comorbidity by a dietitian (in euros)

		Patient	Family	Dietitian	Healthcare insurer	Employer	Premium payer	Total
1	Costs of dietary treatment			-490				-490
2	Price of dietary treatment	-230		490	-260			0
3	Quality of life	27,270	PM					27,270+PM
4	Other care costs				2,140+PM			2,140+PM
5	Healthcare insurance premium				-1,880		1,880	0
6	Production					1,720		1,720
	Total	**27,040**	**PM**	**0**	**0**	**1,720**	**1,880**	**30,640+PM**

Source: SEO Economic Research PM = included as a reminder; no accurate estimate of this effect can be made at present

Costs and benefits of current (4.5 hour) treatment by a dietitian

The benefits of the dietary counselling currently offered in the Netherlands are lower than those shown above, in line with the fact that the average treatment time for an overweight patient is 4.5 hours instead of 8.45 hours. Since the weight loss and the drop in cholesterol level increase linearly with the number of visits to the dietitian (Dansiger et al., 2007; Finkler et al., 2012; Herbert et al., 1999; Sikand et al., 1998), it is assumed that the benefits of the current treatment are 8.45/4.5 = 53 per cent of the benefits of the more intensive treatment. Table 4.4 gives an overview of the costs and overall social benefits of the *current* treatment of an overweight patient with comorbidity by a dietitian. The treatment costs are €260 (4.5 * €58). It is assumed that these costs are spread over two calendar years, so that they are completely covered by the healthcare insurer. The net benefits (total benefits - costs) of the treatment over a five-year period are €16,310. The total benefits of the intensive treatment by the dietitian are thus 260 + €16,310 = €16,570. This still represents a net yield of 6,300 per cent: each €1,- spent on the treatment yields a net gain of €63 over the five-year period considered.

Table 4.4 Benefits (+) and costs (-) of **current** (4.5 hour) treatment of overweight patients with comorbidity by a dietitian (in euros)

		Patient	Family	Dietitian	Healthcare insurer	Employer	Premium payer	Total
1	Costs of dietary treatment			-260				-260
2	Price of dietary treatment			260	-260			0
3	Quality of life	14,520	PM					14,520+PM
4	Other care costs				1,140+PM			1,140+PM
5	Healthcare insurance premium				-880		880	0
6	Production					910		910
	Total	**14,520**	**PM**			**910**	**880**	**16,310+PM**

PM = included as a reminder; no accurate estimate of this effect can be made at present

It is striking that none of the parties involved loses out as a result of the treatment provided by the dietitian. This treatment differs in that respect from most treatments in the healthcare sector, where the premium payer has to bear the costs of the more expensive interventions. That is not the case here, since the savings on the care costs exceed the costs of the dietary treatment.

The major part of the overall benefits accrues to the patient in the form of improved health. The patient's family will also experience benefits, both because they will tend to share the patient's healthier lifestyle and because they are happier when a dear one is in better health. The employer benefits from the fact that his employee is more productive, and all individuals who pay insurance premium will benefit from a lowering of the healthcare insurance premium.

Total benefits of dietary treatment of overweight patients with comorbidity in the Netherlands amount to €1.9 billion

About 360,000 people consult a dietitian annually in the Netherlands.[15] This figure includes about 262,000 overweight or obese patients (72.8 per cent of 360,000; see Table 2.1). Nearly 45 per cent of the overweight patients have one or more comorbidities (diabetes mellitus, hypertension and/or hypercholesterolaemia); see Table 2.2. This group thus contains 116,061 patients. Since the net benefit per patient is €16,310, it follows that the total benefits for the country as a whole are 116,061 * €16,310 = €1.9 billion.

Sensitivity analysis: value of a QALY

The health gain for patients is the main reason for the huge yield on dietary treatment. One quality adjusted life year (QALY) is taken in this study to have a value of €100,000, on the basis of studies by RIVM and CPB (De Hollander et al. 2006; Spreen and Mot 2008). The real value of a QALY is difficult to determine. Even if a QALY were only worth €50,000 the treatment currently offered by Dutch dietitians would still produce benefits of €9,050, corresponding to a yield of 3,500 per cent. The total benefits for the country as a whole would then amount to nearly €1.1 billion on this assumption.

Sensitivity analysis: health gain due to weight loss

The health gain experienced by patients after treatment by a dietitian can have a variety of causes: the contact with the dietitian in itself, the weight loss achieved, the improvement in health due to a lower cholesterol level and/or lower blood pressure, less fatigue, less pain, improved social functioning (for example because the patient has more energy) etc. Hakim et al. (2001) have calculated that the quality of life of overweight patients who also suffer from hypertension, hyperlipidaemia and/or high blood glucose increases more when they lose more weight. They estimated with the aid of regression analysis that weight loss corresponding to one BMI point (about 3 kg) yields a health gain of 0.015 QALY or €1,500.

If only the health gain resulting from weight loss is taken into consideration, intensive treatment by a dietitian yields a health gain of €3,470 over a five-year period while the dietary treatment currently offered in the Netherlands yields a health gain of €1,850 over the same period. The lower limit for the net benefits from the treatment currently offered by Dutch dietitians is then

[15] Judgement of the District Court of The Hague, case No. 413984. Decision in the summary proceedings of 20 March 2012 brought by the Dutch Association of Dietitians (NVD) and the Dutch Federation of Cancer Patients (NFK) against the State of the Netherlands.

€3,640, corresponding to a yield of 1400 per cent. Expenditure of €1 on dietary counselling will thus produce at least €14. This gives a calculated lower limit for the total benefits for the country as a whole of more than €0.4 billion.

5 Conclusions and recommendations

Dietary management should remain part of the basic care package

Treatment of overweight patients with associated comorbidities by a dietitian is highly cost-effective. The major benefit of treatment is the improvement in health experienced by the patient. However, since dietary management was removed from the basic care package in 2012, the number of patients receiving primary treatment from dietitians fell by 28 percent. Moreover, the patients who do continue to receive treatment receive fewer hours of intervention, and on average dietitians were providing 39 percent fewer hours of care in the first quarter of 2012 than in the first quarter of 2011 (Tol et al., 2012b). The fact that patients are required to fund their own care clearly presents a barrier to treatment. Discussion with dietitians makes it clear that at the start of treatment, patients do not yet appreciate the benefits of dietary advice. For example, they believe that symptoms such as fatigue, sleep disturbance and low energy levels cannot be affected by dietary changes. It is only at the end of the course of treatment that patients are able to put the benefits they have gained from dietary treatment into words. This means that at the onset of treatment, some patients are not yet prepared to pay, even though they would benefit from it.

An additional problem is that many people place too much value on present circumstances and are risk-averse: the uncertain future benefits of dietary intervention do not outweigh the costs of treatment at the moment they need to pay for it. The choices of these potential patients are dynamically inconsistent: they decide not to consult the dietitian, even though they know they will benefit from dietary treatment in the future. This is an important reason for keeping dietary management in the basic healthcare insurance package.

Incentives for healthcare insurers to include supplementary insurance in the package

When a maximum of three hours of dietary management per patient is provided in the basic healthcare insurance package, it still makes sense for insurers to enable a greater number of treatment hours through supplementary insurance cover. Three arguments may be given in support of this idea:

- 35 percent of patients seen by dietitians receive more than three hours of treatment per calendar year (data for 2010).
- Dietary management for overweight patients with additional comorbidities (diabetes, high blood pressure, hyperlipidaemia and/or hypercholesterolaemia) generates net savings: every €1 invested in dietitian-led management saves €4 within five years on further care costs (hospital visits and medications).
- More intensive treatment provided by dietitians is more beneficial than less intensive treatment. Increasing the number of consultations per patient allows greater weight loss, as well as greater improvements in blood cholesterol levels and blood glucose, to be achieved.

Dietitians offer the best diet-related treatment for patients with one or more medical conditions

Dietary management provided by GPs is not a good alternative to dietitian-led management: general practitioners themselves admit that they lack the time and knowledge to provide patients with effective dietary advice. Furthermore, various studies have shown that treatment by a dietitian is more effective in terms of weight loss and improved cholesterol level than treatment

provided by GPs. Advice from nutritional consultants or participation in a self-help group such as Weight Watchers only provides a valid alternative for people with moderate weight problems and no additional risk factors or comorbidities such as hypertension, hypercholesterolaemia or diabetes.

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Appendix A Scientific literature

Table A.2 below gives an overview of the available scientific literature on the effects of treatment by a dietitian on overweight patients with comorbidity (type 2 diabetes mellitus, hyperlipidaemia/hypercholesterolaemia and/or hypertension). The table gives the first author of each article and the year of publication, together with the target group, details of the intervention studied, the country where the treatment was given and the main effects of the treatment. The table also gives an indication of the quality level of the publication. The various possible levels are described in Table A.1. The articles are as far as possible of the highest level, which corresponds to a randomized double-blind controlled trials or a review of randomized double-blind controlled trials.

Table A.1 The quality of the publications cited in Table A.2 is classified by level (A1 to D)

Level	Description
A1	Review of at least two independent trials at level A2
A2	Randomized double-blind controlled trial of sufficient scope
B	Comparative trial (for example cohort trial)
C	Non-comparative trial
D	Expert opinion

Table A.2 Effectiveness of dietary treatment of overweight patients with comorbidity (hypercholesterolaemia/hyperlipidaemia, hypertension and/or type 2 diabetes)

Author, year	Country	Quality of study	Target group	Treatment	Outcomes measured	Effects
Avenell et al. 2004a,b	Various	A1 (12 RCTs)	Overweight adults, possibly with comorbidity; average BMI 27.9-34.0	Energy-restricted diet (-600 kcal/day) or low-fat diet	Weight loss, cholesterol, triglyceride, blood pressure, blood glucose	**Weight loss** -5.3 kg after 12 months (-2.35 -3.55 -0.20 after 24 36 60 months). **Total cholesterol** -0.21 mmol **LDL cholesterol** -0.13 mmol **HDL cholesterol** +0.06 mmol **Triglyceride** -0.19 mmol **Diastolic pressure** -3.44 mm Hg (12 mth) and -1.80 (36 mth) **Systolic pressure** -3.78 mm Hg (12 mth) and -2.31 (36 mth) **Blood glucose (fasting)** -0.24 (12) -0.22 (24) -0.13 (36) -0.27 (60)
Foster-Schubert et al. 2011 N=118 diet, N=87 control	US	A2	Overweight women (average age 58), average BMI 30.9	1200/2000 kcal per day (average 1637), <30% kcal from fat, both individual and group sessions	Weight loss, waist circumference, body fat	**Weight loss** -8.5% after 12 months **Waist circumference** -4.7% **Body fat** – 8.9%
Brown et al. 2009	Various	A1 (5 RCTs)	Overweight adults (sometimes with comorbidity) BMI<35	Energy-restricted diet (-600 kcal/day) or low-fat diet	Weight loss, prevalence of diabetes	**Weight loss** not significant (12.24) -3.5kg after 36 months **Diabetes** after 3 years 55% in control group, 39.3% in diet group
Dansiger et al. 2007	Various	A1 (46 RCTs)	Overweight adults (sometimes with comorbidity)	Various dietary treatments	Weight loss	**Weight loss** -1.9 BMI points (about 6 kg) after 12 months. Half of weight loss reversed after 36 months.
Franz et al. 2007	Various	A1 (21 RCTs)	Overweight adults (sometimes with comorbidity)	Various dietary treatments aimed at achieving weight loss	Weight loss	**Weight loss** with diet -4 kg after 12 months, -2 kg after 36 months

6 7	Imayama et al. 2011 N=118 diet, N=87 controls	US	A2	Overweight women (average age 58), average BMI 30.9	1,200/2,000 kcal per day (average 1637), <30% kcal from fat, both individual and group sessions	Health-related quality of life scores	**Physical performance, vitality and mental health s**ignificantly improved.
Aucott et al. 2005		Various	A1 (7 studies, 5 RCTs)	Overweight adults	Diet, supplemented by medication in some studies	Relationship between weight loss and hypertension	Short-term effects (6 months): 1kg weight loss;**-1 mm Hg lower blood pressure** Long-term effects (from 2 years) 1kg weight loss; **-0.5 mm Hg lower diastolic pressure, -0.6mm Hg lower systolic pressure**
Poobalan et al. 2004		Various	A1 (13 studies, 5 RCTs)	Overweight adults aged 18-70, BMI>28	Various treatments aimed at achieving weight loss	Relationship between weight loss and cholesterol and triglyceride levels	Long-term effects (from 2 years): **1 kg weight loss** with **-0.032 mmol cholesterol and weight loss 1 kg with-0.020 triglyceride**
Poobalan et al. 2007		Various	A1/B (11 cohort studies)	Overweight adults aged 18-70, BMI>25	No explicit treatment, cohort studies	Relationship between weight loss and mortality rate	Mortality rate of diabetics with desired weight loss **mortality rate = factor 0.75 lower than mortality rate without weight loss** over (roughly) 10-year period
Gross 2006		Australia					**Obese people** take on average **3.38 more days sick leave** per year than non-obese people. Obese people (aged 45-64) have 8% **lower chance of employment** and 20% lower **chance of full-time employment.**
Siebenhofer et al., 2011		Various	A1 (30 studies, 8 RCTs)	Adults with hypertension	Dietary treatment aimed at achieving weight loss	Blood pressure (systolic and diastolic	**Systolic pressure -4.5 mm Hg** **Diastolic pressure -3.2 mm Hg**
Delahanty et al. 2001 N=90		US	A2	Adults aged 21-65 with hypercholesterolaemia (no medication)	Cholesterol-reducing diet managed by dietitian vs. managed by doctor. 2-3 visits in 3 months, followed by a further 2-3 visits in 3 months if desired reduction in cholesterol not achieved.	Cholesterol and weight loss, including cost-effectiveness	**Cholesterol** -6% =-0.42 mmol (vs. -2%) after 6 months **Cost-effectiveness** $36 per 1% reduction in cholesterol level **Weight loss** -1.9kg (vs. 0 kg) after 6 months **Higher 'life satisfaction'** **Activity** +41 min per week after 3 months
Sikand et al. 1998 N=74		US		Adults aged 32-75 with hypercholesterolaemia (no medication)	Dietitian-led diet for 8 weeks, 2-4 sessions (average 144 minutes total) before start of cholesterol-reducing medication. Further 2 visits (50	Cholesterol level and delay in starting medication, including cost-effectiveness	**Cholesterol** -13% **LDL cholesterol** -15% (-12.1% with 2 visits, -21.9% with 4 visits) **HDL cholesterol** -4% **Total/HDL cholesterol** -9.4%

				min.) in rest of year if medication no longer needed.		**Delay in use of cholesterol-reducing medication** in 34 out of 67 patients (51%) **$1 spent on dietary counselling saves $4,28 in medication + doctor's visits**
McGehee et al. 1995 N=285	US	C	Adults aged 20-80 with hypercholesterolaemia (no medication)	At least 2 dietitian-led sessions over 4 years (average 134 minutes)	Cholesterol	**Cholesterol** -8.6%. Reduction 6% for subjects who spent <90 min. with dietitian, 12% for subjects with >160 min. of dietary counselling
Sikand et al. 2000 N=43	US	A2	Adult males aged 21-75 with hyperlipidaemia (cholesterol 6.2 mmol or higher, triglyceride 1.7 - 9.0 mmol)	Dietary counselling for average of 169 min in 8 weeks. Further 4 visits during rest of year for patients who did not need to take statins.	Cholesterol, triglyceride and BMI, including cost-effectiveness.	**Cholesterol** -11% **LDL cholesterol -**9% **Triglyceride** -22% **BMI** -2% 15 of the 30 patients did not need statins **for at least 1 year** $1 spent on dietary counselling saves $3.58 in costs of statin therapy (1996 dollars)
Herbert et al. 1999 N=645	US	B	Adults aged 20-65 with hyperlipidaemia (no medication)	Dietary counselling for 6 weeks: 1 individual session, 2 group sessions, 1 individual session. No randomization: dietary counselling if LDL cholesterol at 90th percentile or higher.	LDL cholesterol, weight loss after 1 year	**Weight loss** greatest with 3 or 4 sessions vs. < 3 sessions vs. no sessions (-3.9 4kg; -1.71 kg; -0.41 kg) **Cholesterol reduction** greatest with 3 or 4 sessions vs. < 3 sessions vs. no sessions (-0.40 mmol; -0.12 mmol; 0.01 mmol) **LDL cholesterol reduction** greatest with 3 or 4 sessions vs. < 3 sessions vs. no sessions (-0.45 mmol; -0.10 mmol; -0.02 mmol)
Gallardo et al. 2011	Various	A1 (20 RCTs)	Adults aged 20-82 with DM2	Various treatments aimed at achieving weight loss	Relationship between weight loss, blood glucose, blood cholesterol, blood pressure and use of hypoglycaemic medication	Evidence is mixed. Some studies (20%-50%) find that weight loss leads to lower **blood glucose, blood cholesterol, blood pressure and use of hypoglycaemic medication.** Other studies find no significant effect.
Sheils et al. 1998 N=12.308	US	B	Adults aged 55+ with diabetes, among others	Dietary counselling by dietitian	Avoidance of other care costs (over a 6-year period)	**Hospital admissions** -9.5% (-0.017 admissions per quarter) **Consultations with doctor** -23.5% (-0.65 consultations per quarter)
Wolf et al. 2007 N=144 (N=72	US	A2	Adults aged 20+ with DM2 controlled by medication,	Individual dietary counselling (4 hours), group sessions (6	Take-up of care and care costs during 1 year	**Hospital admissions** 2 for intervention group (average 1 day per admission), 16 for control group (average 4.7

intervention group, N=72 control group)			BMI>27	hours) and short monthly phone call from dietitian to check on progress and discuss problems for 1 year + written information vs. written information only; weight measured quarterly	treatment period	days per admission) **Use of medication** -0.9 DD for intervention group, -0.3DD for control group
Coppell et al. 2010 N=93	New Zealand	A2	Adults aged <70 with DM2 +comorbidity (hypertension, dyslipidaemia) and optimized drug treatment	Intensive dietary counselling (with dietary advice based on guidelines of the European Association for the Study of Diabetes). Two individual sessions in first month, then 1 session per month for next 5 months.	Glycated haemoglobin (HbA1c), blood pressure, cholesterol and weight loss after 6 months	**HbA1c** -0.4% **Weight loss** -1.3 kg **Waist circumference** -1.6 cm **Reduction in use of hypoglycaemic medication** 9% in intervention group raised dose vs. 29% in control group. 13% in intervention group reduced dose vs. 4% in control group. 29% of patients on insulin in intervention group had insulin dose decreased by up to 81 units.
Franz et al. 1995 N=179	US	A2	Adults aged 38- 76 with diabetes, not on insulin	Dietary counselling in accordance with guidelines (3 sessions, 151 min.) vs. basic dietary counselling (one 65-min. session) from dietitian for 6 months	Blood glucose, savings on use of medication	**Blood glucose** -1.1 mmol/l vs. -0.4 mmol/l after 6 months **Savings on use of medication** greater in intervention group, thanks to less use of hypoglycaemic medication

Appendix B Cost-benefit analysis calculations

B.1 Quality of life

The ICAN study (Wolf et al. 2004) used the Short Form (SF-36) Health Survey to measure quality of life. This survey contains 36 questions on various aspects of health, such as health in general, the extent to which the state of health limits day-to-day activities, days on which the respondent is hampered in his work by emotional problems, how much pain the respondent has had during the past four weeks and the extent to which pain has limited his activities, the respondent's energy level, whether he suffers from fatigue etc. The answers can be grouped to yield scores in eight dimensions including physical functioning, social functioning and pain (see Table B.1). It is assumed that any costs incurred by the patient due to a change in lifestyle may be derived from the scores for Mental Health and Vitality, which were based on the answers to questions such as "did you feel calm and contented", "did you feel miserable and depressed" and "were you happy".

Nichol et al. (2001) investigated the relationship between the SF-36 scores and QALYs. Using the coefficients that they calculate, the increase in quality of life determined with the aid of the SF-36 survey can be converted into QALYs. The increase in the quality of life after 12 months of dietary treatment is €11,800, on the assumption that 1 QALY is worth €100,000. On the further assumption that the quality of life increased linearly with time during the 12-month treatment period, this means that the average health gain in the first year is worth €5,900.

Table B.1. Increase in quality of life after 12 months of treatment by dietitian valued at €11,800

SF-36 category	Increase in quality of life (SF-36) (1)	Conversion factor SF-36 to QALY (2)	Increase in quality of life (QALY) (1)*(2)	Value of increase in quality of life
Role Limitation Emotional	15	0.0015	0.023	€2,300
Role Limitation Physical	13	0.00046	0.006	€600
Physical Functioning	9	0.0018	0.016	€1,600
Vitality	9	0.0018	0.016	€1,600
Social Functioning	8	0.0015	0.012	€1,200
Bodily Pain	7	0.0043	0.030	€3,000
Mental Health	3	0.0042	0.013	€1,300
General Health	2	0.0009	0.002	€200
Total			**0.118**	**€11,800**

Source: Wolf et al. (2004), Nichol et al. (2001). Calculation by SEO Economic Research

It is assumed that half of this health gain is retained after three years, but that no health gain is left after five years. It is further assumed that the quality of life falls off linearly between year 1 and year 3, and between year 3 and year 5.

Since the health gain is a future benefit, its present discounted value must be determined. Future costs and benefits have less impact than present costs and benefits: people would rather have €100 today than the same amount 5 years from now. To take this into account, future costs and benefits have to be discounted using the appropriate discount rate. According to current views, the discount rate for non-cyclical benefits is 5.5 per cent. The total expected health benefits obtained by discounting the health gains on this basis amount to €27,270 (see Table B.2).

Table B.2 Total discounted health gain over 5-year period is €27,270

Year	Increase in quality of life (QALY)	Average increase in quality of life during year	Discounted health gain
1	0.12	0.06	€5,900
2	0.09	0.10	€9,790
3	0.06	0.07	€6,620
4	0.03	0.04	€3,770
5	0.00	0.01	€1,190
Total		**0.30**	**€27,270**

Source: Calculations SEO Economic Research

B.2 Savings on other care costs

The average savings on care costs during the treatment year amount to €460. It is assumed that the savings on other care costs are proportional to the individual health gains, in other words that the savings on care costs increase linearly in year 1 and fall off linearly after that, reaching zero at the end of year 5. This does not mean that there are no savings on care costs in year 5, since some savings are still achieved at the start of this year. Table B.3 shows that the overall savings on care costs over the 5-year period amount to €2,140. Possible rises or falls in the price of medication and hospital care in coming years are not taken into account in this calculation.

Table B.3 Total savings on other care costs over 5-year period amounts to €2,140

Year	Average reduction in care costs during year
1	€460
2	€770
3	€520
4	€300
5	€90
Total	**€2,140**

Source: Calculations by SEO Economic Research

B.3. Productivity gain

The average productivity gain during the treatment year amounts to €620. It is assumed that the productivity gain is proportional to the individual health gains, in other words that the productivity gain increases linearly in year 1 and fall off linearly after that, reaching zero at the end of year 5. This does not mean that there is no productivity gain in year 5, since some productivity gain is still achieved at the start of this year. Table B.4 shows that the overall productivity gains over the 5-year period amount to €2,860 for a patient who is in employment. Possible future rises in productivity are not taken into account in this calculation: the value of one lost day of work is taken to be €240 in all years.

Table B.4 Average productivity gain over 5-year period amounts to €1,720

Year	**Average rise in productivity during year**
1	**€620**
2	**€1,030**
3	**€700**
4	**€390**
5	**€120**
Average for patients in employment	**€2,860**
Average for all patients	**€1,720**

Source: Calculations by SEO Economic Research

Not all patients who are treated by a dietitian are in employment. In addition, a majority of patients aged 65 or more no longer work. According to figures from CBS (CBS, 2012d; 2012e; 2012f), 68 per cent of men aged more than 15 and 57 per cent of women aged more than 15 were in employment in 2011. It may be concluded on the basis of the age distribution and male/female distribution of patients of Dutch dietitians (provisional data for 2011 from the National Information Facility for Paramedical Care (LiPZ)) that an average of 60 per cent of the patients are in employment.[16] The productivity gain resulting from intensive treatment by a dietitian, averaged over all patients, is thus 0.60* 2,860 = €1,720 per patient over a 5-year period.

A study of Dutch data shows that fewer women with a BMI exceeding 25 take part in the work process, while the corresponding limit for men is a BMI of 30 (Koning et al., 2010). Since overweight also shows a positive correlation with other predictors of reduced participation in the work process (such as low educational level), the actual proportion of adult clients of dietitians who are still in employment is probably somewhat lower than 60 per cent. However, the overall benefits of dietary treatment are not very sensitive to this assumption: even if only 50 per cent of the patients are in employment, the overall benefits of the current treatment are still €1.9 billion.

[16] It is assumed that the number of individuals who older than 65 and still working are equally divided over men and women in the age range 66-74.

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