National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Effects of bundled payment on curative health care c

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An analysis for diabetes care and vascular risk management based on nationwide claim data, 2007-2010

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This report was originally published in Dutch in 2012 under the title *Effect van integrale bekostiging op curatieve zorgkosten. Een analyse voor diabeteszorg en vasculair risicomanagement op basis van registratiebestanden Vektis, 2007-2010*. RIVM report: 260131005.

RIVM-report number: 260013001
ISBN: 9789069602608

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Abstract

This report describes the implementation of disease management programmes for type 2 diabetes and for vascular risk management (VRM) in the Netherlands based on bundled payments and assesses the effects of this bundled payment scheme on the curative health care costs of diabetes patients. Bundled payment was hypothesised to improve the quality of care and encourage task delegation and reallocation. The result could be lower health care costs and efficiency improvements in diabetes care.

We used data from the Vektis health care information centre to analyse insurance claims made to Dutch health insurance companies. The data were confined to the health care costs reimbursed under the basic statutory insurance package required by the Health Insurance Act (Zvw), plus the compulsory and voluntary excesses paid by patients.

By 2010, disease management programmes for diabetes were operating throughout the Netherlands. Just under 100 health care consortia known as care groups were providing such arrangements on the basis of bundled payment contracts with health insurers; others had arrangements in which GPs were paid supplementary management fees for the overhead and other costs of managing diabetes patients on a fee-for-service basis. Only seven care groups in the southern part of the country had bundled payment contracts for VRM in 2010.

The curative health care costs per diabetes patient were about € 4800 for the year 2009. The bulk of these costs were for hospital-based specialist care (€ 2500) and for prescription medicines (€ 1100). The costs of primary care, about € 400 per patient, played only a modest part in the total curative costs. Curative costs per VRM patient were € 1350 in the fourth quarter of 2010.

From 2008 to 2009, the costs per patient treated in a bundled payment diabetes programme increased by € 288 more than the costs of patients receiving care as usual. The cost rises for management fee patients and for care-as-usual patients did not significantly differ.

Nearly 25% fewer patients in a bundled payment diabetes management programme utilised specialist care as compared to care-as-usual patients, and almost 40% fewer used diabetes-related specialist care. The costs of diabetes-specific specialist costs reduced slightly for diabetes management patients. Interestingly, the cost increases for all types of specialist care diverged between the two diabetes management groups, rising for bundled payment patients and declining for management fee patients, in comparison to care as usual.

Key words: bundled payments – care groups – diabetes – vascular risk management – health care costs

Rapport in het kort

In dit rapport wordt de invoering van zorgprogramma's diabetes en vasculair risicomanagement (VRM) in kaart gebracht en de effecten van integrale bekostiging (IB) op de curatieve zorgkosten van diabetes beschreven. Bij de invoering van IB was de verwachting dat de kwaliteit van de zorg zou toenemen en dat er tegelijkertijd taakherschikking en taakdelegatie zou optreden. Hierdoor zouden de zorgkosten kunnen dalen en de chronische (diabetes)zorg doelmatiger worden.

De resultaten van dit onderzoek zijn gebaseerd op de zorgdeclaraties van alle Nederlandse zorgverzekeraars voor mensen met diabetes, verzameld en beheerd door Vektis. Deze declaratiegegevens bevatten de declaraties van de zorg die valt binnen het basispakket in het kader van de Zorgverzekeringswet inclusief de kosten van het eigen risico van de patient.

In 2010 werden vrijwel overal in Nederland zorgprogramma's diabetes via IB aangeboden; bijna 100 zorgroepen boden dit aan. Daarentegen werden zorgprogramma's VRM beperkt gecontracteerd in 2010; slechts zeven zorggroepen in het zuiden van het land boden dit aan.

Curatieve zorgkosten van een diabetespatient bedroegen ongeveer €4800 in 2009. De kosten van ziekenhuiszorg (ongeveer €2500 per patient) en in mindere mate de medicatiekosten (ongeveer €1100 per patient) maakten hiervan het grootste onderdeel uit. Het aandeel van de kosten van huisartsenzorg was beperkt; ongeveer €400 per patient. De curatieve zorgkosten van mensen die participeerden in een zorgprogramma VRM hebben betrekking op declaratiegegevens uit het vierde kwartaal van 2010 en bedroegen ongeveer €1350 per patient voor het laatste kwartaal in 2010.

De kosten van de curatieve zorg van patienten in een zorgprogramma bekostigd via IB waren in 2009 €288 meer gestegen dan de kosten van de curatieve zorg van patienten die reguliere zorg ontvingen. De kostenstijging van patienten in een zorgprogramma bekostigd via koptarief verschilde niet significant van de patienten die reguliere zorg kregen.

Het onderzoek liet verder zien dat deelnemers aan een zorgprogramma diabetes, bekostigd via IB, in 2009 bijna 25% minder vaak gebruikmaakten van het ziekenhuis in vergelijking met diabetespatienten die reguliere zorg ontvingen. Als alleen gekeken wordt naar diabetesspecifieke dbc's dan is de invloed van deelname aan een zorgprogramma nog duidelijker te zien; bijna 40% minder diabetespatienten in een zorgprogramma gingen naar het ziekenhuis ten opzichte van patienten met reguliere diabeteszorg. De kosten per patient die ziekenhuizen maakten voor diabetesgerelateerde zorg namen licht af. Opmerkelijk genoeg namen de totale ziekenhuiskosten van deze patienten juist toe en verklaarden bijna de helft van de toename van de totale curatieve zorgkosten. Bij koptarief werd deze stijging in totale ziekenhuiskosten niet gevonden.

Trefwoorden: Integrale bekostiging – zorggroepen – diabetes – vasculair risicomanagement – zorgkosten

Summary

An initial analysis of the effect of bundled payments on curative health care costs
There have been many initiatives in recent years to improve the efficiency of long-term disease management. One important development has been the creation of disease-specific health care standards. The main purpose of the health care standards is to optimise the quality of care by specifying requirements for the content and organisation of good care. Health care standards provide a strong guiding framework for the development of integrated, multidisciplinary programmes of disease management. The bundled payment model was developed to facilitate the creation of such programmes. It enables health insurance companies to purchase, as a single product, all the health care services needed for the management of a particular chronic disease, including all the activities needed to ensure cooperation and coordination between the health care providers involved. Following a period of experimentation with the bundled payment model in the Netherlands from 2007 to 2009, it was introduced on a long-term basis for diabetes and vascular risk management as from 1 January 2010. At the same time, it is still possible to claim diabetes management according to the older pricing mechanism, which remunerated providers for direct health care provision on a fee-for-service basis, supplemented by a management fee. The fee covers the costs of activities outside the direct provision of health care, such as overhead costs, information and communication technologies and coordination of the integrated care delivery. Diabetes care can also still be provided on the older fee-for-service basis without a supplementary fee. In that case, the care is not part of an organised, integrated programme of disease management. We refer to the latter practice as care as usual. This report maps the scale of implementation of the disease management programmes for diabetes and for vascular risk management (VRM), and it assesses the effects that the bundled payment approach in particular has had on the curative health care costs for diabetes. Our research findings are based on insurance claims for health care to diabetes patients as reported by all Dutch health insurance companies to the health care information centre Vektis. Vektis collects and manages data on all health care procedures covered by the Dutch basic statutory insurance package required by the Health Insurance Act (Zvw), including the costs for compulsory and voluntary policy excesses.

By 2010, disease management programmes for diabetes were available throughout the country
Due in part to the need for central contracting arrangements in the bundled payment approach, health care consortia known as care groups have been set up and charged with the delivery of integrated disease management programmes. By 2010, nearly 100 care groups were operating disease management programmes for diabetes; as a result, diabetes management was being delivered and remunerated by bundled payments virtually everywhere in the country. Comparable programmes for VRM, in contrast, had only been contracted by seven care groups in the south of the country. The scale of VRM implementation depended largely on the attitude of a care group's preferential insurance company to bundled payment.

Curative health care costs per diabetes patient in 2009 put at € 4800
The costs of curative care for all Dutch diabetes patients (average age 67) were about € 4800 per patient in 2009. That was € 1300 higher than the health care costs for an average resident of similar age. General practice costs were only a limited share of that figure, about € 400 per patient. The largest cost items were for specialist or hospital-based care (averaging about € 2500 per year) and medication costs (about € 1100). Curative costs depended strongly on whether patients had other chronic illnesses; the costs were approximately € 2600 higher per comorbid condition.

Highest cost increases were for patients in bundled payment diabetes management
The average yearly costs of treating a diabetes patient by whatever approach rose by € 219 from 2008 to 2009, an increase of about 5% and consistent with the total cost increment for all Dutch health care in the same period. The curative costs for diabetes patients in a bundled payment disease management programme increased by € 288 more than the costs of care-as-usual patients; the increase for management fee patients did not significantly diverge from that for care-as-usual patients.

Fewer bundled payment and management fee patients used specialist care in 2009
About 17% fewer patients receiving some type of diabetes management utilised outpatient or inpatient hospital-based care in 2009 than did care-as-usual patients. The contrast with care as usual was greater for bundled payment patients (25%) than for management fee patients (12%). The influence of diabetes management was even more pronounced when it came to diabetes-specific episodes of specialist care, with almost 40% fewer patients in diabetes management using that care than patients receiving care as usual.

Small cost savings in diabetes-specific specialist care for diabetes management patients, but bundled payment patients had higher costs for specialist care in general
The reduced numbers of diabetes management patients using specialist care resulted in a slight saving of € 36 per patient in the costs of diabetes-specific specialist care in 2009. At the same time, the total specialist cost increase (including non-diabetes costs) for bundled payment patients was € 142 higher than that for care-as-usual patients, whereas it was € 128 lower for management fee patients. The reasons for these contrary cost trends are yet unclear.

Long-term effects of bundled payments on curative health care costs are still unknown
Our cost analyses in this report are based on insurance claims data from 2008 and 2009, a period that can be considered a start-up phase in the bundled payment approach. Both care groups and health insurers were still gaining experience in the contracting and provision of disease management based on bundled payment. Other studies have shown that avoidable double payments occurred for certain medical procedures during this period. Our study was unable to verify that. Another qualifying factor is that the two-year time frame of our study was probably too short to gauge the full impact of bundled payment. Given the clinical course of diabetes, where many complications do not develop until later, such short-term findings may underestimate the ultimate effects of bundled payments. It is also possible that the desired effects on curative health care costs are less likely to be achieved in diabetes than in other diseases, because the Dutch 'care as usual' for diabetes was already of a high standard as compared to that in many other countries. This would make it all the more interesting to study the effects of bundled payments on the costs of VRM and COPD patients. In view of the considerable time interval required for the full incorporation of insurance claims data into the Vektis databases (two years for specialist care), it will still be several years before reliable evidence can be obtained on the effects of bundled payments on diabetes, vascular risk and COPD management.

Financial incentives in secondary care at odds with bundled payment aims
The current findings have shown that although a reduction was achieved in the numbers of diabetes patients using specialist care, no corresponding cost reduction occurred in the secondary care sector. A possible explanation may lie in the pricing system for specialist care, which is mainly based on fee for

services principles. It would be advisable to experiment with financial incentives in both primary and secondary care that are more consistent with the goals of the bundled payment model – quality enhancement aligned with cost savings.

1 Introduction

1.1 Background

Many initiatives to improve the quality of disease management
The Netherlands has seen many initiatives in recent years to improve the quality and effectiveness of health care for people with chronic diseases. Aims are to improve cooperation between health care providers, to improve the coordination of care, to ensure compliance with multidisciplinary guidelines and to promote disease self-management. One key supporting development was the realisation of the Health Care Standard for Diabetes Mellitus type 2 by the Dutch Diabetes Federation (NDF, 2007). With the goal of optimising the quality of care, these health care standards set out the principal requirements of diabetes treatment in terms of the health care services and organisational frameworks necessary for long-term disease management (Coördinatieplatform Zorgstandaarden, 2010). The health care Standards are condition-focused, meaning that they specify the health care services required for managing the disease in question, but they do not prescribe where, how or by whom the services are to be delivered. Since the publication of the NDF Health Care Standard, many initiatives have been taken in the field of practice to implement disease management programmes for diabetes. A major obstacle to introducing such programmes nationwide has been the fragmented pricing mechanisms for long-term care (see Appendix 1 for an introduction of the Dutch health care system). This prompted the Netherlands Ministry of Health, Welfare and Sport (VWS) to experiment from 2007 to 2009 with a bundled payment model for integrated diabetes care (VWS, 2008a).

Bundled payments as a strategy for further quality improvement
The creation of bundled fees enables health insurance companies to purchase, as a single service or product, the entire package of care needed to manage a chronic health condition such as diabetes. Such integrated health care packages have also introduced a new player into the Dutch health system: the care group. Insurance companies sign contracts with care groups to purchase a disease management product (the entire package of required health care services) for a specified chronic condition. The term 'care group' refers to the prime contractor of the disease management programme, not to the team of health care providers that deliver the services. The care group serves as the principal contractor that must

ensure that the care is delivered. A care group subcontracts most care components to individual health care providers or agencies, or it may deliver some components itself. It arranges with all the associated providers which specific services they will provide, as well as setting additional requirements, such as when they are to refer patients, what data they are to record and report to the care group, and what professional development training they are to complete. The Health Ministry expected bundled payments to improve the implementation of formal standards of care, thus improving the quality of disease management. At the same time, health care tasks would be delegated or reallocated within the primary care sector or from secondary to primary care. This could both reduce the costs and improve the efficiency of long-term disease management (VWS, 2008b; VWS, 2009).

Bundled payment model officially launched as from 1 January 2010, with a three-year transition
After the experimentation phase in 2007-2009, bundled payment schemes for diabetes management and for vascular risk management (VRM) were introduced on a more permanent basis on 1 January 2010, followed by the scheme for chronic obstructive pulmonary disease (COPD) on 1 July 2010. Alongside those programmes, disease management services for patients with these chronic health conditions could alternatively still be claimed under the 'old' pricing system. Under that procedure, direct providers of health care were reimbursed on a fee-for-service basis (separate payments), plus a lump-sum 'management fee' per patient. A management fee defrays the costs of activities that are necessary for disease management but not part of the direct health care provision, such as overhead, IT and coordination costs. The years 2010 to 2012 were considered a transitional period from the old to the new pricing mechanism.

Evaluation committee appointed to monitor developments in transitional period
To keep track of developments related to bundled payments, the previous health minister set up the Bundled Payment Evaluation Committee (EIB) to keep the ministry informed whether the necessary conditions for the bundled payment model are being fulfilled and to advise the ministry whether and when the transitional period can be ended. Such prerequisites include health care quality assurance, consistency of care, patient participation, appropriate services for people with multimorbid conditions, and transparency of quality assessment (EIB, 2011a). The EIB has since produced three reports on the initial results of bundled payments (EIB, 2011b; EIB, 2012a; EIB 2012b), including a final report in June 2012.

Research on the impact on health care quality
Two key aspects covered by the EIB recommendations were the effects of payment bundling on the quality and the costs of care. A recent RIVM study focused on the quality effects in diabetes care (Struijs et al., 2012). It found mild improvements over the three-year period in indicators evaluating the patient care process, such as HbA1c tests, yearly foot examinations and regular cholesterol checks. It also saw improvements in patient outcomes, in terms of the percentages of patients with systolic blood pressure under the 140 mmHg target level (6 percentage points higher) and patients satisfying target cholesterol levels (10 points higher).

No evidence yet for cost effects of bundled payments
As of yet there has been no nationwide research on how bundled payments have affected the costs of curative health care. In tentative research, the health insurance companies Achmea and VGZ recently

published widely divergent estimates, ranging from a surge in primary care costs of 49% (Sprangers et al., 2012) to cost savings of 40% in the total costs of care (VGZ, 2012). The Health Ministry thereupon commissioned the RIVM to provide more clarity about the effects of bundled payment on health care costs, drawing on the evaluation questions posed by the EIB.

1.2 Purpose of this study

The present study evaluates the effects that the introduction of the bundled payment model has had on the costs of curative health care.

Distinction between effects of disease management and effects of bundled payments
To clearly identify the statistical effects that bundled payments have on the costs of care, we must distinguish between cost effects generated by a disease management programme per se and cost effects generated by bundled payment arrangements. Given that disease management programmes are in themselves designed to improve the efficiency of care, those effects are theoretically independent of the method of payment. Bundled payment has been chosen as the preferred pricing mechanism for these programmes in the Netherlands, making it a means to an end: the creation of disease management programmes. Other ways of paying for disease management are also conceivable, such as the management fee mentioned above.

In our study we therefore distinguish three comparison groups:
1. **Bundled payment group:** all diabetes patients of GPs who offer a diabetes management programme for which they claim a bundled fee (fee-for-condition payment).
2. **Management fee group:** all diabetes patients of GPs who offer a diabetes management programme on a fee-for-service basis but who claim an additional management fee to cover the planning and coordination of the services of the various health care providers.
3. **Care-as-usual group:** all diabetes patients of GPs who do not offer a diabetes management programme and who provide diabetes treatment on a fee-for-service basis.

Before we can identify the effects of bundled payment on health care costs, we first need to map the extent of implementation of bundled payment. If it has only been implemented on a small scale, then any cost effects would be more marginal than in broader-scale implementation. Our study therefore begins by charting the current scale of implementation of disease management programmes for diabetes and for vascular risk that are covered by bundled payment contracts, as well as the costs generated by the people receiving care under any disease management programme. Our analysis of patient costs is confined to diabetes, whereby both the bundled payment and the management fee groups are considered in comparison to the care-as-usual group. Cost effects of VRM programmes could not yet be properly quantified, because such programmes have not yet been widely contracted (Van Til et al., 2010). As we anticipate that some cost effects of bundled payments will be specifically accountable to the fewer referrals to secondary care, we also investigate how many diabetes patients utilise hospital-based (outpatient or inpatient) specialist care. The implementation of COPD management programmes is not documented in this report.

The above considerations led us to the following research questions:

1a. What is the current scale of implementation of diabetes and vascular risk management programmes that are covered by bundled payment contracts?
1b. What curative health care costs do people generate when they receive care in disease management programmes for diabetes and vascular risk?
2. What effect does the introduction of bundled payment diabetes management have on curative health care costs in comparison to the fee-for-service arrangements with management fees or care as usual?
3. Has the introduction of bundled payment diabetes management led to reductions in the numbers of people with diabetes who utilise specialist care in comparison to arrangements with a management fee or care as usual?

Our nationwide data on health care costs and health service utilisation was based on insurance claims data from Vektis, a health care information centre that records and provides access to data from all Dutch health insurance companies. Its databases reflect the health care costs reimbursed under the basic statutory insurance package specified by the Health Insurance Act (Zvw), including the compulsory and voluntary excesses paid by patients. This report makes use of Vektis claims data for 2007 to 2010.

1.3 Structure of this report

This report presents our study of the effects of bundled payment introduction on health care costs. Our most important conclusions and recommendations are summarised in the summary at the beginning of the report, which also serves as an executive summary. Chapters 2 and 3 describe the implementation of bundled payment programmes and estimate the health care costs for diabetes management and for vascular risk management (research questions 1a and 1b). Chapter 4 reports our comparative findings on health care costs (question 2), and in chapter 5 we assess changes in the utilisation rates of hospital-based specialist services by diabetes patients (question 3). In chapter 6, we report and discuss our conclusions and make policy and research recommendations.
Appendix 1 is an introduction to the Dutch health care system. Appendix 2 shortly describes the Vektis health care databases which were used in this study, while Appendix 3 gives a detailed description of the design and employed methods of the study. Appendix 4 lists the people at the RIVM who have contributed to the report, as well as the external steering group and the project group of Vektis. The final Appendix 5 provides figures and tables of additional performed analyses.

2 Diabetes management: implementation, costs and cost trends

Outline
This chapter describes our study population and examines cost trends in the three comparison groups of diabetes patients in the period from 2007 to 2009. We first describe the study population we studied for the 2007-2010 period. We then analyse (section 2.2) how curative health care costs evolved in the three groups from 2007 to 2009 (cost data for 2010 were not yet fully available). Section 2.3 goes on to itemise the health care costs in bundled payment arrangements and explain these in more detail.

2.1 Sample population

2.1.1 Comparison groups

Size of sample population grew strongly in 2007-2010
The overall number of diabetes patients in our yearly samples increased from 183,721 in 2007 to 365,004 in 2010 (Table 2.1). This doubling in patient numbers was largely due to the increasing incorporation of Dutch health insurance policyholders into Vektis databases. Vektis did not begin its record keeping until 2006, and not all health insurers were reporting data in 2007 and 2008. Quite in line with our expectations, the number of patients in our bundled payment subgroup likewise grew sharply from 2007 to 2010, as a result of increasing numbers of care groups and increasing numbers of GPs who joined them. The coinciding declines in the numbers of patients in the management fee and care-as-usual groups also matched our expectations.

The number of diabetes patients in our sample does not equal the total number of diabetes patients in the Netherlands. In order to ensure unambiguous differentiation between the comparison groups, and hence reliability in the results, we applied certain exclusion criteria in the sampling. Among these were the exclusion of patients whose data were not available for all four quarters of any calendar year, or who were registered with more than one GP or care group during a single year (see Appendix 3 for a full explanation of exclusion criteria).

Table 2.1 Numbers of diabetes patients and care groups by comparison group, 2007-2010.

Year	Bundled payment			Management fee			Care as usual			Total		
	patients (n)	%	care groups (n)	patients (n)	%	care groups (n)	patients (n)	%	care groups (n)	patients (n)	%	care groups (n)
2007	27,403	14.9	26	26,111	14.2	7	130,207	70.8	-	183,721	100	33
2008	40,354	19.2	44	53,529	25.4	19	116,888	55.5	-	210,771	100	63
2009	148,523	47.5	52	51,198	16.4	19	112,778	36.1	-	312,499	100	71
2010	308,591	84.5	98	10,637	2.9	1	45,776	12.5	-	365,004	100	99

Table 2.2 Characteristics of patients in the comparison groups, 2010.

	Bundled payment	Management fee	Care as usual	Total
General characteristics				
Number of patients	308,591	10,637	45,776	365,004
Mean age (SD)	67.1 (11.9)	66.8 (12.3)	66.9 (11.9)	67.1 (11.9)
Gender (% male)	50.2	51.1	51.0	50.4
% of patients with comorbid chronic conditions	34.5	34.2	34.8	34.5
1 other condition	26.4	26.7	26.8	26.5
2 other conditions	6.8	6.5	6.7	6.8
≥3 other conditions	1.2	1.0	1.2	1.2
Medication use				
% taking oral diabetes medicines[#] (1 or more insurance claims per year)	83.3	89.6	100.0	85.6
% injecting insulin[$] (180 DDD[§] or more per year)	3.0	1.9	0.0	2.6

= defined by ATC code A10B; $ = defined by ATC code A10A; § = daily defined doses; SD = standard deviation.

Similar patient characteristics across groups

By 2010, most diabetes patients were in the bundled payment group (308,591 of the total of 365,004, or 84.9%; Table 2.2). Little difference was found between the three comparison groups in terms of age, gender or comorbidity rates. The care-as-usual group did differ from the other two in terms of medication use; unlike in the other groups, all care-as-usual patients were taking oral diabetes medicines. This discrepancy was due to differences in selection criteria for the three groups. Bundled payment and management fee groups were selected by how their diabetes management programme was claimed. As this was not possible for the care-as-usual group, it was selected by the types of medicines claimed (see Appendix 3). Patients injecting insulin were excluded from the care-as-usual group.

Table 2.3 Average numbers of health insurance companies, GPs and diabetes patients per care group in the bundled payment comparison group, 2010*.

	Bundled payment
Number of care groups	98
Average number of insurers per care group (SD)	19.1 (3.3)
25th percentile / 75th percentile	18/21
Average number of GPs per care group (SD)	45.6 (41.9)
25th percentile / 75th percentile	12/69
Average number of diabetes patients per care group (SD)	3148.9 (3439.5)
25th percentile / 75th percentile	555/4423

* Data in this table are based on the bundled payment comparison group in the sample; because many patients were excluded from the sample, the figures on the number of patients in bundled payment arrangements are underestimates of the actual number. SD = standard deviation

2.1.2 Care groups

Care group catchment areas covered almost the entire Netherlands
A total of 98 care groups had bundled payment contracts for diabetes management in 2010. Strong increases had occurred in the numbers of care groups since 2007, when the bundled payment arrangements were introduced and the first care groups were established. There was also a swift expansion of the catchment areas of care groups in 2008 and 2009. By 2010, the catchment areas of all the care groups together covered virtually the whole country (Figure 2.1); most of the remaining 'white spaces' in the figure are apparently due to incomplete data provision by two small health insurers (see also Appendix 3). Generally speaking, care groups signed bundled payment contracts with the market-leading (preferential) health insurance company in their region; an average of eighteen other companies then 'honoured' that contract. An average of about 3100 patients per care group were being treated in the diabetes management programmes covered by bundled payment contracts in 2010.

2.2 Curative health care costs for diabetes patients under differential pricing schemes from 2007 to 2009

This section traces trends in health care costs for people with diabetes in our three comparison groups in the 2007-2009 period. We report the average curative costs per patient per year. Figure 2.2 gives a breakdown of the health care costs in three categories.

Increase in average curative costs per patient from 2007 to 2009
The average cost of curative health care per diabetes patient rose from € 4492 in 2007 to € 4832 in 2009 (Figure 2.3). In all three comparison groups, a cost surge was particularly observable from 2007 to 2008.

General practice costs were a small share of total costs: € 400 per patient in 2009
In all three groups, the costs of care in the GP practice made up but a small part of the curative health care costs of diabetes patients (Figure 2.3). We could not make meaningful cross-group comparisons of

Figure 2.1 Geographical diffusion of care groups with diabetes management programmes covered by bundled payment contracts, 2007- 2010 (showing catchment areas).

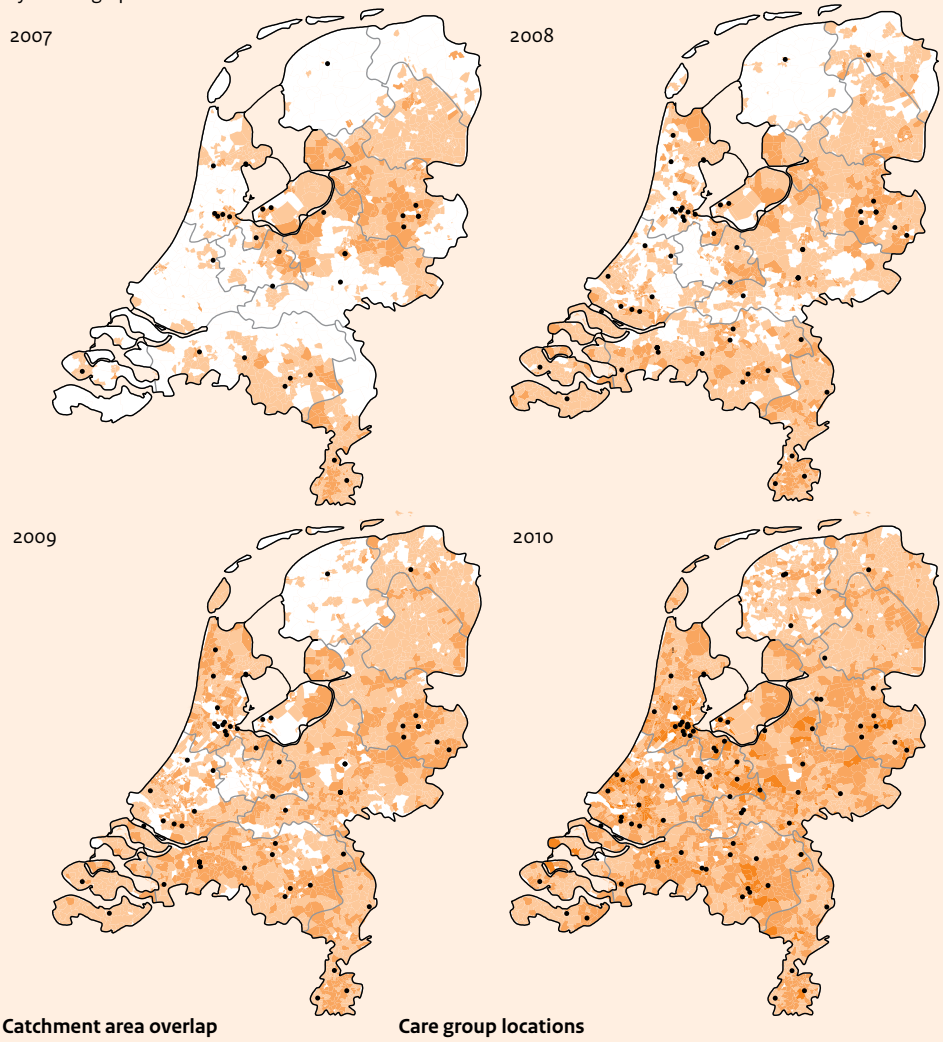
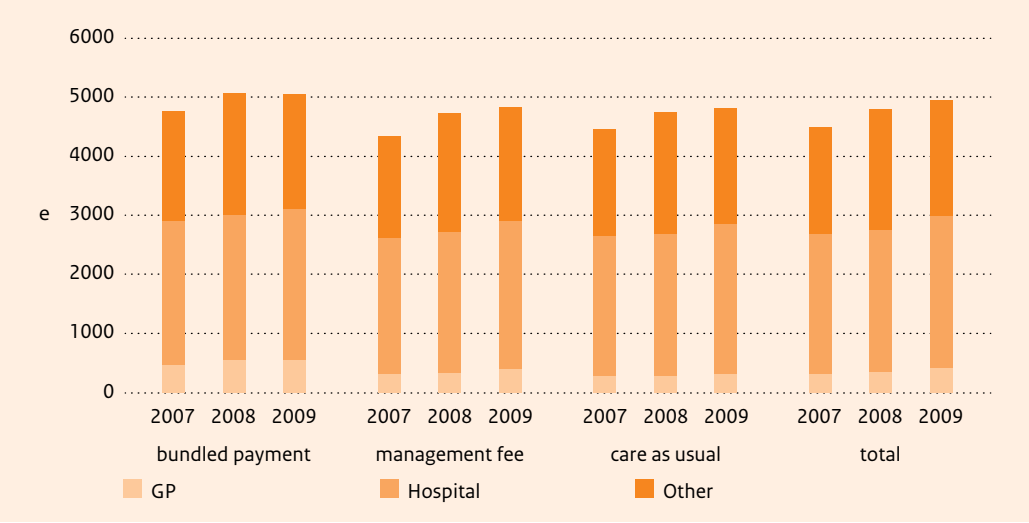


Figure 2.2 Three categories of health care costs for diabetes patients.

Figure 2.3 Mean curative costs per diabetes patient, by comparison group, 2007-2009.



the average per-patient general practice costs, as the costs in the bundled payment and management fee groups also included fees for integrated care arrangements that were not available in the care-as-usual group. A large proportion of those fees covered non-GP-based care, such as that provided by subcontractors like dieticians and podiatrists. The general practice costs in those groups were therefore higher than those in the care-as-usual group. This overestimate of the general practice costs was the highest in the bundled payment group, because the bundled fees covered more services than management fees. Figures A5.1 to A5.4 show the year-by-year costs per comparison group per sector.

Half of the costs were for hospital-based specialist care: about € 2500 per patient

More than half of the average curative health care expenditures for diabetes patients went into hospital-based specialist care (Figure 2.3). Average per-patient hospital costs rose in all three comparison groups from 2007 to 2009 (Figure A5.2). They diverged very little across groups in 2009: € 2573 per bundled payment patient, € 2528 per management fee patient and € 2564 per care-as-usual patient.

Pharmacy costs predominated in 'other costs': about € 1100 per patient
The category 'other health care costs' included pharmacy costs, medical aids, non-medical health care, patient transport and mental health care. These costs were comparable across groups in 2009 and averaged € 1941 per bundled payment patient, € 1929 per management fee patient and € 1978 per care-as-usual patient (Figures 2.2 and A5.3). Pharmacy costs were approximately € 1100 per patient in all three groups.

2.3 Curative costs for diabetes patients in the bundled payment group in 2009

We now focus in more detail on the costs of general practice care, specialist care and other services in 2009 for patients being treated for diabetes specifically under bundled payment arrangements. We distinguish between average costs per user – costs of the services actually utilised by patients – and average costs per patient (whether or not the covered services were actually utilised). We also assess per-patient variations between and within care groups.

Average curative costs per bundled payment patient over € 4800 per year
The average costs per diabetes patient in the bundled payment comparison group were € 4872 in 2009. The costs of general practice care, € 519, were a small proportion. Specialist care, at € 2481 per patient, claimed about half the costs. Other health care services came to € 1872 per patient, thus also forming a substantial share of the yearly costs (Table 2.4). These average costs per bundled payment diabetes patient (mean age 67) were € 1325 higher than the average curative health care costs per resident of the Netherlands in the 65-to-69 age category.[1]

Costs of integrated care constituted one half of general practice costs
In the bundled payment group, more than half of the general practice costs for diabetes patients, or € 287, were accounted to the integrated care arrangements. As we explain below in section A3.1.3, about 15% of the patients in this group were not in fact in a diabetes management pathway, but were receiving care as usual (see Table 2.5). The average cost of integrated care per user came to € 339 in 2009. This figure should not be understood as the average bundled fee for diabetes management, as the calculation also included people for whom the fee was claimed for fewer than four quarters of 2009. The average bundled payment was higher.

[1] According to the recent Cost of Illness study (Slobbe et al., 2011), the average cost per resident of the Netherlands was € 3374 in 2007. Applying a CPI-based deflator of 1.0511 for 2007-2009, we estimated a cost for 2009 of € 3374 × 1.0511 = € 3546 (Table A4.9).

Table 2.4 Average curative health care costs per diabetes patient and per actual user in bundled payment group in 2009 (N = 148,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
Costs of general practice care	100	519 (212)	519 (212)
Costs of specialist care	95,7	2592 (6236)	2481 (6124)
Other health care costs	99,8	1876 (3862)	1872 (3859)
Total curative costs			**4872 (7888)**

SD= standard deviation.

Table 2.5 Average costs of general practice care per diabetes patient and per actual user in bundled payment group in 2009 (N = 148,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
Costs of integrated care	84.7	339 (84)	287 (145)
Diabetes-specific costs	27.5	16 (47)	5 (26)
Practice nurse costs	86.7	20 (30)	17 (29)
Consultation and capitation fees	100	210 (153)	210 (153)
Costs of general practice care			**519 (212)**

Practice nurse = nurse working in GP practice with appropriate professional qualifications; SD = standard deviation.

Some bundled payment patients had additional diabetes-specific general practice costs

Over and above the bundled diabetes management fee, GP practices claimed additional 'diabetes-specific costs' in 2009 for more than one quarter of the patients in the bundled payment comparison group (Table 2.5). These costs were low (€ 5 per patient, € 16 per user). Examples were blood glucose testing strips or yearly diabetes counselling. The additional diabetes-specific claims are attributable in part to the fact that some patients in the bundled payment group were not in a diabetes management pathway (as explained in section A3.1.3) or to the inclusion of patients for whom fewer than four quarterly bundled payments were claimed in 2009. We were unable to judge whether double payments were also claimed.

Virtually all bundled payment patients received specialist care in 2009

Claims for additional hospital-based specialist services were made in 2009 for nearly all patients in the bundled payment group (95.7%; Table 2.4). Average per-patient costs for all types of hospital services for all health conditions came to € 2481 that year. Only 3.3% of those costs (averaging € 81 per patient) involved episode-of-care payments for diabetes-specific treatment (Table 2.6). These additional costs were low because only 11.4% of the patients utilised such diabetes-specific services. Most patients who went to hospitals for such diabetes-related treatment received outpatient care; fewer than 1% received day-patient care and even fewer received diabetes-specific inpatient care.

Table 2.6 Average costs of diabetes-specific specialist care per diabetes patient and per user in bundled payment group in 2009 (N = 148,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
Outpatient specialist diabetes treatment	10.7	443 (173)	46 (145)
Day-patient specialist diabetes treatment	0.9	948 (573)	9 (105)
Inpatient specialist diabetes treatment	0.6	4259 (2323)	26 (381)
Specialist diabetes treatment	**11.4**	**714 (1081)**	**81 (430)**

SD = standard deviation.

Table 2.7 Average costs of other health care services per diabetes patient and per actual user in bundled payment group in 2009 (N = 148,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
Non-medical health care	19.0	518 (806)	99 (406)
Medical aids	52.9	692 (1164)	366 (915)
Pharmacy	99.7	1139 (1749)	1136 (1747)
Mental health care	4.9	3788 (1282)	188 (2967)
Hospital transport	8.3	1011 (1199)	84 (443)
Costs of other health care services			**1872 (3859)**

SD = standard deviation.

Other costs were largely pharmacy costs

The average costs for services not categorised as GP or specialist care were € 1872 per bundled payment patient in 2009 (Table 2.7). The largest share of these was for pharmaceutical products (€ 1136). Almost all patients in the bundled payment group were on medication (99.7%). Mental health care costs came to € 188 per patient, but the proportion of users was only 4.9%; calculated by actual user, those costs were high at € 3788.

Wide cost variations across and within care groups

In addition to calculating the various types of health care costs, we also assessed variations between and within care groups. In terms of the average per-patient costs in 2009, major differences between care groups emerged (Figures A5.5 - A5.8). Variations in the average per-patient costs were also wide within the care groups themselves; that is, there were patients with low costs and with very high costs. In view of these large differences, it did not suffice to simply report the mean costs per patient. We therefore also calculated the 25th and 75th percentiles of the mean costs (Figures A5.9 - A5.12). Yet even on the basis of those dispersion measures, wide differences between care groups still remained.

3 Vascular risk management: implementation and costs

Outline
This chapter traces the implementation of vascular risk management (VRM) programmes with bundled pricing arrangements. We first briefly describe the general characteristics of the care groups, GPs and patients involved in the VRM programmes. Section 3.2 details the health care costs of the patients in 2010, the first year these could be claimed under bundled payment contracts.

3.1 Progress in implementing VRM

Seven care groups had VRM bundled payment contracts in 2010
In 2010, there were seven care groups in the Netherlands with bundled payment contracts for vascular risk management; all seven also had bundled payment contracts for diabetes care. An average of just under 70 GPs per care group were involved in the VRM programmes (see Table 3.1) – fewer than in diabetes management programmes. This means that, within care groups, not all doctors offering diabetes management were also providing VRM.

Care groups with bundled payment VRM programmes all in south of country
The seven care groups providing vascular risk management on a bundled payment basis were located solely in some southern regions of the Netherlands (Figure 3.1). It seemed evident that the purchasing strategy of the regional preferential insurance company was a strong influencing factor in whether or not care groups had contracted VRM in 2010. On average, that insurer's bundled payment contract for VRM was 'honoured' by eleven 'peripheral' insurance companies (Table 3.1) – lower than the average of nineteen companies that abided by preferential diabetes contracts (see Table 2.3).

Table 3.1 Characteristics of care groups and patients in vascular risk management (VRM) programmes on a bundled payment basis, 2010.

Care groups (N = 7)	
Average number of GPs per care group (SD)	68,1 (37.6)
25th percentile / 75th percentile	44/112
Average number of health insurers with VRM contracts per care group (SD)	12 (4.3)
25th percentile / 75th percentile	8/16
Average number of VRM patients per care group (SD)	13,217 (11,050)
25th percentile / 75th percentile	6,300/24,057
Patients (N = 92,523)	
Gender (% male)	44.9
Mean age (SD)	64 (13.6)
% of patients aged ≤ 18	0.1
% of patients deceased in 2010	0.5
% of patients with comorbid chronic conditions	29.7
% with 1 other condition	23.4
% with 2 other conditions	5.3
% with ≥3 other conditions	1.0

SD = standard deviation.

More than 13,000 patients on average per care group in VRM programmes, but with large variations by GP

An average of 13,217 patients per participating care group were involved in its vascular risk management programme. The numbers of VRM patients per GP within the seven care groups varied from 30 to nearly 400 (Figure 3.2). These disparities seem wider than would be expected from any differences in the prevalence of cardiovascular disease or risk factors; possibly different criteria were used by the various care groups to select patients for the programmes. The average number of patients taking part in a VRM programme per care group was considerably higher than the average number of 6151 in diabetes programmes.[2] This is mainly because the prevalence rates of cardiovascular disease and cardiovascular risk are higher than the rate for diabetes; people in both of those cardiovascular categories meet the selection criteria for the VRM programmes.

VRM patients were younger on average than diabetes patients and had lower rates of comorbid diseases

The characteristics of patients in VRM programmes differed from those of the diabetes patients. VRM patients were younger on average (age 64 versus 67) and had a lower rate of comorbidity (29.7% versus 34.5%). Their mortality rate in 2010 was also considerably lower. A possible explanation for these differences is again that VRM, unlike diabetes management, is not restricted to those who already have the disease; people with high risk are also eligible. VRM participants thus form a relatively healthier population.

[2] Based on patient numbers before application of exclusion criteria (see Appendix 3).

Figure 3.1 Geographical distribution of care groups with bundled payment VRM programmes, 2010 (also showing catchment areas).

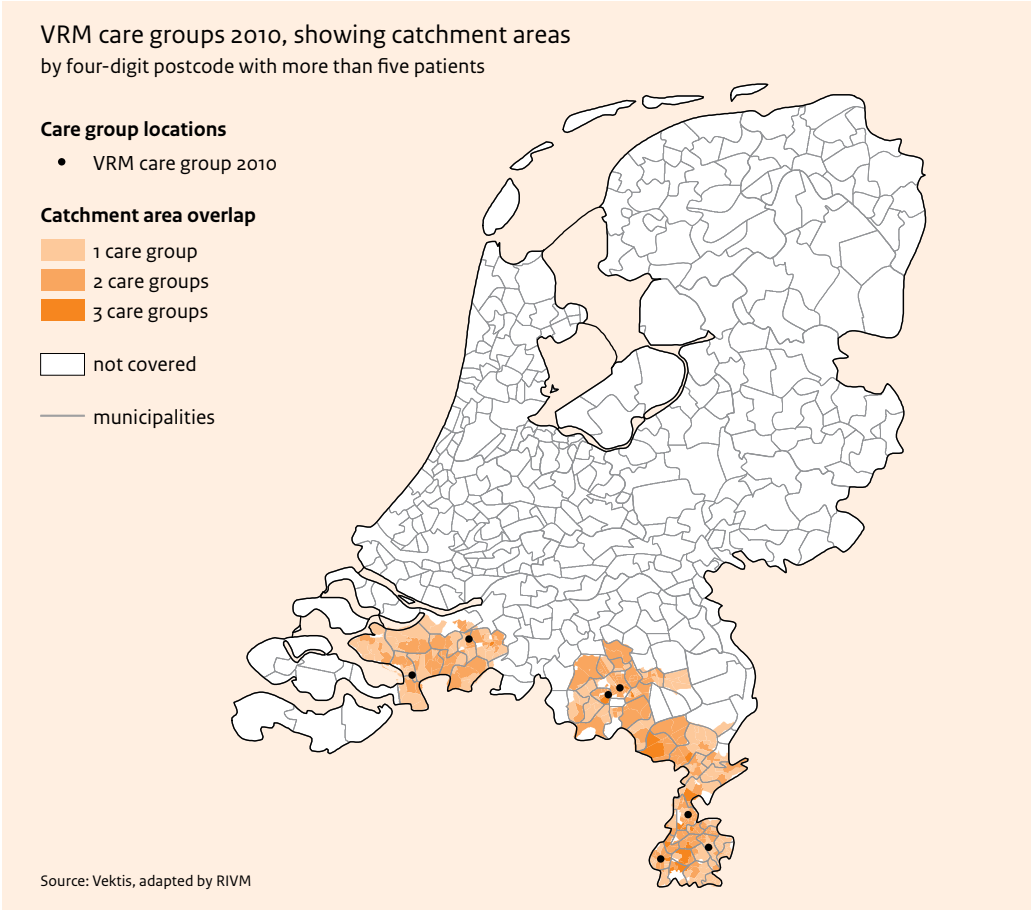
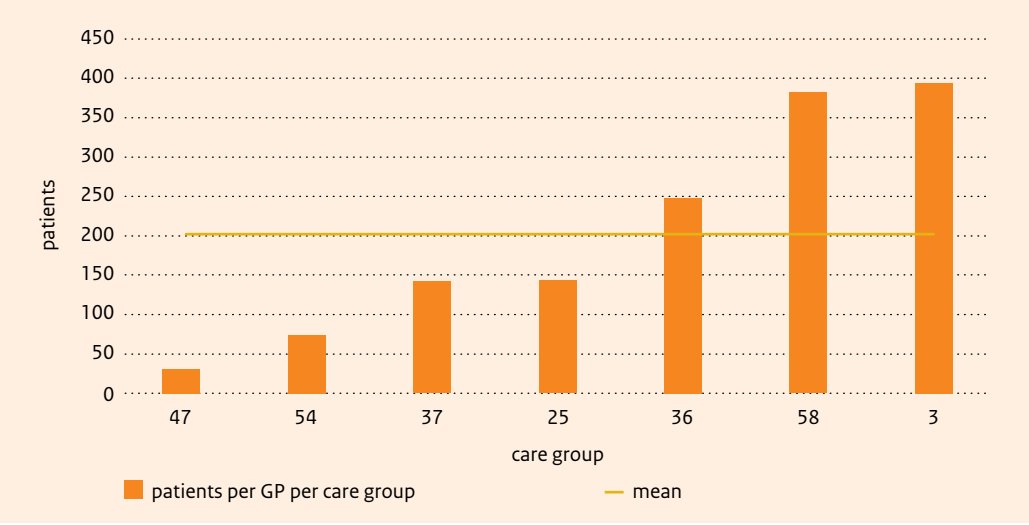


Figure 3.2 Numbers of patients per GP per care group in VRM programmes in 2010.



3.2 Curative health care costs in VRM programmes in fourth quarter of 2010

Average costs for VRM patients calculated for fourth quarter of 2010 only
Because only one of the seven care groups had concluded a bundled payment contract for VRM for the full year in 2010, we confined ourselves to fourth-quarter claims data to assess the health care costs. The cost estimates for hospital-based specialist care and mental health care should be interpreted with some caution, as not all the relevant data had been entered into the Vektis databases at the time of our analysis; our figures for these items are therefore underestimates.

General practice costs per VRM patient about € 100
The average costs of general practice care were approximately € 100 for VRM patients in the fourth quarter of 2010 (Table 3.2). About half of these were accountable to integrated care arrangements. The direct costs of the care provided by practice nurses (€ 3) formed only a small part of the VRM patients' cost profile; the real practice nurse costs were higher, as most were categorised as integrated care costs. The per-patient costs of additional GP care for VRM-specific symptoms were also low (€ 1), due to the small percentage of actual users.

Over 40% of VRM patients made use of hospital-based specialist services
A total of 43.3% of all VRM patients utilised some form of specialist care in the fourth quarter of 2010. Per-patient costs averaged € 440 (Table 3.5). When it came to the VRM-specific episode-of-care payments claimed for these patients, the vast majority of patients received outpatient care only (Table 3.3). Fewer than 10% underwent day-patient or inpatient treatment. Despite the small percentage with inpatient admissions (4.8%), the average per-patient costs were relatively high at € 160.

Table 3.2 Average costs of general practice care per VRM patient and per actual user, 4th quarter of 2010 (N = 92,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
Costs of integrated care	100	49 (20)	49 (20)
Practice nurse costs	99,6	3 (5)	3 (5)
Other costs	100	46 (55)	46 (55)
VRM-specific costs	3.2	45 (20)	1 (9)
General practice costs	**100**		**100 (62)**

SD = standard deviation.

Table 3.3 Average costs of VRM-specific specialist care per VRM patient and per actual user, 4th quarter of 2010 (N = 92,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
Outpatient VRM-specific treatment	28.7	280 (974)	80 (537)
Day-patient VRM-specific treatment	4.7	844 (1,429)	40 (358)
Inpatient VRM-specific treatment	4.8	3,363 (4,065)	160 (1,141)

SD = standard deviation.

Table 3.4 Average costs of other health care services per VRM patient and per actual user, 4th quarter of 2010 (N = 92,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
Pharmacy	97.5	507 (1267)	495 (1254)
Medical aids	33.8	453 (1109)	153 (679)
Non-medical health care	13.7	574 (845)	79 (370)
Mental health care	0.03	1,370 (4781)	45 (898)
Patient transport	6.8	758 (1036)	52 (330)
Costs of other health care services	**97.9**		**823 (1998)**

SD = standard deviation.

Average costs for 'other care' per VRM patient were € 823

Per-patient costs of services not categorised as GP or hospital-based care averaged € 823 in the fourth quarter of 2010, and more than half of these (€ 495) were pharmacy costs (Table 3.4). Mental health care costs were relatively low at € 45 per patient, but the rate of mental health care utilisation was very low indeed (.03%).

Average costs per VRM patient were € 1362

The average total cost of curative health care for VRM patients in the fourth quarter of 2010 was € 1362 (Table 3.5). A substantial share of these costs, € 823 per patient, was for 'other services'. The cost of general practice care formed a relatively small part of the total.

Table 3.5 Average curative health care costs per VRM patient and per actual user, 4th quarter of 2010 (N = 92,523).

	% of users	Mean costs per user in € (SD)	Mean costs per patient in € (SD)
General practice costs	100	100 (62)	100 (62)
Costs of specialist care	43.3	1016 (2466)	440 (1699)
Other health care costs	100	841 (2016)	823 (1998)
Total curative costs	**100**		**1362 (2859)**

SD = standard deviation.

4
Effects of bundled payment arrangements on curative diabetes costs in comparison to management fee arrangements and care as usual

Outline
This chapter addresses research question 2: 'What effect does the introduction of bundled payment diabetes management have on curative health care costs in comparison to the fee-for-service arrangements with management fees or care as usual?' We approach this analysis in two steps. We first identify the overall effects on curative costs associated with the introduction of diabetes management, with no distinctions made as to pricing systems (section 4.1). We then examine specifically whether the bundled payment arrangements themselves had any distinct influence on the health care costs of diabetes patients (section 4.2). Our analyses are based on regression analyses for 2008 and 2009. The year 2010 could not be included, as not all relevant data had yet been entered into the Vektis databases; the 2007 data were not analysed because of the small patient numbers in some groups. Appendix 5 gives a detailed overview of results.

4.1 What effect did diabetes management programmes have on curative health care costs in comparison with care as usual?

To assess whether diabetes management programmes affected the health care costs of diabetes patients, we combined the bundled payment and management fee subgroups from our sample and compared them to the care-as-usual subgroup. The cost comparison was based on the differences in cost trends between these two groups from 2008 to 2009 (Box 4.1). We began by determining the increase in curative costs for all diabetes patients that year.

Box 4.1 Summary of analysis method in Table 4.1	
Sample:	diabetes management patients (bundled payment + management fee groups; n = 20,257 +13,722 = 33,979) versus care-as-usual patients (n = 30,160), including only patients remaining in same comparison group throughout 2008 and 2009 (N = 64,139)
Dependent variable:	difference in curative costs between 2008 and 2009
Control variables:	baseline curative costs in 2008; patient characteristics (age, gender, comorbidity)
Analyses:	multivariate regression, including two-level models (GP- patient, insurer-patient)
Sensitivity analyses:	(1) patients with oral medication only (A10B) and (2) data from 2007 to 2009

Table 4.1 Cost increases in euros from 2008 to 2009 for diabetes patients (whether or not in diabetes management programmes) (N = 64,139).

		Model 0	SE	Model 1	SE
Intercept		219***	24	-678***	44
2008 baseline costs		-0.6***	0.004	-0.6***	0.004
Age[3] (centred)				16***	2
Gender (ref. = female)				290***	48
Comorbidity (0-15)				1789***	36
Diabetes management patient	yes			142**	47
	no			ref.	

SE = standard error; p-values: ** ≤ .01; *** ≤ .001.

Average costs increased for all diabetes patients

Looking first at the cost trends for all diabetes patients, we found that the average per-patient costs rose by € 219 from 2008 to 2009 (Table 4.1, model 0). This was an increase of 5%, matching the coinciding rise for the Dutch general population (CBS, 2012a). The average curative costs per diabetes patient in 2008 (baseline costs) proved to be negatively associated with the cost increase; that is, the higher the 2008 costs, the smaller the 2009 increase (a 60-cent lower increase for every euro of higher costs in 2008). The patient characteristics age, gender and comorbidity also significantly influenced the cost increase (model 1); older patients, men and patients with comorbid conditions showed higher increases.

Greater cost increases for diabetes management patients

As model 1 in Table 4.1 shows, the 2008-2009 cost trend for patients in diabetes management diverged from that for patients receiving care as usual. After adjustment for patient characteristics, the costs for diabetes management patients increased by € 142 more than those for care-as-usual patients. [3]

Few apparent cost influences from GPs, care groups or insurance companies

Multilevel analyses were carried out to detect any separate influence that GPs or health insurers might have had on the differential cost increases. Detailed results are reported in Appendix 5. These additional analyses indicated that GPs played only a marginal role in the cost increase differential between diabetes management and care-as-usual patients (Table A5.1, model 4). That is, although the increases did vary

[3] Reference age is 67.8

between GPs, the actual GP-level differential cost increase between diabetes management and care as usual was only € 4. Since care-as-usual patients were not being treated in care groups, we could not investigate whether care groups had any such effect overall. We did, however, use the data in the bundled payment comparison group to test for differences between care groups in their per-patient costs for 2009, finding only limited care group-level variation (Table A5.2). We further tested whether care groups with recently implemented bundled payment contracts in 2009 diverged from those with longer-running programmes in terms of per-patient costs, but no differences emerged (see Box 4.2). Nor was any significant effect found for health insurance companies in relation to the 2008-2009 per-patient cost increases (Table A5.1, model 6).

Sensitivity analyses yielded similar results

We tested our findings in two sensitivity analyses. Because we had identified care-as-usual patients in the insurance database on the basis of their medication codes and diabetes management patients by their procedure codes (see Table A3.3), the latter group also included people with type 2 diabetes who were not taking medication. In our first sensitivity analysis, we repeated our analyses including only the patients in both groups who were taking oral medication. The differential cost increase between groups was maintained (Table A5.1, model 7). In the second sensitivity analysis, we repeated our analyses including only those patients whose data over the entire 2007-2009 period were available and who were continuously in the same comparison group. Here, too, the results were highly comparable to the previous ones, with greater cost increases for patients in diabetes management than for care-as-usual patients (Table A5.3).

Box 4.2 Did care groups with bundled payment contracts vary in their per-patient costs?

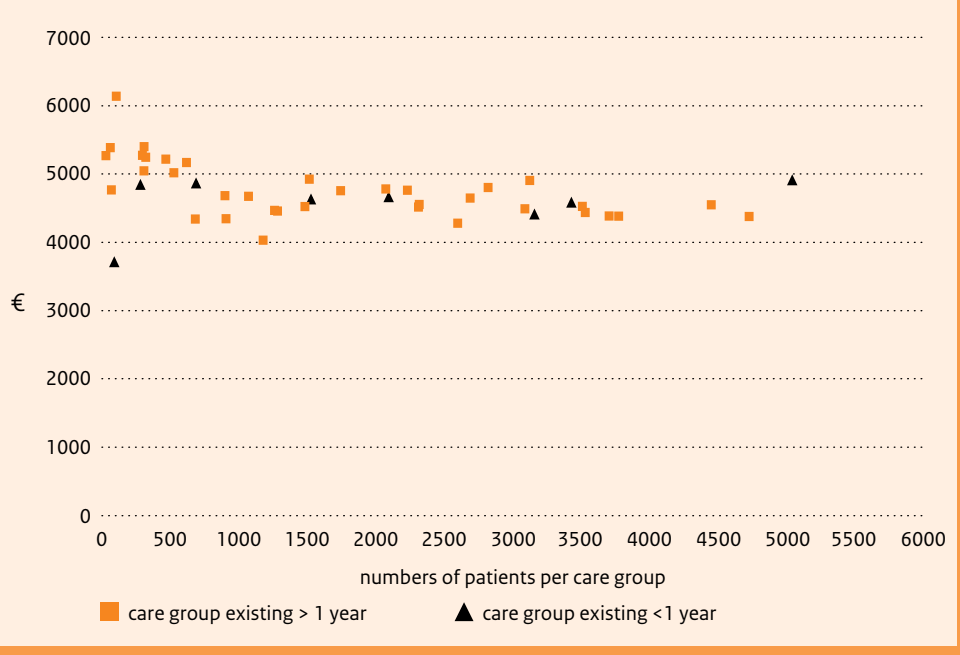
Curative costs per patient varied about € 1000 between care groups

In the figure below, we have plotted the per-patient curative health care costs by care group against the numbers of diabetes patients per care group in 2009. In care groups with more than 650 diabetes patients, the average health care costs per patient ranged between € 4000 and € 5000, a span of about € 1000. Most care groups with fewer than 600 diabetes patients had per-patient costs averaging € 5000 to € 6000. Groups with smaller numbers of sampled patients did not necessarily have fewer diabetes patients in total, as some may have had more patients excluded during the sample selection (see Appendix 3).

No higher costs per patient in start-up year

Care groups that had first begun work in 2009 are denoted by grey dots in the figure below, and older ones by black dots. As no systematic distribution of new groups is evident, we conclude that the year of inception had no influence on per-patient health care costs in 2009.

Figure Mean per-patient curative costs in care groups with bundled payment diabetes management contracts, by numbers of patients per care group, 2009 (N = 52).



4.2 What effect did the introduction of bundled payment diabetes management have on curative health care costs in comparison to management fee arrangements or to care as usual?

We now examine the extent to which the increase in health care costs we observed in section 4.1 could be attributable to the introduction of bundled payment schemes. We addressed this research question in two different analyses. First, we compared the increases in health care costs for those patients in the bundled payment, management fee and care-as-usual groups who stayed in the same comparison group throughout the 2008-2009 period (section 4.2.1). This analysis could identify differences in cost trends between the comparison groups, but could not provide evidence on any causal effects of bundled payments. We therefore conducted a second analysis assessing cost trends for patients who were transferred from management fee to bundled payment arrangements from 2008 to 2009 (section 4.2.2).

4.2.1 Effects of bundled payment arrangements on curative health care costs in comparison to management fee arrangements or care as usual (for patients remaining in same arrangement in 2008-2009)

Our first analysis examines effects of bundled payment amongst patients who stayed in the same comparison group in the two-year period. Box 4.3 describes the method of analysis.

Box 4.3 Summary of analysis method in Table 4.2

Sample:	bundled payment patients (n = 20,257) vs management fee patients (n = 13,616) vs care-as-usual patients (n = 30,160). Reference group: care as usual. All patients remained in the same comparison group throughout 2008 and 2009 (N = 64,033).
Dependent variable:	difference in curative costs between 2008 and 2009
Control variables:	baseline curative costs in 2008; patient characteristics (age, gender, comorbidity)
Analyses:	multivariate regression, including two-level models (GP- patient, insurer-patient)
Sensitivity analyses:	patients with oral medication only (A10B)

Greater cost increases for bundled payment patients than for management fee patients or care-as-usual patients

The health care costs of patients in the bundled payment group increased by € 288 from 2008 to 2009, significantly more than the costs of patients receiving care as usual (Table 4.2). The cost increase for patients in the management fee group did not significantly diverge from that in the care-as-usual group. This implies that the previously observed greater cost increase of € 142 for patients in some form of diabetes management as compared to care-as-usual patients (see section 4.1) is completely accountable to those in the bundled payment group. Supplementary analyses showed that costs were not significantly clustered by GPs or insurance companies (Table A5.4, models 4 and 7).

Table 4.2 Differences in total health care costs in euros from 2008 to 2009 for diabetes patients in same pricing system in both years (N = 64,033)[4].

		Model 1	SE
Intercept		-882***	46
2008 baseline costs		-0,7***	0,004
Pricing system	Bundled payment	288***	55
	Management fee	-74	63
	Care as usual	ref.	
Age[5] (centered)		17***	2
Gender (ref. = female)		296***	48
Comorbidity		1813***	36

SE = standard error; *** p-value ≤ .001.

Sensitivity analyses yielded a similar picture

Here again, an analysis including only those diabetes patients taking oral medication produced very similar results (Table A5.1, model 7).

4.2.2 Effects of bundled payment arrangements on the curative health care costs of management fee patients transferring to bundled payment or care as usual in 2009

Our second analysis of the effects of bundled payment arrangements was designed to detect any causal effects these might have had on health care costs.

Box 4.4 Summary of analysis method in Table 4.3

Sample:	patients who were in the management fee group in 2008 (N = 14,666); comparisons were made between patients who remained in those arrangements in 2009 and those who were transferred to bundled payment or care-as-usual arrangements
Dependent variable:	difference in curative costs between 2008 and 2009
Control variables:	baseline curative costs in 2008; patient characteristics (age, gender, comorbidity)
Analyses:	multivariate regression, including two-level models (GP- patient, insurer-patient)
Sensitivity analyses:	patients with oral medication only (A10B)

The subsample analysed here consisted of patients in our management fee subgroup from 2008. These patients were already receiving diabetes management; only the pricing system changed for some of them in 2009, enabling the isolated effect of that change to be identified. The health care costs of patients transferred to bundled payment in 2009 were compared to the costs of (1) those transferred to care-as-usual arrangements in 2009 and (2) those remaining in management fee arrangements. Box 4.4 summarises the method of analysis applied.

[4] Patient numbers differ slightly from those in Table 4.1, because some care groups had non-existent provider codes.

[5] Reference age is 67.8.

Table 4.3 Differences in curative health care costs in euros from 2008 to 2009 for diabetes patients in management fee arrangements in 2008 (N = 14,666).

		Model 1	SE
Intercept		-751**	256
2008 baseline costs		-0.6***	0.008
Pricing system	Bundled payment	-92	344
	Management fee	-6	254
	Care as usual	ref.	
Difference between bundled payment and management fee groups[6]		-86	n.a.
Age[7] (centred)		18***	4
Gender (ref. = female)		200*	93
Comorbidity (0-15)		1703***	70

SE = standard error; n.a. = not applicable; p-values: * ≤ .05; *** ≤ .001.

Numbers of patients were limited because few care groups worked with management fees in 2008
The total number of patients under management fee arrangements in 2008 was small (N = 14,666) in comparison with the numbers in our other analyses. In 2009, some of these patients (n = 554) were transferred to bundled payment arrangements. Another limited number were transferred to care as usual (n = 496). In view of these small patient numbers, the results should be interpreted with caution.

No significant cost increases for patients transferred to bundled payment arrangements in 2009
As Table 4.3 shows, the cost increases for patients transferring to bundled payment did not significantly diverge from the increases for patients transferring to care as usual or staying in management fee arrangements. No causal effect is therefore apparent between the implementation of bundled payments and the cost increases previously observed in the bundled payment group. Additional analyses controlling for clustering by GPs or health insurance companies did not alter these conclusions (Table A5.5, models 4 and 6).

Sensitivity analyses yielded no different insights
Repetition of the analyses including only patients with oral medication produced no different results than the broader analyses (Table A5.5, model 5).

[6] Using the least-square means procedure.
[7] Reference age is 67.8.

5
Effects of bundled payment arrangements on the numbers of diabetes patients using specialist care

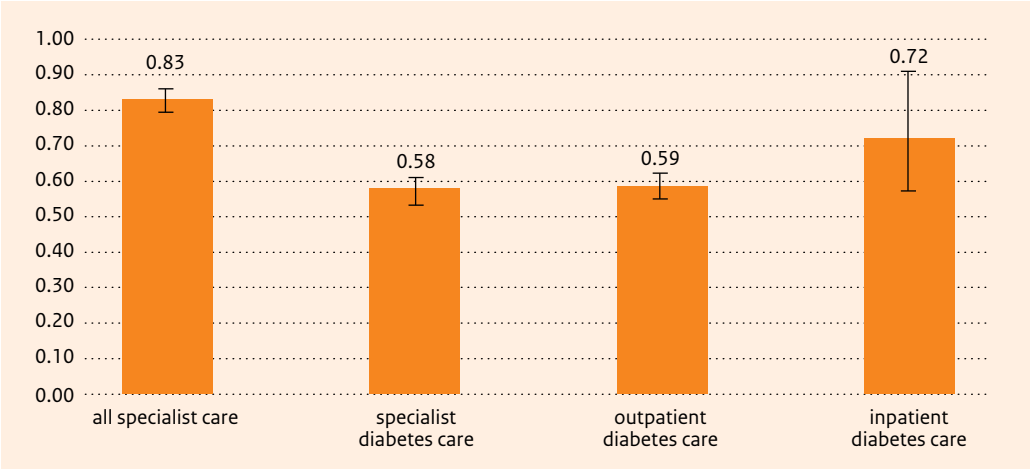
Outline
The aim of the Dutch Ministry of Health, Welfare and Sport in introducing the bundled payment model was to enhance the quality of diabetes management in primary care. Fewer people with diabetes would then need to utilise outpatient or inpatient hospital-based (specialist) care, thus reducing costs. This chapter investigates whether the anticipated decrease in patient numbers in secondary care has actually occurred. Section 5.1 assesses the extent to which diabetes management programmes of any kind are associated with lower utilisation rates of hospital-based services as compared to care as usual. Section 5.2 then examines whether the bundled payment approach in particular has led to an independent reduction in the number of patients using specialist care in comparison to the management fee model or to care as usual.

5.1 Effects of diabetes management programmes on the use of specialist care in 2009

Fewer diabetes management patients used specialist care
As Figure 5.1 shows, almost 17% fewer patients who were participating in any kind of diabetes management programme in 2009 utilised hospital-based specialist services than patients receiving care as usual.[8] The effect of diabetes management stands out even more clearly if we look at diabetes-specific hospital-based specialist services alone: nearly 40% fewer diabetes management patients used diabetes-specific specialist services (OR = 0.58). The latter effect was less pronounced for inpatient than for outpatient care (OR = 0.72 vs 0.59).

[8] The conclusion that 17% fewer diabetes management patients used specialist care derives from the odds ratio of 0.83 (Figure 5.1). An odds ratio (OR) is a comparison between the likelihood that an event will occur in one group and the likelihood that it will occur in another.

Figure 5.1 Differences in the use of hospital-based specialist care in 2009 by diabetes management patients as compared to care-as-usual patients (odds ratios[#]).



Reference category = care as usual; # = adjusted for age, gender, comorbidity and 2008 specialist care utilisation.

Specialist care utilisation varied with age and comorbidity

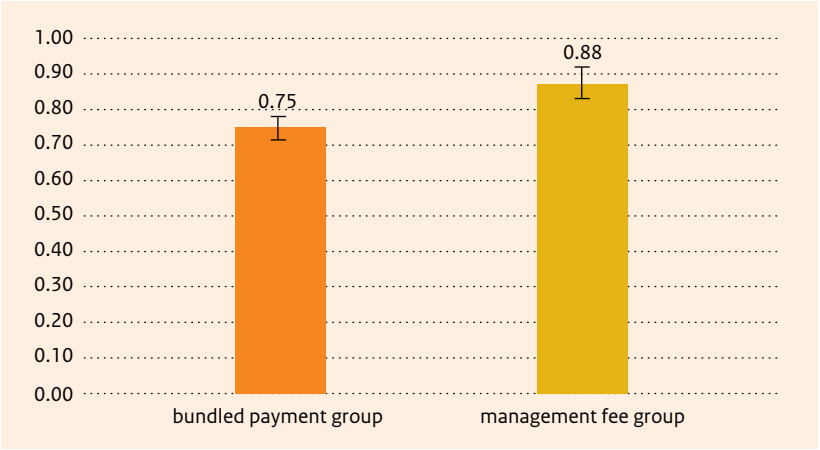
Diabetes patients who were older or who had two or more chronic health conditions were more likely to use specialist care; differences between men and women were not apparent in most analyses (Tables A5.6-A5.9).

5.2 Effects of bundled payment introduction on the use of specialist care in 2009

Patients in bundled payment and management fee groups had lower odds of specialist care utilisation than care-as-usual patients

Distinguishing between diabetes management patients in bundled payment programmes and in management fee programmes and comparing each of them to the care-as-usual group, we found that both of the former groups were less likely to call on hospital-based services. Nearly 25% fewer bundled payment patients and nearly 12% fewer management fee patients did so in 2009 as compared to care-as-usual patients (see Figure 5.2 and Table A5.10, model 0). An additional comparison between the two groups of diabetes management patients showed that the difference between them was also significant (Table A5.10, model 2).

Figure 5.2 Differences in the use of hospital-based specialist care in 2009 by bundled payment patients and by management fee patients as compared to care-as-usual patients (odds ratios#).



Reference category = care as usual; # = adjusted for age, gender, comorbidity and 2008 specialist care utilisation.

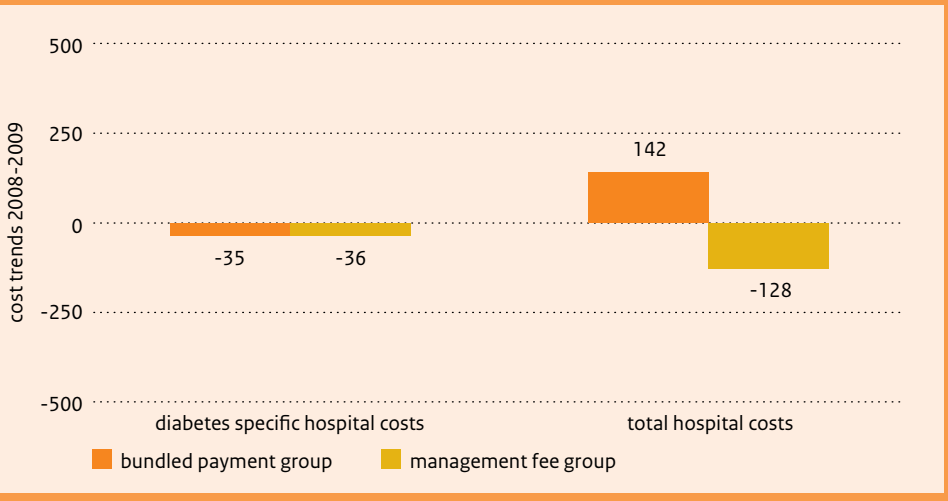
Patients transferring from the management fee group to other pricing models did not differ significantly from non-transferred patients in terms of specialist care utilisation

In a subanalysis, we examined the use of hospital-based services by patients who were in the management fee group in 2008 (N = 14,661). We compared patients who were transferred to another pricing model in 2009 to those who remained in the management fee group. In 2009, 554 patients were transferred to bundled payment arrangements and 496 to care as usual (see section 4.2.2). No significant effect of the transfer emerged for either of those groups in terms of numbers of patients using hospital services (see Table A5.11, model 1), implying that the pricing system itself had no substantial influence on the use of specialist care in the transferring groups. These findings should be interpreted with caution in view of the very small patient numbers in the groups.

Box 5.1 Lower hospital utilisation rates in bundled payment group not associated with hospital cost savings

As analyses in chapter 5 show, both bundled payment and management fee patients were less likely to utilise hospital-based specialist care in 2009 than patients receiving care as usual, and they were even less likely to use diabetes-specific hospital-based specialist services. At the same time, curative health care costs increased that year in the bundled payment group (chapter 4). As this raised the question of whether the reduced numbers of patients using hospital care led to reduced hospital costs in 2009, we conducted additional analyses.

Figure Hospital costs from 2008 to 2009 for bundled payment and management fee patients, adjusted for age, gender, comorbidity and baseline diabetes-specific hospital costs for 2008 (in €).



The additional analyses found reductions in diabetes-specific specialist care costs of about € 35 for both the bundled payment and the management fee patients. In terms of total hospital costs, however, the cost savings in the management fee group were € 126 per patient, whereas patients in the bundled payment group showed cost increases of € 142. This indicates that about one half of the differential cost increase of € 288 observed between the bundled payment and care-as-usual groups (see Table 4.2) may be explained by diverging increases in their hospital costs. By implication, the cost savings achieved by reducing diabetes-specific hospital costs for bundled payment patients were more than offset by the increased costs of the non-diabetes-specific hospital services used by those patients. It is unclear how to explain these diverging cost trends in the light of the coinciding sharper drop in the numbers of patients using specialist care in both the bundled payment and the management fee groups.

6 Discussion

The purpose of this study was to estimate the effects of the introduction of diabetes and vascular risk management programmes on the macro costs of Dutch health care, and to specifically gauge the effects of the bundled payment model as a pricing mechanism for such programmes. In section 6.1 below, we briefly summarise our findings for each of the research questions we posed. Section 6.2 discusses our research methods and section 6.3 considers our research findings in perspective. Section 6.4 makes recommendations for policy and for future research.

6.1 Summary of findings

Research question 1a:	What was the current scale of implementation of diabetes and vascular risk management programmes that are covered by bundled payment contracts?

Diabetes management programmes based on bundled payments were available almost everywhere in the Netherlands, but VRM programmes only in limited regions

Nearly 100 care groups had contracts for integrated diabetes management on a bundled payment basis in 2010, covering virtually the entire country. Vascular risk management (VRM) programmes were only available in 2010 through seven care groups in the south of the country.

Research question 1b:	What curative health care costs did people generate when they received care in disease management programmes for diabetes and vascular risk?

Average yearly costs of diabetes patients just under € 4800 in 2009

The curative costs for diabetes patients (average age 67) were about € 4800 in 2009. That is € 1300 more than the health care costs for the Dutch population aged 65 to 69 (Slobbe et al., 2011). General practice costs for diabetes patients came to approximately € 400 per year. The largest cost categories pertained to hospital-based specialist care (€ 2500) and pharmacy products (€ 1100). Costs varied for different types of

patients. In particular, patients with more than one chronic disease had additional costs of about € 2600 a year per comorbid condition.

Average quarterly costs of VRM patients about € 1350 in fourth quarter of 2010
Costs for patients in VRM programmes had to be calculated on the basis of insurance claims data from the fourth quarter of 2010, because only one care group had a bundled payment VRM contract for the entire year; the other six contracts took effect in the course of that year. The average quarterly curative costs were approximately € 1350 per VRM patient. General practice costs amounted to only € 100, but the costs of other care exceeded € 800 per patient, almost € 500 of which was for pharmaceutical products. A total of 43.3% made use of specialist care.

Research question 2:	What effect did the introduction of bundled payment diabetes management have on curative health care costs in comparison to the fee-for-service arrangements with management fees or care as usual?

Greater cost increases for bundled payment diabetes patients
For all patients receiving diabetes care of any type, the average cost increase from 2008 to 2009 was € 219, or 5%, comparable to the general cost rise in Dutch health care that year. In comparison to the diabetes patients receiving care as usual, those in bundled payment programmes generated an additional cost increase of € 288, whilst the cost rise for management fee patients did not significantly diverge from that for care-as-usual patients.

Research question 3:	Did the introduction of bundled payment diabetes management lead to reductions in the numbers of people with diabetes who utilised specialist care in comparison to arrangements with a management fee or care as usual?

Nearly 25% fewer patients in bundled payment diabetes management used specialist care in 2009 as compared to care-as-usual patients
In comparison with patients receiving care as usual, almost 25% fewer patients in diabetes management programmes based on bundled payments utilised some kind of specialist care in 2009. Diabetes-specific specialist care was used by nearly 40% fewer patients in the diabetes management programmes based on either bundled payment or management fees.

Despite lower rates of specialist care use, a cost reduction did not materialise
Although the reduced numbers of diabetes patients using specialist care resulted in per-patient savings of € 35 in the costs of diabetes-specific specialist care in 2009, the total cost increase for all types of specialist care was over € 140 higher per bundled payment patient. This implies that half of the additional cost increase of € 288 generated by bundled payment patients was due to their increased costs of specialist care. No such additional rise in specialist costs was seen for patients in management fee arrangements; in fact, their specialist costs rose by € 128 less than those of care-as-usual patients. It is still unclear what may have caused the cost divergence between bundled payment and management fee patients.

No causal effects of bundled payments on cost trends have yet emerged
Initial analyses of possible causal effects of bundled payment arrangements on cost trends showed that management fee patients transferring to the bundled payment comparison group did not generate significantly different cost increases from those transferring to the care-as-usual group. Nor did the cost increases of those transferring to the bundled payment group diverge significantly from those of patients who remained in the management fee group. Due to small patient numbers, these findings should be interpreted with caution.

6.2 Research methods

The analyses carried out for this study were based on databases from the Vektis health care information centre. The major advantage of that source was that we could include data from all Dutch health insurance companies; some limitations of it are noted in section 6.2.1. Limitations of our methods of analysis are discussed in section 6.2.2.

6.2.1 Data

Incomplete data for 2007 and 2010
The Vektis data for the years 2008 and 2009 were suitable for use in our longitudinal analyses of the effects of the bundled payment approach on the health care costs of people with diabetes. As a consequence of the long period of time needed by Vektis to get all claims data entered into its databases (two years for specialist and mental health care), the costs generated by diabetes patients in 2010 were not fully retrievable at the time of our analyses. For 2007, the Vektis databases did not yet include mental health care. The complete costs of curative care for those years were therefore not available for longitudinal analysis; our longitudinal analyses therefore cover a two-year time frame in 2008 and 2009.

Limited information available on VRM due to low number of contracts in 2010
Since only seven care groups had contracts for bundled payment VRM programmes in 2010, and only one of them from 1 January, the total costs of VRM patients could not be ascertained for the entire year. Because no VRM data was obtainable elsewhere, we have reported the health care costs of the VRM patients for the fourth quarter only of 2010 for the seven care groups providing VRM. These qualifications need to be borne in mind in interpreting the data.

No data analysed on COPD management
It was not possible within the time available to address all the research questions formulated by the Bundled Payment Evaluation Committee (EIB) about the effects of bundled payments on the costs of Dutch curative health care. After consulting with the EIB, we decided to document the cost effects of bundled payment in diabetes management as thoroughly as possible and to forego analysis of the COPD bundled payment programmes.

The analysed health care costs were limited to those covered by the basic health insurance package and the associated policy excesses
Dutch health care is paid for from various sources, including the basic statutory insurance package, patient contributions and the Exceptional Medical Expenses Act (Awbz, which covers 'non-insurable risks'. For a detailed description of the Awbz see Appendix 1). The Vektis databases are limited to the costs covered by the basic package, also allowing for the compulsory policy excess and any voluntary excess. Although Dutch policyholders can take out supplementary policies to insure additional health care risks, neither those costs nor the Awbz costs are recorded by Vektis, and we could therefore not take them into account in our study. In reality, then, the costs of diabetes care will be higher than those reported here, but we do not believe this limitation had any substantial influence on our research conclusions. The bulk of Dutch diabetes management costs are covered by the basic package, and any limitations of the Vektis data should have affected all our comparison groups in equal measure.

Bundled payment data not correctly reported by all insurance companies
In the course of the research project, it emerged that not all Dutch health insurance companies had furnished Vektis with correctly coded data. As a consequence, a large percentage of policyholders who were in bundled payment diabetes management were not identifiable in the Vektis databases. The problem was rectified by the largest companies (see section A3.1.3) but not by several small ones. This means that the implementation of the disease management programmes could not be documented in its entirety. That can be seen in our geographical depiction of the rollout of the diabetes programme (Figure 2.1), as one of the small companies had many policyholders in northern regions. This slight shortcoming could not have affected our conclusions about cost trends, because the small insurers in question had but a 3% share of the market in 2009.

6.2.2 Methods of analysis

Year 2007 not included in longitudinal analyses
Although bundled payment for diabetes management was possible from 2007, the numbers of patients taking part were still limited, and many patients were switched from one pricing model to another in the 2007-2009 period. We therefore decided against including 2007 in our longitudinal analyses, but we did employ the 2007-2009 dataset for sensitivity analyses, and these did not suggest any different conclusions.

Comorbidity identified via 2010 medication claims data
We adjusted our analyses for systematic differences between the three comparison groups in terms of the patient characteristics of age, gender and comorbid chronic conditions. Patients with comorbid chronic conditions were identified on the basis of drugs prescribed for more than 180 days from specified pharmaceutical cost groups (CVZ, 2009). Up to sixteen chronic diseases could be identified in this way. The percentage of patients identified with comorbid conditions in our study was 34.5%, lower than in another recent study that determined comorbidity using codes from the International Classification of Primary Care (ICPC), which enables more chronic conditions to be distinguished (Van Oostrom et al., 2011). It is unlikely, though, that our underestimated comorbidity rates would have biased our results and conclusions, since the underestimate would have equally affected all three comparison groups.

Identification of diabetes patients receiving care as usual was based on prescribed oral medications
Diabetes patients receiving care as usual were identified on the basis of claims data reflecting their use of diabetes medication. Persons taking oral diabetes drugs (A10B codes in the ATC classification), and who had no procedure codes claimed for bundled payment or management fees, were assigned to the care-as-usual comparison group. Patients with A10A (insulin) codes only were not included, in order to minimise the numbers of type 1 diabetes patients in the care-as-usual group. Although this inadvertently excluded some insulin-only type 2 patients, we believe that number was very limited, as most type 2 insulin patients also take oral drugs. This selection technique also resulted in the omission from the care-as-usual group of diabetes type 2 patients whose treatment consisted not of drugs, but of a diabetes-specific diet. To check the accuracy of our comparisons, we therefore conducted additional sensitivity analyses restricted to patients taking A10B drugs in the bundled payment and management fee groups (consistent with the care-as-usual group). No different results emerged.

To ensure optimal between-group comparisons, patient assignment was based on their GP's pricing category
To enable the most meaningful possible comparisons between the groups representing the different pricing mechanisms, we assigned patients to the three comparison groups on the basis of the pricing category associated with the GP with whom they were registered. Hence, if a diabetes patient's GP was providing diabetes management based on bundled payment, that patient was assigned to the bundled payment comparison group, even if she or he was not currently receiving treatment under that diabetes management programme. This enabled the health care costs of patients of bundled payment GPs to be taken into account in the bundled payment cost calculations, even if they were receiving secondary care treatment the entire year (meaning that no primary care bundled payment was being claimed for them). Had we assigned patients on the basis of their own insurance claims, the costs of such secondary care patients would have been apportioned to the care-as-usual group, resulting in systematic overestimation of the care-as-usual costs and underestimation of the costs of bundled payment patients. Analyses showed that 15% of the bundled payment comparison group were not actually in a primary care diabetes management pathway at the time of the study.

All investment costs were apportioned to diabetes management programmes
Recent research has shown that half of all care groups have meanwhile contracted a COPD management programme and one quarter have a VRM programme, in addition to their diabetes programme (De Jong-van Til et al., 2012). Implementing a second or third disease management programme should entail fewer investments, because many start-up expenses will have already been borne during the implementation of the first programme. Per-patient overhead costs should also decline. Since these potential economies of scale could not be taken into account in our current analyses, all non-recurring investment costs were defined as diabetes management implementation costs, resulting in an overestimate of the costs of bundled payment diabetes management. It will be interesting in future research to assess the effects of bundled payment on health care costs in cases where several different disease management programmes are involved.

6.3 Discussion

We shall now discuss our findings in more detail, distinguishing three topics: the bundled payment model, care groups and health insurance companies.

6.3.1 Bundled payment model

Findings consistent with other studies?
The results of our study have shown that the health care costs of diabetes management patients in the bundled payment group rose more steeply than those of patients in the management fee group. These results and conclusions are consistent with those in another recent study by the Achmea insurance group (Sprangers et al., 2012). In an analysis of data on Achmea policyholders and those of their Agis subsidiary in the 2006-2009 period, the researchers likewise concluded that the costs of disease management patients under bundled payment contracts had increased more strongly than the costs of those in programmes supported by management fees. Like us, they also reported a decline in the use of hospital-based specialist care resulting from bundled payment introduction.

Yet the results of our study differ markedly from those of another recent study by the VGZ insurance company, which indicated that its own diabetes patients generated a cost reduction amounting to 40% of the total health care costs. Because the final report of that study (VGZ, 2012) was not available when we completed the present study, we could not explore why those results diverged so sharply from our own findings and those of the Achmea study.

Bundled payment has not yet resulted in cost reductions in secondary care
The expectation was that the introduction of bundled payment for diabetes care would help improve the organisation of care and encourage the reallocation and delegation of tasks, thereby keeping more patients in treatment in the primary care sector. The present study found that care groups with bundled payment contracts had been able to reduce the numbers of patients using specialist care by almost 25% as compared to care as usual. Limited cost savings were also achieved in terms of diabetes-specific episodes of specialist care, but no overall reduction occurred in specialist care costs. The reasons are unclear. One possibility is that patients were being referred to secondary care later (and perhaps too late) as a result of the introduction of disease management programmes. That could have made their care needs more complex and more expensive. Other possible reasons for the higher specialist costs could be a choice for more expensive specialist procedures than medically necessary or the submission of claims for more than one, or for overlapping, procedures for the same patient (overclaiming) (Hasaart, 2011). There is also evidence that some medical specialists choose the most lucrative treatment options (Dafny, 2005; Hasaart, 2011). More research on these issues could clarify the underlying mechanisms.

Long-term effects of bundled payments on health care costs are unknown
Our analyses in the present study are based on health insurance claims data from 2008 and 2009. That period may be regarded as the start-up phase, in which both care groups and insurance companies were accumulating experience with the contracting and delivery of disease management programmes on a bundled payment basis. Other studies have found that more double payments than necessary occurred for certain procedures in that period (Sprangers et al., 2012; Struijs et al., 2010a). We could shed no more

light on this in the present study. Another difficulty is that a study time frame of two years is probably too short to estimate the full impact of the bundled payment model. In the clinical course of diabetes, many complications do not develop until later, and short-term findings like these may well underestimate the eventual effects of bundled payments. It is also conceivable that the expected reduction in health care costs from bundled payments is less likely to be achieved in diabetes care than in the management of other diseases, as the Dutch 'care as usual' for diabetes was already of a high standard as compared to that in many countries (Rutten, 2008). That would make it all the more interesting to study the effects of bundled payments on the health care costs of VRM and COPD patients. In view of the considerable time lag before insurance data gets fully entered into the Vektis databases (two years for specialist care), it will be several years before more empirically supported conclusions can be reached on the effects of bundled payments on diabetes, vascular risk and COPD management.

Interplay between disease management programmes for different chronic conditions not yet systematically studied

The present study has focused primarily on the effects of bundled payments on diabetes management. Effects on the management of COPD and vascular risk could not yet be quantified. It is therefore not yet possible to investigate any economies of scale that might arise when care groups contract two or more disease management programmes. Contracting such programmes in combination could eventually deliver cost savings, but it will be several years before more clarity can be obtained about the linking of programmes and the first tentative outcomes. One problem in systematically assessing bundled payments for other medical conditions than diabetes would lie in the difficulty of identifying a control group on the basis of medication data. That would be impracticable for many diseases.

It is unclear whether bundled payment has increased the influx of patients into disease management programmes

There is evidence that some patients have been inducted into diabetes management programmes who do not (or do not yet) fully satisfy the diagnostic criteria for diabetes (Struijs et al., 2010b). Interviews revealed that some GPs admitted 'marginal cases' to diabetes programmes, because they expected those patients to develop full-blown diabetes in the foreseeable future. They considered the early inclusion medically appropriate to enable timely intervention in existing risk factors. In the present study we were unable to investigate whether this 'magnet effect' of bundled payment arrangements actually existed and how it might have affected health care costs.

6.3.2 Care groups

Curative health care costs per patient varied between care groups, possibly due to differing content or organisation of services

The average curative health care costs per diabetes patient ranged by care group from € 4000 to € 5000. Almost all care groups showed wide standard deviations in their average costs per patient, meaning that some patients had low costs and others extremely high costs. Care groups appear to have limited influence over their per-patient costs. Earlier research on care groups has found considerable organisational variation between them in terms of how they design, coordinate and manage the contracted services (De Jong-van Til et al., 2012). As care groups develop further, the organisation and content of their disease management programmes tend to evolve.

One possible cause of the large differences in per-patient costs may lie in the variations in organisation and content.

Quality variations hold potentials for improvement
Care groups have also been found to vary in the quality of the care they deliver (Adviesgroep Ketenzorg et al., 2012; Struijs et al., 2012). Information on the causes of the variations observed in both the costs and the quality of care will be essential to further improve the efficiency of diabetes care. This also raises questions about what activities and what infrastructural elements promote quality and cost improvements. Research on such topics could support health insurance companies in determining the infrastructural and organisational requirements they make on care groups as they negotiate contracts. Care groups, for their part, could benefit from such research as they make decisions about the further development of their disease management programmes and organisational arrangements.

6.3.3 Health insurance companies

Hesitancy by health insurers explains limited VRM implementation
As this study has shown, the implementation of vascular risk management programmes based on bundled payment had not really got off the ground by 2010; this was confirmed in later research (De Jong-van Til et al., 2012). A key determining factor in VRM implementation is the attitude of a care group's preferential insurance company towards the bundled payment approach. A number of companies are hesitant to enter into VRM contracts (Romeijnders et al., 2011). There are several possible explanations for this reluctance. For one thing, the existence of unambiguously interpretable standards of care for the medical condition in question appears to be an important prerequisite for implementing a disease management programme (Struijs et al., 2010; Struijs et al., 2010a). The Health Care Standard currently in place for VRM does not define a clear-cut patient population for inclusion in disease management. Consequently, wide variations exist between care groups in terms of the numbers of patients to receive treatment and the resulting costs (Romeijnders et al., 2011). Secondly, a number of insurance companies are not, or not yet, convinced of the concept or model of bundled payment. They have misgivings about whether bundled payment achieves the intended efficiency improvements, or they suspect these can be better achieved via fee-for-service care supplemented by a management fee (EIB, 2012). To gain more experience with bundled payment, these insurers have only contracted VRM programmes for a limited number of care groups.

6.4 Recommendations

In the light of the discussion in section 6.3, we have developed several recommendations in support of the future efforts of policymakers and health care professionals.

Experimentation by insurers with the combined purchase of primary and secondary care to ensure complementary financial incentives
Our results have shown that although the numbers of diabetes patients using specialist services were reduced, no corresponding reduction in secondary care costs was achieved. This could be a consequence of the current pricing system for specialist services, which is mainly based on fee-for service payments. It

is advisable to experiment with financial incentives in both primary and secondary care that are consistent with the goals of the bundled payment model – quality enhancement aligned with cost savings.

Research needed on long-term effects of bundled payments, including the effects of several disease management programmes in combination
It is not yet known what the effects of bundled payments will be in the longer term. A replication of the present study over a longer time frame, with an added focus on the combined cost effects of two or more disease management programmes, seems essential to determine the ultimate value of the bundled payment model.

Research needed on the (cost)effectiveness of the bundled payment approach: the relationship between the content, quality and costs of disease management programmes
A number of different studies have investigated the effects of bundled payments on health care quality (Adviesgroep Ketenzorg and Landelijke Vereniging Georganiseerde eerste lijn, 2012; Van Dijk et al., 2011; Smeele et al., 2012; Struijs et al., 2012). The present study and the studies by two Dutch insurance companies (Sprangers et al., 2012; VGZ, 2012) have provided initial findings on the cost effects. Yet the role played by the health care content of disease management programmes has so far been largely passed over, even though the quality and cost effects of the bundled payment approach and the disease management approach are difficult to interpret without knowing what health care services are included in the programmes. It is therefore important for future research to assess the quality, the costs and the content of the care in conjunction with one another. This should include special attention for causes and explanations of the considerable variations between care groups in terms of the quality, costs and content of the services they deliver.

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Appendices

Appendix 1 The Dutch health care system

The Netherlands has a unique but complex health care system. Insight in the idiosyncrasies of the system may help to appreciate the significance of the introduction of the bundled payment model and the results of the present evaluation. This chapter focuses on the organisation and funding of the Dutch health care system, against the background of the system reforms introduced in 2006. But first, some population and demographic data are presented.

Population and demographics

In 2012, 16,730,348 people are living in the Netherlands, 49.5% being male (CBS Statline, 2012b). In 2011, 180,060 children were born and 135,516 people died (CBS Statline, 2012c; CBS Statline, 2012d). Infant mortality was 3.8 per 1000 life born children (CBS Statline, 2011). Life expectancy at birth is 79.0 for males and 82.7 for females (CBS Statline, 2012e). Like other Western countries, the Dutch population is ageing. That process is expected to reach its peak at the end of 2040. The percentage of persons of 65 years and over in that year is estimated to be 25.9% as compared with 15.6% in 2011 (CBS Statline, 2010).

January 2012, 20.9% of the Dutch population has a foreign background: 11.5% non-Western (first and second generation) and 9.3% non-Dutch Western. The largest groups of people of non-Dutch Western origin are from Germany (376,606), Belgium (114,022) and Poland (100,775). The largest groups of people of non-Western origin are Turkish people (392,923), Moroccans (362,954) and people from Surinam, a former Dutch colony (342,016) (CBS Statline, 2012f).

Health system reforms

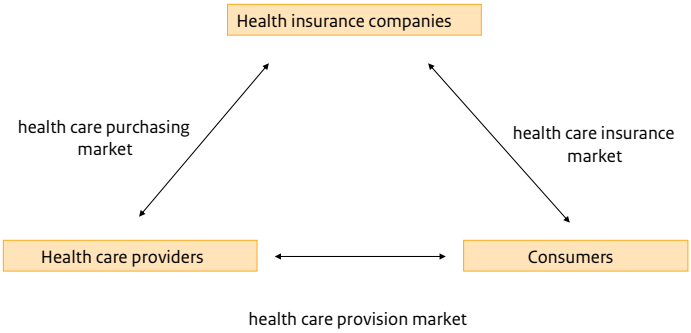
2006 was a landmark year for the Dutch health system. Minor changes to the health care system had been gradually introduced in previous decades, to culminate in the introduction of market forces and competition on a much wider scale in 2006. By opening up the health care market to more competition it was aimed to keep health care affordable while ensuring good quality care and accessibility for all. The health care market is not an entirely free market; it is a regulated market, as it is subjected to laws and regulation to safeguard public interest. Quasi-governmental, independent oversight bodies monitor whether these rules are observed by the market players (Schäfer et al., 2010). To make the health care market work, the stakeholders in health care, i.e. the care consumers, the providers of care and the health insurers, were assigned a much more prominent role, while the government, although still pulling the final strings, assumed a less controlling role. The legal foundation for the new health system was laid by the Health Insurance Act (Zorgverzekeringswet (Zvw)), the Health Care Institutions Admission Act (Wet toelating zorginstellingen (Wtzi)) and the Health Care Market Regulation Act (Wet marktordening gezondheidszorg (Wmg)), which came into force in 2006.

The main features of the new health system are a mandatory 'basic' health insurance for everybody that covers essential medical care, mandatory acceptance for the 'basic' health insurance by the insurer, enrolees are allowed to switch insurer at the beginning of each year, there are in-kind and restitution policies, there is risk equalisation for insurers. Health insurers are private companies, although not all of them are profit-driven, price negotiations are limited, and there is selective contracting on certain conditions.

Health care market

The health system reforms introduced market forces into the health care market to a far wider extent than before. The three market players, i.e. the patients or consumers, the care providers and the insurance companies, were consigned far more prominent roles in making the health care market work. The health care market consists in three subsidiary markets: the health care provision market, the health care purchasing market and the health insurance market. The three markets are interrelated: for a single market to work, the other markets have to work too (see Figure 2.1).

Figure A1.1 The Dutch health care system and its three markets.



On the *health care purchasing market* health insurers purchase care from health care providers. For this market to work properly, they should purchase good-quality care at competitive prices. Insurers indicated, however, that quality of care played hardly any role in the purchase of care, because of a lack of relevant information (NZa, 2010a). Extensive efforts have been made to make quality of care more transparent. Such efforts include the development and use of quality indicators by, e.g., the Health Care Inspectorate (Inspectie voor de Gezondheidszorg (IGZ)) and in the framework of the Transparent Care programme (Zichtbare Zorg). To monitor consumer experiences with (quality of) care, the Centre for Consumer Experience in Health Care (Centrum Klantervaring Zorg (CKZ)) has developed Consumer Quality indexes. Results, although still limited, are made accessible through websites like kiesBeter.nl and Consumentenbond.nl. As of January 2013, the Quality Institute in formation (Zorginstituut Nederland) is to support and coordinate these efforts to make the quality of care more transparent.

Slowly but gradually health insurers are starting to purchase care on the basis of quality. The four main health insurance companies, Achmea, UVIT/VGZ, CZ and Menzis (together about 15 million insured) have formulated quality standards for a number of surgical procedures. Hospitals that fail to meet these standards will not be contracted and/or will not get a favourable rating (Achmea, 2012; VGZ, 2011; CZ, 2012; Menzis, 2012). Selective contracting by health insurers is still limited, but it is expected to grow considerably in the near future (Evaluatie risicoverevening Zvw, 2012). For hospital care, selective contracting is the case with specific bundled payment schemes and independent treatment centres (Zelfstandige Behandel Centrum (ZBC)).

Competition on price is possible to a certain extent depending on the type of care. As to hospital care, a distinction is made between a regulated segment (formerly called A-segment) and a free segment (former B-segment). The rates for services provided in the free segment are the result of negotiations

between providers and insurers, while the rates for services in the regulated segment are fixed. The size of the free segment has grown considerably; from 6% in 2006 to 30% in 2010 to be increased to about 70% as of 2012 (Taskforce, 2012). The rates for physiotherapy have been freely negotiable since 2008. Bundled payments for Diabetes type 2, COPD and VRM (vascular risk management) are negotiated between the care groups and the health insurers. The rate of GP care is negotiable for a small part only, i.e. a subsidy for Modernisation and Innovation (M&I) (Taskforce, 2012). At the beginning of 2012 the fixed fees for dental care were abolished. As this has lead to an increase in costs, this decision is to be reversed as of January 2013 (VWS, 2012a). The influence of health insurers on the purchasing market has probably been most pronounced in relation to medicines, due to the introduction of the Medicine Reimbursement System (Geneesmiddelen Vergoedings Systeem (GVS)). This system presents a 'preferred' medication list; unless medically indicated, only preferred medicines are reimbursed by the health insurer.

On the *health insurance market* health insurers supply health insurance, which is purchased by consumers. Since the Zvw, all health insurers are private companies and are allowed to make a profit and pay dividends to shareholders (Schäfer et al., 2010). However, there are a number of health insurance companies that operate on a non-profit basis.
Health insurers are allowed to compete on quality of care, services and premium. They can do so by for instance purchasing care from providers of their choice, operating certain bundled payment schemes or running their own care facilities. After the introduction of the Zvw and the mandatory basic health insurance in 2006, competition among health insurers has been especially fierce on premium, even to the extent that they incurred losses. They made a profit on the basic insurance for the first time in 2009, and again in 2010 and 2011. Competition on coverage of the basic health insurance package is hardly possible, as under the Zvw coverage it is the same for all basic packages. It is allowed for insurers to offer a slightly extended basic package to their enrolees, but this is by no means common practice.
For the insurance market to work, consumers need to be able to switch health insurers. This is provided for by the Zvw, which allows the insured to change insurer at the beginning of each year. In 2006, 18.1% of the enrolees took advantage of this provision and switched. Since then, this percentage dropped to pre-Zvw levels of about 3.5% to steadily rise again during the last few years (see Table A2.1).

Table A2.1 Health insured mobility, (2005-2012) (Vektis, 2012).

	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Switchers total (%)	18.1	4.5	3.5	3.5	4.1	5.5	6

Under the Zvw, insurers have an obligation to accept all applicants living in the Netherlands or abroad who are compulsorily insured under the Zvw. To compensate insurers for enrolees with a predictably higher care consumption and thereby to prevent risk selection, there is a risk equalisation scheme. The scheme distributes funds from the Health Insurance fund across the health insurers on the basis of the risk-profiles of enrolees.
Information on insurers and insurance packages is provided by websites like kiesBeter.nl and Independer.nl. They present for all health insurers, for both basic and complementary health insurance packages, conclusive lists of services covered plus premiums. This enables consumers to choose a package according to their needs or on premium.

On the *health provision market* health care suppliers provide care to care consumers. Still, as previously stated, information on quality of care is hardly available, making it hard for the care consumer to make an informed choice regarding care providers. Consumers are increasingly using the Internet to look for information on care providers and quality of care. The website kiesBeter.nl offers information on quality of care for a number of care services and enables a comparison, although limited, between care providers. For a large number of care providers (some) quality data are still lacking. Performance qualifications are based on data from the programme Zichtbare Zorg and data from the providers themselves. The website Consumentenbond.nl allows consumers to select hospitals that offer the best treatment for 20 diagnoses, including diabetes and several forms of cancer. The qualifications are based on CQ indexes and the results of expert panels. Consumers with a pgb (personal care budget) or a VPZ-budget (Reimbursement scheme personal care) are able to buy care from either professional or informal caregivers of their own choice, or from both. Very little is known of the quality of care funded by these budgets.

Health insurance system

The Dutch health insurance system consists in three 'compartments' (Schäfer et al., 2010). The *first compartment* comprises a compulsory social health insurance scheme for long-term care, which is regulated by the Exceptional Medical Expenses Act (Algemene wet bijzondere ziektekosten (Awbz)). The Awbz is funded by social security premiums, taxes and income-related co-payments. The Awbz premium paid by everybody is 12.5% of income before tax, to a maximum of € 4114 per year in 2012. Especially for people living in institutions with a limited income, co-payments may take up the major part of their income. The Awbz covers chronic care that is in principle too expensive for the private market. It includes nursing, medical and residential care for the elderly, people with mental or physical disabilities and chronic psychiatric patients, support care people need to avoid neglect or to enable them to remain living in their own home, Government Vaccination Programme, and pgb. Everyone who lives in the Netherlands is insured under the Awbz. To be eligible for Awbz care, a request must be submitted to the Centre of Needs Assessment (Centrum Indicatiestelling Zorg (CIZ)). CIZ determines whether one is entitled to Awbz care as well as the kind and amount of care one is entitled to. The responsibility for organising and purchasing that care remains with regional care offices (zorgkantoren), which are affiliated with health insurance companies. The Ministry of Health, Welfare and Sport intends to abolish these offices and to have insurers take over their tasks as of January 2013, thus to improve the coordination of care between the first and second compartment, i.e. long-term care and cure (VWS, 2011). It would also make the insurers carry the financial risk related to managing Awbz-care.

Applicants may opt for care in kind or, with some exceptions, for a pgb or a VPZ-budget. Care in kind is provided directly by regular care service providers and home care providers. A pgb and VPZ enable people themselves to organise and purchase the care they need with people or providers they want. The indication criteria for the pgb and VPZ differ. Because of the high and rising costs of Awbz care, the government is looking for ways to cut costs. Thus, as of 2012, for people to be eligible for a pgb they need a CIZ indication for residential care.

The *second compartment* consists in a social health insurance scheme for basic health insurance, which is regulated by the Zvw. It substitutes the former two-tier system of state-regulated compulsory sickness funds for people on a lower income and private health insurance schemes for people on a higher income. The scheme is paid for in two ways. Every insured person (with the exception of children up to the age of

18 who are paid for by the state) pays a 'nominal' flat premium to the health insurer and an income-related contribution to the Health Insurance fund. The nominal premium is the same for people with the same insurance policy regardless of age, income, wealth, or health and averaged € 1094 in 2008 rising to € 1287 in 2012. Collective contracts and voluntary excess (€ 100 - € 500) are the exceptions to this rule, as they allow for a premium discount. Collective contracts are contracts between insurance companies and specific groups of people, like company employees or patient organisations. In 2012, 67.6% of all insured had a collective insurance with an average premium discount of 3.7%.
In an attempt to make people more aware of the costs of health care, a compulsory excess of € 150 for everybody was introduced in 2008. It has steadily increased and amounts to € 220 in 2012 (and € 350 in 2013). Excluded from compulsory excess are children up to the age of 18, GP-care, obstetrics and maternity care. Although growing, the proportion of insured with voluntary excess is small, 7% in 2012 (Vektis, 2012). To compensate low-income households for the nominal premium, they are entitled to a health care allowance under the Healthcare Allowance Act (Wet op de zorgtoeslag (Wzt)). The allowance depends on the number of persons per household and income.
The contribution to the Health Insurance fund is levied through taxes. For employees it is deducted from their salary by their employers, who are legally obliged to compensate their employees for the contribution. Self-employed people pay their contribution themselves through taxes. Because of the employer compensation, the contribution for employees is higher than for self-employed people, to a maximum of € 3554 and € 2503 per year respectively in 2012 (Belastingdienst, 2012).
Coverage of the basic package includes care provided by GPs and medical specialists, hospital care, dental care up to the age of 18 and dentures, medicines (on prescription only and in accordance with the GVS), maternity care, secondary mental health care, patient transport, necessary medical care when abroad, and, to a limited extent, paramedical care and primary mental health care (VWS, 2012b). In an attempt to cut health care costs, a number of measures have been taken to reduce coverage for 2012. Such measures include increasing the number of physiotherapy and primary mental health care sessions people have to pay for themselves, introducing and increasing compulsory excess in secondary and primary mental health care, and excluding from coverage non-chronic use of antacids, stop-smoking-programmes and dietary counselling (with exception of bundled payment schemes).
Selective contracting by health insurers makes it increasingly important for the insured to be aware of which health care providers and services are contracted by insurers. Depending on the insurance policy, not-contracted care may not be reimbursed to the full extent and potentially contribute substantially to out-of-pockets payments. Health insurers are obliged to offer sufficient information to the insured to enable them to make an informed choice as to what policy suits them best (NZa, 2012a).

The *third compartment* consists in the complementary voluntary health insurance. Coverage and premium are determined by the health insurers; all health insurers offer a variety of policies against different premiums. Coverage may include care not covered by the Awbz or Zvw, like dental care for adults over 18 years old, additional allied health care services and medical aids, as well as co-payments for, e.g., ambulatory mental care. It is possible to take out a basic health insurance and a complementary insurance with different companies. However, this is done by less than 1% of the insured. A small, though growing, proportion of the insured does not take out complementary insurance, 7% in 2006 versus 12% in 2012, mainly because of cost considerations (NZa, 2012b).

In addition to Awbz home care, there is home care regulated by the Social Support Act (Wet maatschappelijke ondersteuning (Wmo)). The Wmo came into force in 2007, making local councils responsible for the funding and provision of support and home care and allowing them to tailor the provision of care to the needs of the local population. The target population of the act consists in chronically ill people, disabled people and the elderly in need of support. The allowance depends on income, age and household composition and the local council.

Control and over sight

Four main organisations watch over the performance of health care and the health care market.
The *Health Care Insurance Board* (College voor Zorgverzekeringen (CVZ)) advises the Ministry of Health, Welfare and Sport as to coverage of the basic health insurance. It does so on the basis of care-related as well as financial and social considerations. The final decision about coverage is made by the ministry. CVZ manages the Health Insurance Fund and the Exceptional Medical Expenses Fund and distributes the funds among care offices (Zorgkantoren) responsible for organising and purchasing long-term Awbz care and health insurers. As such, it operates the risk equalisation scheme. CVZ also handles the care-related paperwork of pensioners and benefit recipients living abroad, it reimburses the cost of care for those with conscientious objections to health insurance and collects premiums from people who have failed to take out health insurance or to pay their premiums.
The *Dutch Healthcare Authority* (Nederlandse Zorgautoriteit (NZa)) has a special role as supervisor, market maker and regulator in health care and long-term care. NZa monitors competition and determines maximum tariffs. NZa establishes rules, budgets and fees for the part of health care that is regulated and formulates conditions for market competition for the liberalised market (NZa, 2010b). NZa also acts as the supervisor of the healthcare market and monitors the conduct of providers and insurers on the curative and long-term care market and monitors whether they act in accordance with the Zvw, the Awbz and the Wmg. The ultimate aim is to protect the care consumers by safeguarding their freedom of choice and legal rights as well as to attain market transparency.
The *Healthcare Inspectorate* (Inspectie voor de Gezondheidszorg (IGZ)) focuses on the quality of health services, preventive care and medical products, ultimately to promote public health. It does so by applying measures, such as advice, encouragement, pressure and coercion and advising responsible ministers. The IGZ acts independently of party politics and the current care system (IGZ, 2012).
The *Netherlands Competition Authority* (Nederlandse Mededingings autoriteit (NMa)) enforces compliance with the Dutch Competition Act, takes action against parties that participate in cartels by, for example, fixing prices, sharing markets or restricting production; takes action against parties that abuse a dominant position and assesses mergers and acquisitions (NMa, 2012).
As supervisors of financial institutions, the Netherlands Authority for the Financial Markets (Autoriteit Financiële Markten (AFM)) and the Dutch Central Bank (De Nederlandsche Bank (DNB)) also watch over health insurers.

Health care expenditure

In 2011, health care expenditure amounted to € 90 billion, with hospital care and care for the elderly together accounting for over 44% of that amount (see Table 2.2) (CBS, 2012g). Costs of care have risen by 3.2% in 2011 compared to 2010. Over the last few years, growth in the volume of care has been the major determinant of the rise in costs.

Table A2.2 Health care expenditure (million €) by (groups of) providers (CBS, 2012h).

	2008	2009	2010	2011	2010-2011
Providers of health care - Total	46,748	48,705	50,791	52,575	3.5
Hospitals and medical specialists	20,259	21,436	22,727	23,590	3.8
Mental health care providers	4899	5273	5401	5524	2.3
GP practices	2444	2470	2498	2701	8.1
Dentist practices	2518	2558	2637	2658	0.8
Allied health care providers and midwife practices	1702	1720	1810	1883	4.0
Municipal health care services	686	707	734	820	11.7
Occupational health care and safety agencies	1211	1260	1279	1266	-1.0
Providers of therapeutic equipment	6098	6204	6365	6470	1.6
Providers of support services	2929	2670	2727	2829	3.7
Providers of other health care	1593	1786	1882	1973	4.8
Providers of social care - Total	2409	2620	2729	2861	4.8
Providers of long-term care for the elderly	30,255	32,195	33,399	34,407	3.0
Providers of care for the disabled	14,775	15,211	15,712	16,084	2.4
Providers of other social care	7138	7802	8061	8338	3.4
Administration and management organisations	8312	9183	9626	9986	3.7
Total health care expenditure	3029	3001	2994	3022	0.9
	80,000	83,901	87,183	90,005	3.2

* = provisional figures; # = %-mutation

Health expenditure as a share of gross domestic product (GDP) rose from 13.4% in 2008 to 14.9% in 2011. This increase is mainly due to a drop in GDP due to the economic recession combined with a continued growth in healthcare spending. Expenditure per capita was € 5392 in 2011 versus € 4865 in 2008 (CBS, 2012g).

Appendix 2 Brief description of Vektis health care databases

Outline
The present study used data on health insurance claims obtained from the Vektis health care information centre. This appendix briefly describes the Vektis databases we employed; our description is derived from the Dutch website www.zorggegevens.nl. A specification of the types of health care costs included in our analyses is given in section A3.2.2.

A2.1 Description of Vektis databases

Vektis maintains the following databases that were relevant to this study:
- Dutch Primary Care Information System (ELIS);
- Pharmacy Information System (FIS);
- Information System for Hospital and Specialist Care (IZiZ);
- Basic Health Insurance Information System (BASIC).

Dutch Primary Care Information System (ELIS)
The Dutch Primary Care Information System (ELIS) collects data on health insurance policyholders, health care providers and services delivered (at the procedure code level). It covers the following health care domains: general practice, medical aids and non-medical practice (physiotherapy, speech therapy, occupational therapy). The ELIS data are obtained from the insurance companies every quarter.

Not all Dutch health insurance policyholders are represented in ELIS. For the purposes of our study, Vektis determined that ELIS covered 93% of policyholders in 2010, 92% in 2009, 83% in 2008 and 78% in 2007. The reason for the lower 2007 and 2008 coverage was that not all insurance companies were reporting data at the time. Coverage also failed to reach 100% later because several insurers with a small share of the market were still not providing data and because no data were included on people living in residential care. This report employs data from the ELIS general practice database (ELIS H).

Pharmacy Information System (FIS)
The Pharmacy Information System (FIS) provides information on the use of prescription medicines by all health insurance policyholders in the Netherlands. It is retrieved quarterly by Vektis and recorded at the insurance claims level. In addition to data on the prescribed drugs, the database also includes details on the prescriber, the supplying pharmacy and the policyholder. The 2010 coverage of the FIS was 99%.

Information System for Hospital and Specialist Care (IZiZ)
The Information System for Hospital and Specialist Care (IZiZ) provides data on the utilisation of hospital-based and other specialist services by all policyholders in the Netherlands. Claims-level data is supplied to Vektis by insurance companies on a quarterly basis. The IZiZ database specifies the health care delivered, policyholder characteristics and information on the providing institution. Data has been collected since 2005, the year in which diagnosis-related episode-based payment for most Dutch specialist and hospital treatment was introduced. IZiZ data are employed for purposes such as research on the risk equalisation model and the determination of the equalisation payments required by the Health Insurance Act (Zvw). Its 2010 coverage was 99%.

Basic Health Insurance Information System (BASIC)
BASIC is a central register that records all the health care services utilised by Dutch policyholders. It thereby differs from the other databases, which confine themselves to one health care sector. The data are delivered separately for BASIC by the insurance companies; that is, the BASIC databases are not compiled from other databases. This means that claims data on services such as GP care are supplied to Vektis by insurance companies twice. They are retrieved from the companies every quarter, but are entered into the database at the yearly level after cleaning. Data are therefore available by year only and not by quarter. Data from the other central registers (ELIS H, FIS and IZiZ) can be linked to the BASIC data at the policyholder level.

BASIC gives access to insurance claims data for every policyholder for any specified time frame, classified by the type of health care procedure. The procedures recorded are those covered by the basic Dutch insurance package as stipulated by the Health Insurance Act.

All Dutch health insurance companies supply datasets for BASIC every quarter. These contain personal information on the policyholders (including date of birth, gender, postcode, level of compulsory and voluntary policy excess and type of insurance contract) as well as data on the claims made. The coverage rate of BASIC comes to 98% of all health insurance policies in the Netherlands. At the time of our study, BASIC had data available up to and including 2010.

Appendix 3 Method

Outline
This study is a retrospective longitudinal investigation. The descriptive statistics are based on data from the 2007-2010 period. The longitudinal analyses covered the period 2008 and 2009. Some sensitivity analyses also covered the 2007-2009 time frame. We employed health insurance claims data accessible via various Vektis databases (see Appendix 2). Appendix 3 contains three different sections explaining our research methods. Section A3.1 describes the study population, section A3.2 the data collection and section A3.3 the methods of analysis.

A3.1 Study population and sample

A3.1.1 Procedure codes employed

The Vektis databases contained a number of different procedure codes used by health care providers to make insurance claims for diabetes and vascular risk management programmes. Which codes were used depended on the particular policy guidelines from the Dutch Healthcare Authority (NZa) under which a patient's disease management programme had been contracted. These guidelines were entitled as follow:

1. Policy guideline *Innovatie ten behoeve van nieuwe zorgprestaties* (Innovation in support of new health care services) (NZa, 2007a-c; NZa, 2008a; NZa, 2009a; NZa, 2010a; NZa, 2012).
2. Policy guideline *Prestatiebekostiging multidisciplinaire zorgverlening chronische aandoeningen* (Bundled payments for multidisciplinary health care provision for chronic conditions) (NZa, 2010b-c).
3. Policy guideline *Samenwerking ten behoeve van geïntegreerde eerstelijnszorgproducten* (GEZ) (Collaboration in support of integrated primary care products) (NZa, 2010d-e).
4. Policy guideline *Verrichtingenlijst M&I (Module Modernisering & Innovatie)* (List of procedures in the Modernisation and Innovation Module, M&I) (NZa, 2007d-f; NZa, 2008b-c; NZa, 2009b; NZa, 2010e).

We shall now explain which procedure codes were used to claim diabetes and vascular risk management programmes under the various guidelines. This information is necessary to understand how we categorised patients for the different comparison groups based on the three pricing models.

Policy guideline 1. Innovation in Support of New Health Care Services
This policy guideline effective 1 January 2007 enabled experimentation in the contracting of integrated disease management arrangements on a bundled payment basis (Figure 3.1). Before a disease management fee could be claimed by a health care provider, the preferential health insurance company had to apply to Vektis for a procedure code for that specific bundled payment contract. For all such applications under the NZa *Innovation* policy guideline, Vektis assigned codes beginning with 15###, giving each contract a unique number in the so-called '15### range'. The same policy guideline was used for other small-scale experiments with innovative health care procedures. These also included the management fee contracts, as treated in this report, which likewise received codes in the 15### range.

Policy guideline 2. Bundled Payments for Multidisciplinary Health Care Provision for Chronic Conditions (DM type 2[9], CVR[10])
These policy guidelines were created for the long-term introduction of the bundled payment schemes for diabetes and VRM from 1 January 2010. For disease management arrangements contracted under this NZa policy guideline, Vektis assigned procedure codes in the 40### range. Unlike the 15### codes, the 40### codes were independent of care groups or insurance companies. All care groups thus claimed their diabetes management procedures using the same code number of 40001; a different unique code applied to claims under VRM contracts. Health care procedures covered not by the basic statutory insurance package but by a voluntary supplementary package (though still included in the diabetes management contract) were claimed under procedure code 40002, but such claims data were not accessible in the Vektis databases, and many insurance companies did not supply them. The procedure codes deriving from the NZa *Innovation* and *Bundled Payments* policy guidelines, as employed in our sample selection, are shown in Table A3.1.

Policy guideline 3. Collaboration in Support of Integrated Primary Care Products
From 2009, disease management arrangements could also be contracted under this guideline as 'integrated primary care products'. Procedures performed under these code numbers were reimbursed as part of the GP capitation allowances. In other words, the reimbursements for disease management were 'diffused' over all the patients registered with the GPs working under this policy guideline. As a consequence, we were unable to use these procedure codes to identify individual patients in the Vektis databases who were participating in disease management programmes.

Policy guideline 4. List of procedures in the Modernisation and Innovation Module (M&I)
The Modernisation and Innovation Module (M&I) also provided opportunities for claiming disease management programmes. Procedure codes under M&I were grouped in the 14### range. After examining all 14### codes, two RIVM researchers concluded that only one such code could be considered to refer to a diabetes arrangement. In the course of the research, however, it emerged that reimbursement under that arrangement was likewise subsumed into the GP capitation allowances, making it again impossible to identify the diabetes management patients in the Vektis databases and include them in the analyses (see also section A3.1.3).

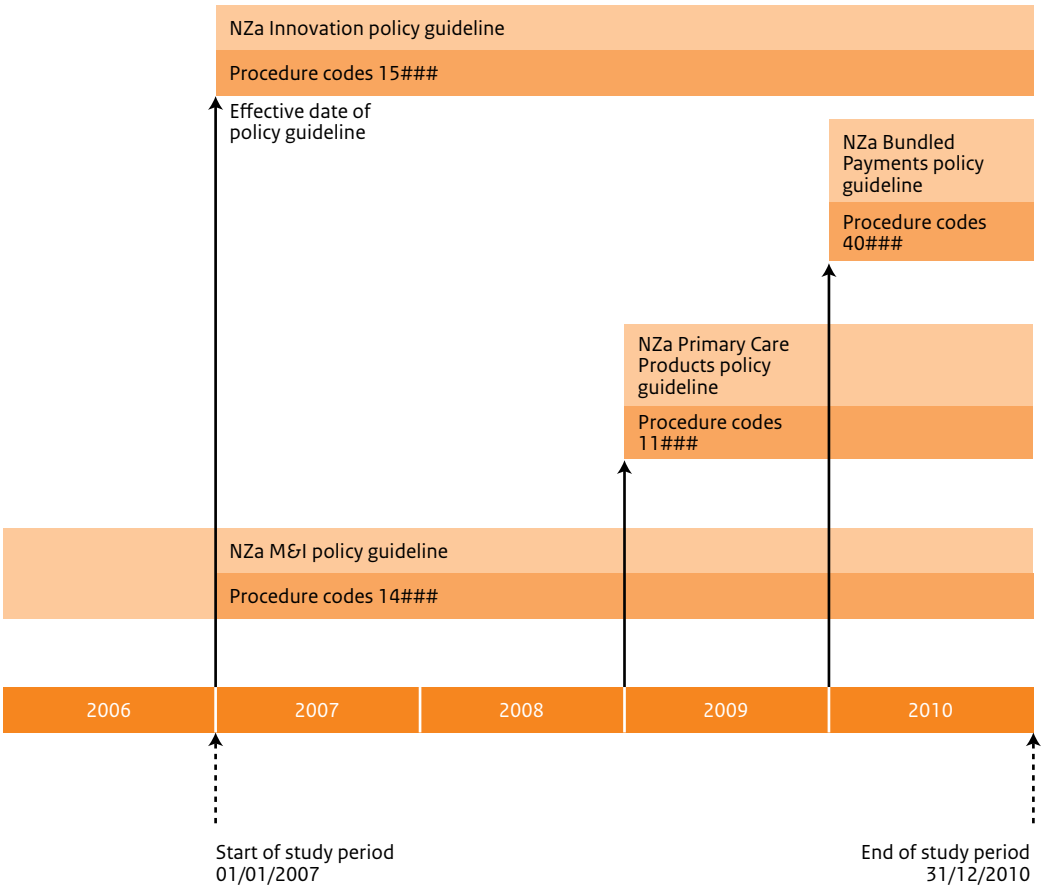
Figure A3.1 gives a schematic representation of the procedure codes that might have potentially been used to identify diabetes management patients in the 2007-2010 time frame.t ways.

A3.1.2 Assignment of patients to comparison groups based on pricing models for diabetes treatment

We shall now explain how we assigned patients year by year to the three comparison groups for the study. We confine ourselves here to the assignment of diabetes patients. We first identified all diabetes patients and their pricing arrangements in terms of the individual insurance claims made for them in a particular year. The final assignment to groups was made on the basis of the pricing arrangement associated that year with the GP with whom they were registered.

[9] Type 2 diabetes mellitus for persons aged ≥18.
[10] Cardiovascular risk management, called VRM from 2011 onwards

Figure A3.1 Time frame of the study and procedure codes potentially used to claim diabetes management programmes under NZa policy guidelines.



Patients categorised initially into three groups on the basis of insurance claims

Three types of diabetes patients were distinguished:

1. Patients being treated in a disease management programme reimbursed by bundled payments. They were labelled 'bundled payment patients'.
2. Patients being treated in a disease management programme for which no bundled payment claims were submitted. They were labelled 'management fee patients'.[11]
3. Patients being treated for diabetes but not in a disease management programme. They were labelled 'care-as-usual patients'.

[11] On inquiry to insurance companies, we learned that the 'management fee' in some contracts also covered certain health care procedures, such as fundus imaging; these were therefore not always true management fee contracts.

The three types of patients were identified in the Vektis databases in different ways.

1. Bundled payment patients
Patients being treated in bundled payment disease management programmes were identified using procedure code numbers. For the 2007-2009 period, we began by retrieving the code numbers for disease management programmes of any kind deriving from the Innovation policy guideline (15### codes). Using the descriptions provided by Vektis, two RIVM researchers then distinguished the patients by whether they were in diabetes or vascular risk management programmes and by whether these were reimbursed by bundled payments or otherwise.

For 2010, we identified patients in programmes contracted according to the Bundled Payments policy guideline (40### codes). Many claims that year still bore 15### procedure codes, as many care groups had older contracts extending into 2010. As these contracts expired and new ones took effect, care groups switched to the 40### codes (deriving from the Bundled Payments policy guideline) to claim disease management reimbursement. Table A3.1 shows the code numbers denoting diabetes or VRM programmes on a bundled payment basis that were used for this study.

Table A3.1 Procedure codes used to identify patients in diabetes and vascular risk management (VRM) programmes reimbursed by bundled payments.

Diabetes	40001 15000 15001 15004 15005 15007 15008 15009 15010 15011 15012 15013 15014 15015 15016 15017 15018 15019 15020 15022 15027 15028 15029 15030 15031 15032 15033 15034 15035 (beginning 2010) 15036 15037 15038 15039 15040 15043 15044 15045 15060 15061 15062 15064 15065 15076 15087 15088 15089 15091 15092 (Menzis policyholders in 2010) 15093 15098 15099 15100 15105 15106 15111 15118
Vascular risk	40011

2. Management fee patients
Procedure codes were also used to identify patients in disease management programmes supported by management fees under the Innovation policy guidelines. All codes flagged by two researchers as suggesting a management fee contract were submitted to that care group's preferential insurer for verification.

Additional data from Achmea to identify management fee patients
The Achmea insurance group reimbursed GPs who had management fee contracts during the period under study via a supplement to their capitation allowances. As such patients were not identifiable by procedure codes, Achmea provided additional data files (see also section A3.1.3) that enabled Vektis to readily and reliably identify the management fee patients in its databases.

Table A3.2 Procedure codes to identify patients in diabetes and vascular risk management (VRM) programmes not reimbursed by bundled payments.

Diabetes	15021 15025 15026 15044 15075 15035 (including 2010) 15092 (except Menzis policyholders in 2010)
Vascular risk	not applicable

Table A3.3 ATC codes used to identify patients receiving care as usual (CVZ, 2009).

Diabetes	ATC code	Drug names or descriptions
	A10BA02	Metformin
	A10BB01	Glibenclamide
	A10BB03	Tolbutamide
	A10BB09	Gliclazide
	A10BB12	Glimepiride
	A10BD02	Metformin and glibenclamide
	A10BD03	Metformin and rosiglitazone
	A10BD04	Glimepiride and rosiglitazone
	A10BD05	Metformin and pioglitazone
	A10BD07	Metformin and sitagliptin
	A10BD08	Metformin and vildagliptin
	A10BF01	Acarbose
	A10BG02	Rosiglitazone
	A10BG03	Pioglitazone
	A10BH01	Sitagliptin
	A10BH02	Vildagliptin
	A10BX02	Repaglinide
	A10BX04	Exenatide
Vascular risk management	**not applicable**	

3. Care-as-usual patients

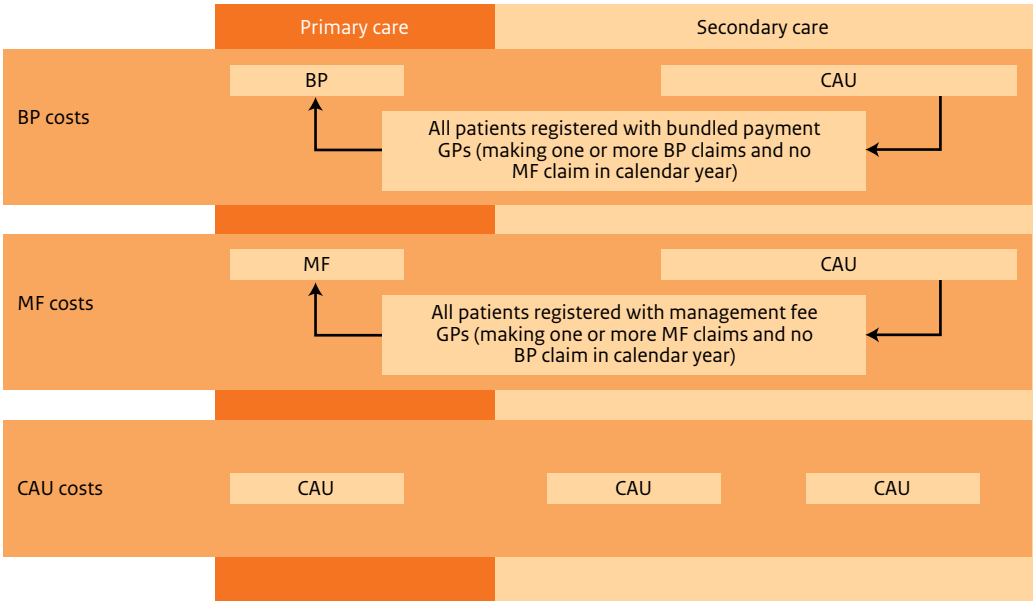
Diabetes patients receiving care as usual were identified using two criteria. First, they were to have no insurance claims for bundled or management fees in the calendar year in question; second, they were to have claims for specified types of medicines. The determining marker for diabetes patients was the range of A10B codes in the ATC classification (Table A3.3). No care-as-usual VRM patients could be identified, since no drugs were prescribed that were uniquely linkable to VRM.

Defining comparison groups on the basis of GP classification

For all the patients thus far selected for the initial sample for a particular year, we next identified the GP with whom they were registered, using the codes for the capitation allowances claimed for those patients by GPs in that year, as recorded in Vektis's ELIS H database. The GPs were then categorised as 'bundled payment GPs', 'management fee GPs' or 'care-as-usual GPs' on the basis of the types of patients (see above) that they claimed for. Bundled payment GPs were ones that had bundled payment patients in their patient population at any time within the calendar year in question. Management fee GPs were ones with management fee patients, and care-as-usual GPs were ones that had no bundled payment or management fee patients in the year in question. The GP categorisation was performed separately for each year of the study, as GPs could change categories from year to year.

After this procedure, we then assigned the patients to comparison groups not according to their individual classifications on the basis of their own procedure codes, but according to the category of their GP. In this fashion, the bundled payment comparison group came to consist of all patients registered with bundled payment GPs in the year in question, whether or not those patients were actually being treated

Figure A3.2 Schematic representation of the assignment of patients to the bundled payment, management fee and care-as-usual comparison groups and their types of health care costs.



BP = bundled payment, MF = management fee, CAU = care as usual

under a bundled payment arrangement. In other words, our bundled payment comparison group could contain both bundled payment patients and care-as-usual patients. Similarly, the management fee comparison group could also contain some CAU patients. The care-as-usual comparison group consisted solely of patients receiving care as usual. Figure A3.2 depicts the procedure by which we assigned patients to comparison groups.

A3.1.3 Final sample selection

To arrive at the final patient dataset for each year of the study, we performed 21 selection steps. To safeguard patient privacy, steps 1 to 8 were carried out by Vektis in consultation with the RIVM. At the end of step 8, the patients' citizen service numbers (national ID numbers) and the health care provider codes (AGBs) of their GPs were pseudonymised by Vektis. The pseudonymised datasets were then cleaned further by the RIVM in steps 9 to 21.

Because the selection steps were similar for the samples of diabetes and VRM patients, we discuss in detail here only the steps for the diabetes study population. Figure A3.3 shows step for step how the application of each selection or exclusion criterion affected the number of patients in the sample for 2009. Figures A5.13-A5.16 depict the procedures and steps in other years, as well as for the VRM patients we sampled for 2010.

Step 1. Selection of patients from ELIS H
Procedure codes of claims made by care groups on behalf of GPs (see Tables A3.1 and A3.2) were reported to Vektis by health insurance companies for the ELIS H database. Because ELIS H did not have complete nationwide coverage, not all Dutch health insurance policyholders could be identified in terms of disease management programmes and thereby assigned to the appropriate comparison groups. As some patients would have thus been incorrectly assigned to the care-as-usual group, we limited the selection to patients appearing in ELIS H.

Step 2. Exclusion of patients with more than one diabetes management procedure code in a single quarter
Each patient could be categorised in no more than one pricing model per quarter. Those having more than one procedure code associated with a bundled payment or other diabetes management programme within a single quarter were therefore excluded.

Step 3. Exclusion of patients switching care groups within the calendar year
Accurate categorisation was not possible for patients who moved from one care group to another within the selection year. We therefore removed them from the dataset in step 3; this also entailed exclusion of patients whose care groups merged during that year.

Step 4. Addition of patients on the basis of supplementary data from Achmea
Patients being treated in disease management arrangements based on management fees rather than bundled payments were inducted into the dataset (see also section A3.1.2).

Step 5. Addition of patients on the basis of prescribed medicines; categorisation as care-as-usual patients
Patients with type 2 diabetes who were not being treated in disease management programmes (that is, the care-as-usual patients) were now added to the dataset. They were identified by the claims made for their prescribed diabetes-specific medicines (A10B codes; see Table A3.3).

Step 6. Exclusion of patients with no known GP or more than one GP
Patients for whom no GP information was available in the Vektis databases were excluded, as were those registered with two or more GPs within the calendar year; they could not be reliably assigned to a comparison group.

Step 7. Exclusion of patients without data in BASIC
In this step, the citizen service numbers of the patients selected so far were linked to the BASIC database, enabling access to data on a large proportion of their health care costs. Patients not present in BASIC were now excluded from the dataset, as there was no reliable information on most of their costs.

Step 8. Final verification by Vektis
In step 8, Vektis rechecked the data file to verify whether the selection had proceeded correctly and whether the exclusions in steps 2 and 3 had been accurately carried out on the patients added in steps 4 and 5. The patients' citizen service numbers and their GPs' provider codes were then pseudonymised. The dataset could then undergo further cleaning by the RIVM in steps 9 to 21.

Step 9. Exclusion of women with gestational diabetes
Because our sample was to be limited to people with type 2 diabetes mellitus, we removed women with gestational diabetes from the dataset. They were traced via procedure codes for gestational diabetes specialist treatment in the IZiZ database.

Step 10-12. Exclusion of patients younger than 18, those with missing gender data and those from care groups with incorrect provider codes
Reimbursement for diabetes management programmes for patients under age 18 was not allowed by NZa policy guidelines. All patients below that age were therefore removed from the dataset, as were patients whose gender was not available and patients whose care groups had incorrect provider codes.

Step 13. Exclusion of deceased patients
In step 13, we excluded all patients who died during the year in question, because their health care costs were likely to be far higher than those of other patients (Drabik et al., 2012; Wong et al., 2011). Although the introduction of disease management might eventually lead to reduced mortality, no observable effect could be expected in these early years. We therefore believe that excluding deceased patients did not cause underestimation of cost effects, but did improve the comparability of the groups in the sample. (Effects of disease management on mortality rates and the associated health care costs need to be evaluated over a longer period.)

Step 14. Exclusion of patients from care-as-usual group whose insurance companies had not supplied reliable data
In the course of the study, it emerged that several insurance companies had reported disease management–related procedure codes to Vektis for only small numbers of patients or for none at all, causing bundled payment patients to be incorrectly categorised as receiving care as usual. After consulting with the EIB, with Vektis and with two insurance companies, we decided to repair the dataset. Data for patients categorised as care-as-usual from certain small insurance companies were not corrected, but removed, given the short span of the project and their small share of the market. Bundled payment patients with reliably reported data from those insurers were retained.

Step 15. Repair of dataset (2nd round)
The data-reporting problems described in step 14 were further corrected in step 15 after supplementary data reports by two large insurance companies. In view of the short span of the project, we decided to add this additional data directly to our dataset, rather than having ELIS updated and generating a new data file (see step 1). This correction of the procedure codes for the patients from those two insurers was carried out in step 15. Only some care-as-usual patients were recategorised using the newly reported data; no new patients were added.

Step 16. Recategorisation of patients by reviewing quarterly claims in combination; exclusion of those with missing data for one or more quarters
Patients with more than one type of quarterly pricing in a single year were recategorised into their predominant pricing model. Those for whom data for one or more quarters of that year were missing from the Vektis databases were removed from the dataset, as no reliable cost estimates were possible.

Step 17. Assignment of patients to comparison groups on basis of their GP's pricing arrangement
As we have explained in section A3.1.2, all patients so far included in the dataset were now assigned to the final bundled payment, management fee or care-as-usual comparison groups according to the pricing arrangement in which we had categorised their GP (and hence not according to the categories for individual patients).

Step 18. Final verification by RIVM
Following step 17, the RIVM performed one last check on the dataset to verify whether all selections had proceeded correctly. We also checked to ensure that no patients were included from care groups that were marked as having both bundled payment and management fee arrangements within a single year, a possibility that had resurfaced after step 15.

Step 19. Exclusion of patients in repaired dataset who switched care groups within the calendar year
Patients in the repaired dataset (step 15) who were in bundled payment arrangements from different care groups within the calendar year were excluded, because they could not be identified to a unique care group.

Step 20-21. Exclusion of patients whose GP had more than one care group or type of diabetes management arrangement in the calendar year
The final two steps involved excluding any remaining patients who could not be correctly assigned because their GP was linked to more than one care group, or to both a bundled payment and a management fee arrangement, within the year in question.

Fewer steps required for VRM sample
Selecting the VRM sample required fewer steps. Table A3.4 compares these steps to the ones for the diabetes sample.

Figure A3.3 Data stream for the selection of the diabetes patient sample for the year 2009 in the 21 described steps.

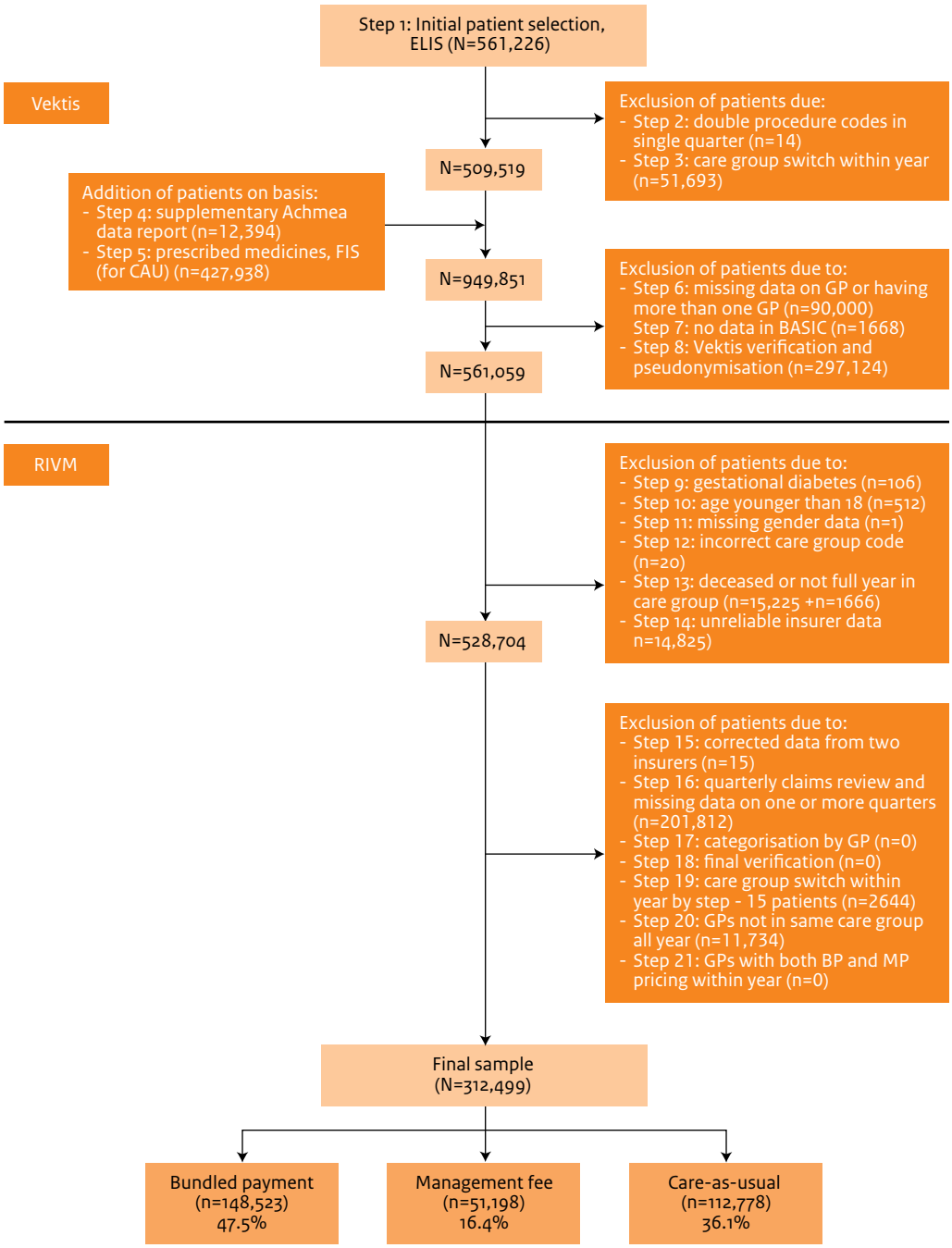


Table A3.4 The nine selection steps to arrive at the final sample of VRM patients (as compared to the diabetes sample selection).

		Diabetes	VRM
1	Initial selection of patients from ELIS register database	X	X
2	Exclusion of patients with double procedure codes in single quarter	X	X
3	Exclusion of patients switching care groups within calendar year	X	X
4	Addition of patients after supplementary data	X	
5	Addition of patients for care-as-usual category on basis of prescribed medicines	X	
6	Exclusion of patients with no or more than one GP	X	X
7	Exclusion of patients without data in BASIC	X	X
8	Final verification by Vektis	X	X
9	Exclusion of women with gestational diabetes	X	
10	Exclusion of patients under age 18	X	
11	Exclusion of patients with missing gender data	X	
12	Exclusion of patients with incorrect care group codes	X	X
13	Exclusion of deceased patients	X	
14	Exclusion of care-as-usual patients with unreliable insurer data	X	X
15	Repair of dataset with corrected data from large insurers	X	
16	Recategorisation after combined review of quarterly claims; exclusion of patients with missing quarterly data	X	X
17	Assignment to comparison groups on basis of GP pricing arrangement	X	
18	Final verification by RIVM	X	
19	Exclusion of step-15 patients who switched care groups within year	X	
20	Exclusion of patients whose GP had more than one care group within year	X	
21	Exclusion of patients whose GP had both bundled payment and management fee arrangements within year	X	

A3.2 Data collection

A3.2.1 Characteristics of patients, GPs and care groups

Vektis databases give access to many characteristics

Many characteristics of care groups, GPs and patients can be obtained from the Vektis databases:

- patient identification number;
- gender of patient;
- age of patient;
- comorbid conditions of patient (defined in terms of pharmaceutical cost groups for 2010);
- postcode of patient;
- fraction-of-year code (part of year that patient was insured by insurer);
- GP identification number;
- gender of GP;
- age of GP;
- years of experience of GP;

- care group identification number;
- postcode of care group;
- insurance company identification number;
- comparison group based on pricing arrangement;
- comparison group subgroup based on procedure code (bundled payment group only);
- prescribed diabetes medicines.

A full description of the datasets we employed, including the variables used, meanings of the variables, data sources and operational categories is found in Table A4.8.

A3.2.2 Curative health care costs included in the analysis

Both diabetes-related and other health care costs

The analysis encompassed all health care costs covered by the Dutch basic statutory insurance package, including the compulsory and any voluntary policy excess but not including costs covered by any voluntary supplementary packages.

All costs adjusted for price trends and expressed in 2010 prices

To enable meaningful cost comparisons between years, we adjusted all health care costs using the consumer price indexes published by Statistics Netherlands. All costs reported in this study have been converted to 2010 prices (see Table A4.9 for the deflators employed).

Insurance claims data distinguished into general practice, specialist and other health care costs

- The curative health care costs were broken down into the following cost categories:
- general practice costs;
- costs of specialist (hospital-based) care;
- other curative costs.

We shall now further specify which costs and procedure codes were classified into which cost categories.

General practice costs

Costs of general practice care obtained from ELIS H included different items

The cost data for general practice care were based on data from the ELIS H database and were distinguished into the following cost categories:

- costs for practice nurses;
- general practice costs specific to the disease in question;
- consultation fees and capitation allowances (other costs);
- costs for integrated care (bundled payments or management fees).

The procedure codes associated with practice nurse costs, disease-specific general practice costs, other costs and integrated care costs are summarised in Tables A4.3-A4.6.

Integrated care costs treated as general practice costs for pragmatic reasons

The costs of integrated care arrangements were treated as general practice costs for pragmatic reasons, but we should point out that only a fraction of these costs were directly associated with the GP surgeries themselves. A large percentage involved costs for general practice laboratories and non-medical health care

services (such as dietetics or podiatry), but a breakdown by health care discipline was not possible within the integrated care category. As a consequence, the general practice costs were overestimated and costs in other categories were underestimated.

Costs of specialist care

Costs of hospital-based and other specialist care obtained from IZiZ and BASIC
The costs of specialist care were available through both the IZiZ database (at the quarterly level) and the BASIC database (at the yearly level). IZiZ recorded all specialist episode-of-care payments. The costs of specialist treatment recorded in BASIC included not only those for hospital-based episodes of care but also other costs, such as those for additional procedures[12] (Stichting AB, 2008) or those claimed under the previous fixed-budget reimbursement system (NVZ, 2012). The 2007 diabetes dataset we obtained from IZiZ (which contained data on episode-of-care payments only) did not include all the costs of specialist care episodes. We therefore used the BASIC data in our descriptive analyses of the 2007-2010 hospital costs for diabetes patients (chapter 2), in order to report comparably calculated figures.

For our analyses in chapters 4 and 5, we used the specialist cost data from IZiZ, as those analyses covered only 2008 and 2009, and the IZiZ data were more accurate for determining whether or not diabetes patients had generated specialist costs. For the VRM analyses, we also used IZiZ data, since we were calculating costs for the fourth quarter of 2010 only.

Costs of diabetes-specific specialist care as distinguished by delivery setting
The costs of diabetes-specific hospital-based treatment were based on the claimed episodes of care and were broken down as follows:
- outpatient costs;
- day-patient costs;
- inpatient costs.

The procedure codes linked to these cost categories are shown in Table A4.2.

Costs of other curative care

Aggregated costs from a wide range of health care sectors
We used BASIC to calculate the costs of other curative care that was not diabetes- (or VRM-) specific. The BASIC database records costs at the level of health care sectors and the data are therefore less highly detailed than the ELIS H or IZiZ data. The 'other curative care costs' consist of:
- total pharmacy costs;
- total costs of medical aids;

[12] These included procedures performed by referral-only specialist disciplines:
– for another referral-only discipline as part of an episode of care (as a specified part of the clinical pathway);
– as requested by a primary care provider;
– as interdepartmental service provision;
– for another specialist discipline in the same institution that was not part of the episode-based pricing system (such as dental surgery or rehabilitation medicine).

- total costs of non-medical health care (including physiotherapy, exercise therapy, speech therapy, occupational therapy, dietetics);
- total costs of patient transport;
- total costs for mental health care.

A3.3 Analyses

Our analysis methods have been briefly summarised in separate boxes for each research question in the chapters above. The results on our first research question were reported in chapters 2 and 3, the results for the second question in chapter 4, and those for the third question in chapter 5. We shall now explain the analyses in more detail.

Question 1a:	**What is the current scale of implementation of diabetes and vascular risk management programmes that are covered by bundled payment contracts?**
Question 1b:	**What curative health care costs do people generate when they receive care in disease management programmes for diabetes and vascular risk?**

To address this question we mainly used descriptive statistics, including frequency tables and percentages whereby we did not test for significant differences between care groups or between years. We distinguished between mean costs per user (patients who actually utilised the services) and mean costs for all patients (whether or not they utilised them). The reported results for diabetes (chapter 2) and vascular risk (chapter 3) were not adjusted for patient characteristics.

Question 2:	**What effect does the introduction of bundled payment diabetes management have on curative health care costs in comparison to the fee-for-service arrangements with management fees or care as usual?**

We addressed this question in a series of steps. First, we performed regression analyses to assess the cost effects of diabetes management programmes of any kind in comparison to care as usual. In this analysis, we made no distinction as to whether a programme was reimbursed by bundled payments or by existing payment schemes supplemented by a management fee. We hence performed multivariate regression analyses in which the bundled payment and management fee groups were aggregated and compared as a whole to the care-as-usual group (the reference group). The dependent variable was the difference in curative health care costs between 2008 and 2009. We adjusted the analysis for age (centred), gender, comorbidity and baseline curative costs (over 2008). We then carried out sensitivity analyses on patients taking oral medication only (ATC subgroup A10B; see Table 3.3) to ensure an optimal comparison with the care-as-usual group, setting A10B drugs as the sole selection criterion. We repeated the sensitivity analyses on the 2007-2009 dataset. Box 4.1 summarises the key features of the analyses and section 4.1 reports the results.

We next performed several regression analyses to determine whether bundled pricing have influenced the health care costs of diabetes patients. The above analyses were repeated with a distinction made as to whether the diabetes management programmes were based on bundled payments or management fees (again using care as usual as the reference category). The key features of these analyses are outlined in Box 4.3 and the results are reported in section 4.2.1.

Because patients' health care costs are not necessarily independent of the GP or insurance company they are registered with, we next carried out multilevel analyses to investigate whether clustering of health care costs by GP practices or by insurance companies have influenced the results. Clustering by care groups could not be analysed, because care-as-usual patients were not in care groups. Two-level regression analyses were performed, using intraclass correlation coefficients (ICCs) to test for significant patient cost variations between GPs and between insurers. Results are reported in Tables A5.3 and A5.4.

The above analyses compared the cost rises in the bundled payment, management fee and care-as-usual groups for patients that stayed in the same comparison group during the years 2008-2009. Although those analyses shed light on between-group differences in cost trends, they could not provide evidence for any causal effect of bundled payment arrangements. This necessitated a comparison of costs before and after transition to bundled pricing. In subsequent analyses, we therefore examined cost trends amongst patients who were transferred from management fee to bundled payment arrangements between 2008 and 2009 (see section 4.2.2 and Table A5.5). Our subsample for these procedures consisted of patients who were in the management fee group in 2008; since all such patients were already in disease management programmes, only their type of pricing arrangement was subject to change and not the treatment content. This enabled us to analyse the isolated effects of changes in the pricing model. We compared the 2009 health care cost trends of those who were transferred to the bundled payment group in that year with the cost trends of those who remained in the management fee group and those who were transferred to the care-as-usual group. The dependent and control variables were identical to those in the other analyses (see Box 4.4).

Question 3:	Has the introduction of bundled payment diabetes management led to reductions in the numbers of people with diabetes who utilise specialist care in comparison to arrangements with a management fee or care as usual?

This research question examined whether bundled payment arrangements led to the expected reduction in the number of patients utilising hospital-based specialist care in 2009. We began by analysing whether diabetes management programmes (regardless of pricing model) were associated with lower numbers of diabetes patients using hospital-based care. Here again, the patients from the bundled payment and management fee comparison groups were aggregated and compared to those in the care-as-usual group. We carried out a series of logistic regression analyses with dependent variables as follow: (1) one or more insurance claims for specialist care in 2009 (yes/no); (2) one or more diabetes-related claims for specialist care (yes/no); (3) diabetes-related outpatient specialist care (yes/no); (4) diabetes-related inpatient care (yes/no). We controlled for the patient characteristics of age (centred), gender and comorbidity as well as for 2008 specialist care utilisation. The results of these analyses are reported in section 5.1 and Tables A5.6-A5.9.

We next repeated these analyses, restoring the distinction between the bundled payment, management fee and care-as-usual groups. Results are reported in section 5.2. We then tested for differences between management fee patients who were transferred to other payment modes between 2008 and 2009 and those who remained in the management fee comparison group.

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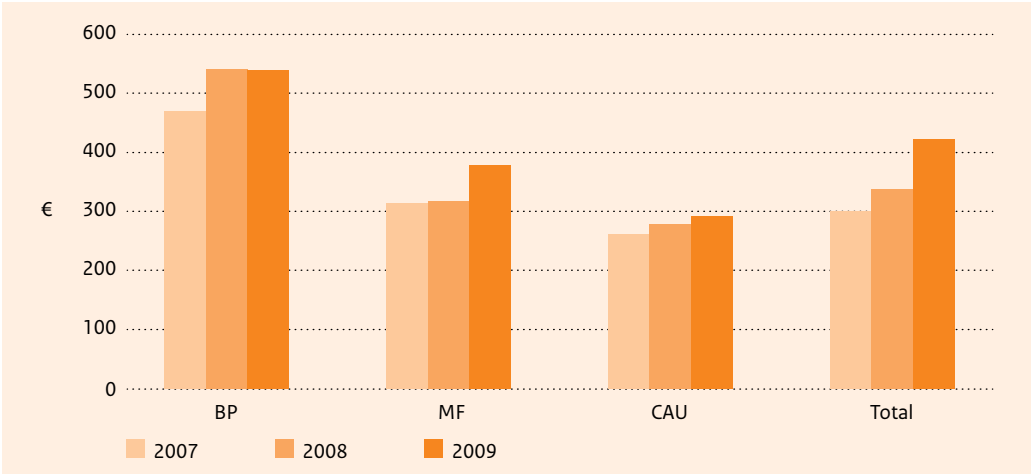
Appendix 5 Tables and figures

Outline

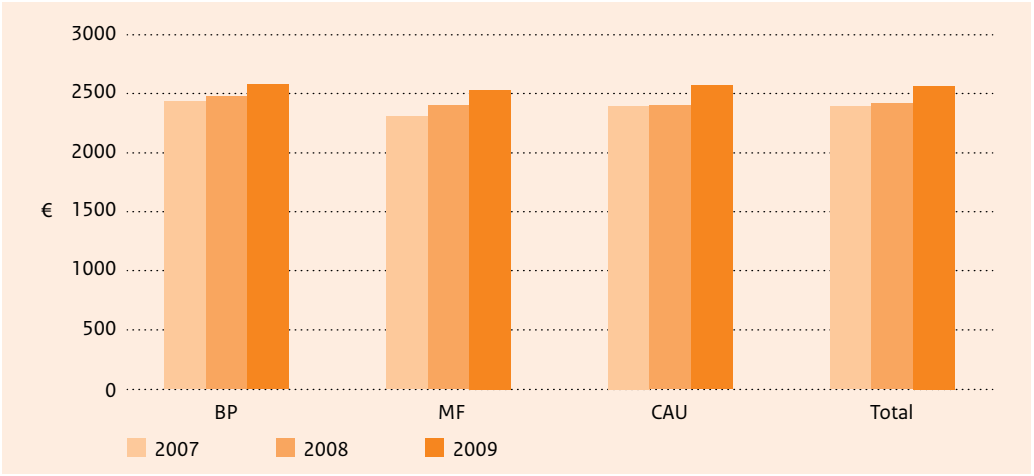
This appendix presents additional figures and tables from chapter 2-5 and Appendix 3. In the main text of the report and Appendix 3 is referred to the corresponding figures and tables and is the interpretation of the results described. In this appendix the results will not be discussed.

Figure A5.1 Average GP costs per diabetes patient in the different pricing schemes in the time period 2007-2009.



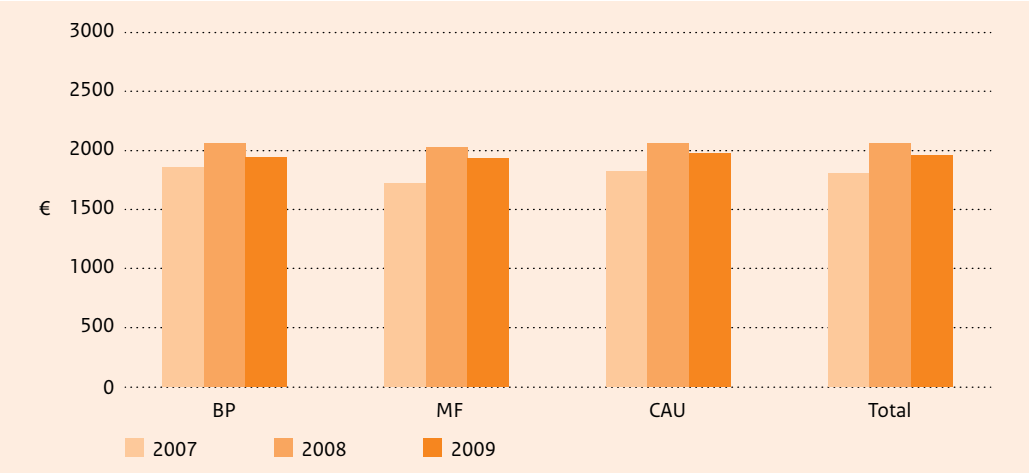
BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual.

Figure A5.2 Average costs for specialist care per diabetes patient in the different pricing schemes in the time period 2007-2009.



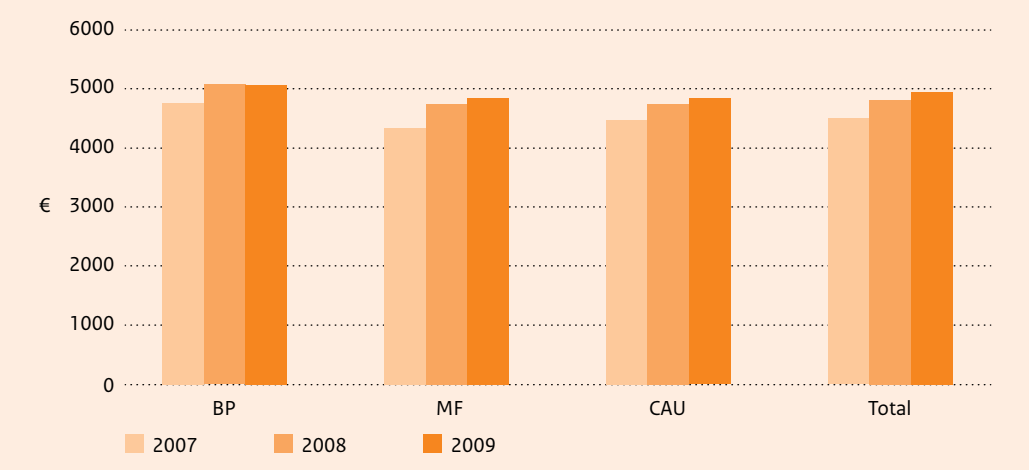
BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual.

Figure A5.3 Average other costs per diabetes patient in the different pricing schemes in the time period 2007-2009.



BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual.

Figure A5.4 Average curative health care costs per diabetes patient in the different pricing schemes in the time period 2007-2009.



BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual.

Figure A5.5 Average GP costs with standard deviation per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

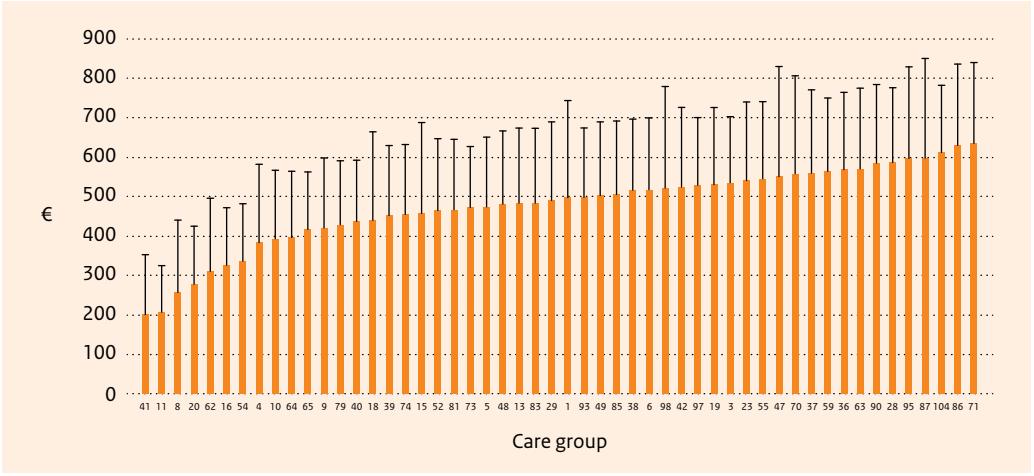


Figure A5.6 Average costs for specialist care with standard deviation per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

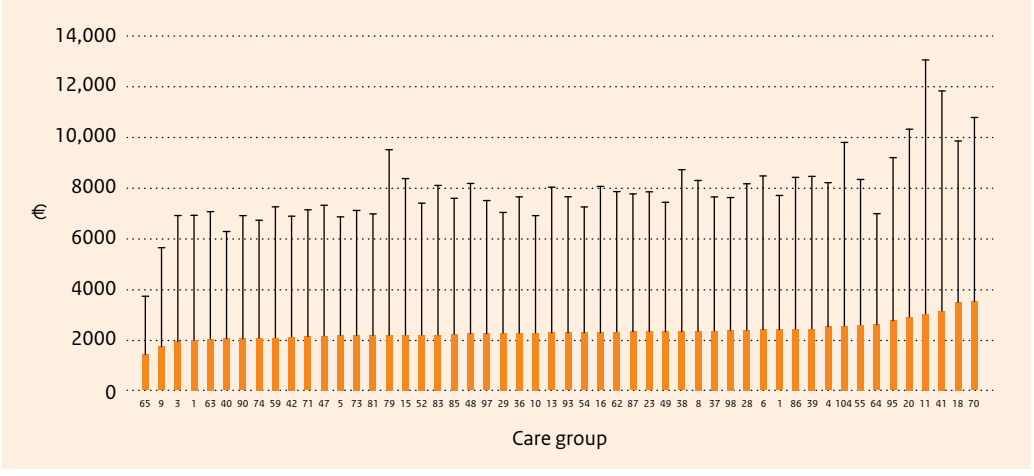


Figure A5.7 Average other costs with standard deviation per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

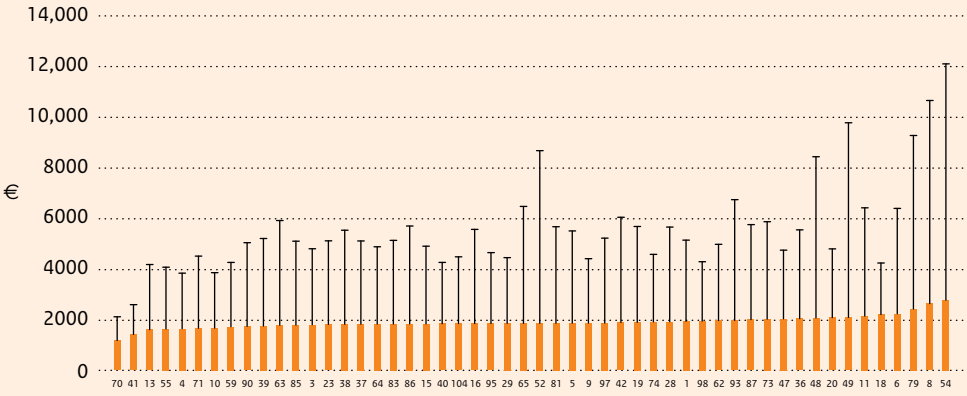


Figure A5.8 Average curative health care costs with standard deviation per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

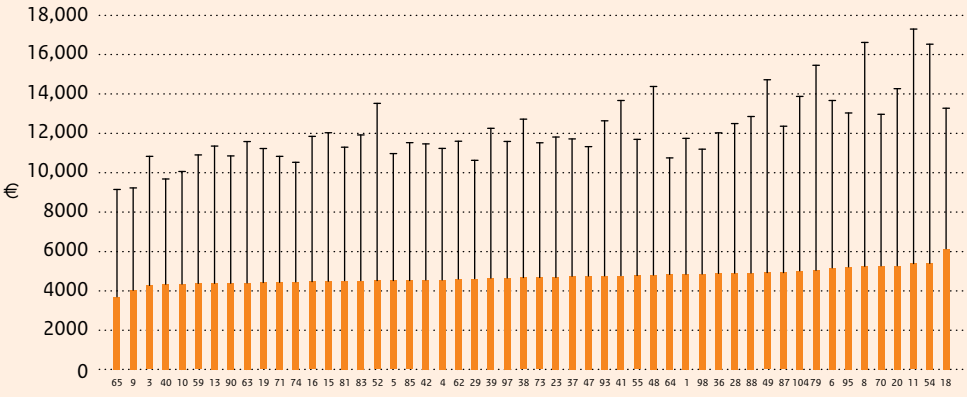


Figure A5.9 25-percentile and 75-percentile of the average GP costs per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

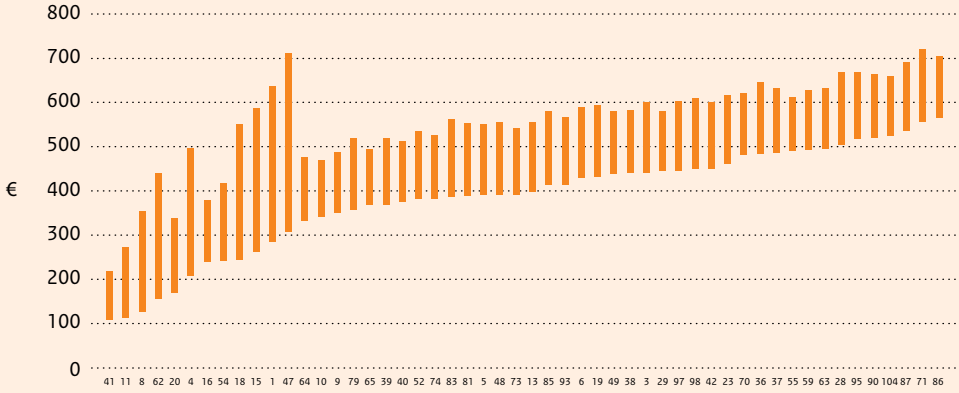


Figure A5.10 25-percentile and 75-percentile of the average costs for specialist care per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

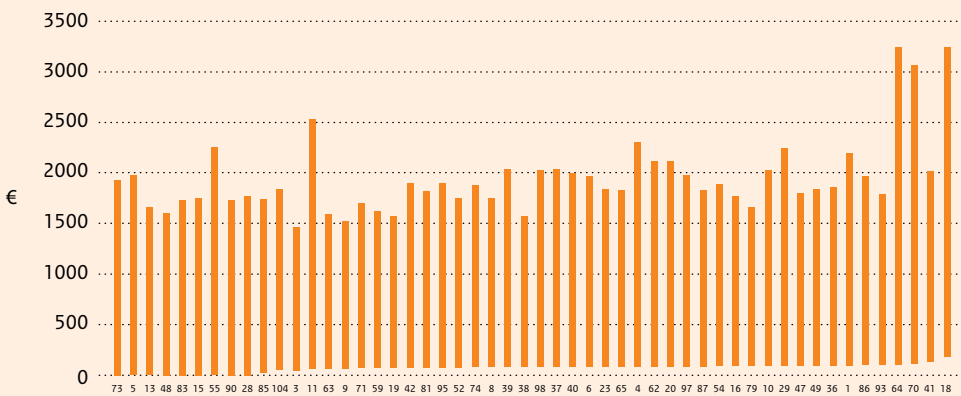


Figure A5.11 25-percentile and 75-percentile of the average other costs per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

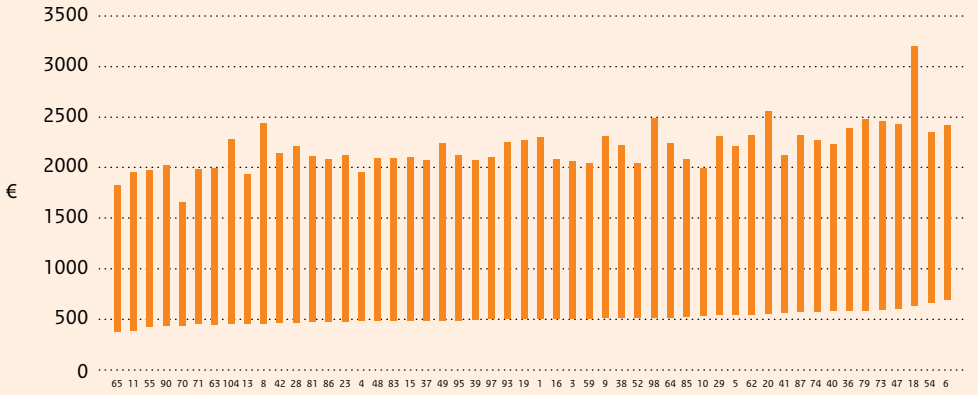


Figure A5.12 25-percentile en 75-percentile of the average curative health care costs per patient per care group with a bundled payment contract for diabetes care in 2009 (N = 52).

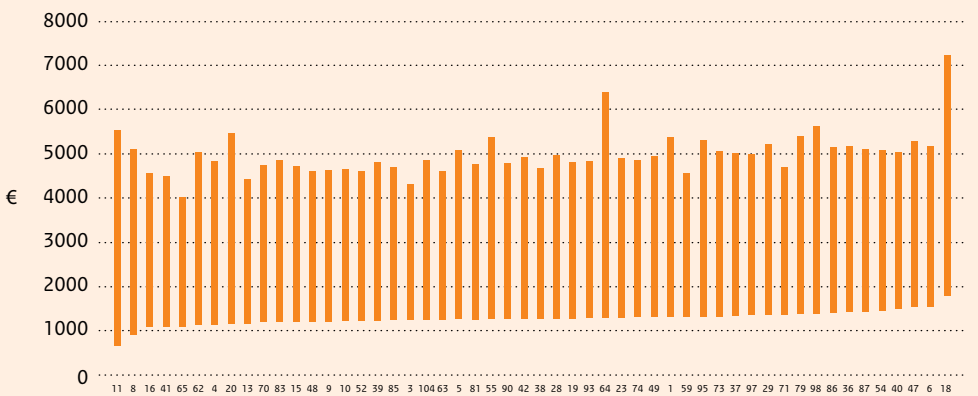


Table A5.1 Cost increases in euros from 2008 to 2009 for diabetes patients whether or not in diabetes management programmes (N = 64,139).

		Model 0[13]	SE	p-value	Model 1	SE	p-value	Model 2	SE	p-value	Model 3	SE	p-value
Intercept		219.2	23.9	<0.0001	-744	37.8	<0.0001	134.1	34.9	<0.0001	-677.8	43.7	<0.0001
2008 baseline costs		-0.6	0.004	<0.0001	-0.6	0.004	<0.0001	-0.6	0.004	<0.0001	-0.6	0.004	<0.0001
Age[14] (centered)					16.2	2.1	<0.0001				16.1	2.1	<0.0001
Gender (ref. = female)					288.2	47.5	<0.0001				289.6	47.5	<0.0001
Comorbidity (0-15)					1789.9	35.6	<0.0001				1789.2	35.6	<0.0001
Care program	No							ref.			ref.		
	Yes							160.6	47.9	0.0008	141.5	46.9	0.0026

Table A5.1 continued Cost increases in euros from 2008 to 2009 for diabetes patients whether or not in diabetes management programmes (N = 64,139).

		Model 4[15]	SE	p-value	Model 5[16]	SE	p-value	Model 6	SE	p-value	Model 7[17]	SE	p-value
Intercept		-817.1	45.8	<0.0001	--	--	--	-782.1	65.2	<0.0001	-821.8	46.2	<0.0001
2008 baseline costs		-0.7	0.004	<0.0001	--	--	--	-0.7	0.004	<0.0001	-0.7	0.004	<0.0001
Age[18] (centered)		16.2	2.1	<0.0001	--	--	--	16.3	2.1	<0.0001	16.2	2.2	<0.0001
Gender (ref. = female)		290.1	47.5	<0.0001	--	--	--	292.8	47.5	<0.0001	293.4	48.4	<0.0001
Comorbidity (0-15)		278.40	41.8	<0.0001	--	--	--	1788.6	35.6	<0.0001	1795.7	36.2	<0.0001
Care program	No	ref.			--	--	--	ref.			ref.		
	Yes	138.7	48.3	0.0041	--	--	--	157.8	49.7	0.0015	140.2	49.2	0.0044
ICC		0.15%		0.0533	--	--	--	0.06%		0.0822	0.17%		0.0404
Number of patients		64,139			--	--	--	64,139			61,497		
Number level-2	GPs	3082			--	--	--				3078		
	Insurers				--	--	--	24					
Average number per level-2		20.8			--	--	--	2672.5			20.0		
-2 log likelihood		1,296,424			--	--	--	1,294,529			1,242,723		

ICC=Intraclass Correlation coefficient; SE=standard error.

[13] In the null-model without correction for baseline costs the intercept was €171.2 (SE 28.9). p-value <0.0001.
[14] Reference age is 67.8.
[15] Also without comorbidity no significant difference between pricing schemes.
[16] The care group-level does not exist in the care-as-usual group. Therefore model 5 can be executed.
[17] Exclusively A10B users included.
[18] Reference age is 67.8.

Table A5.2 Curative health care costs in 2009 for diabetes patients within a bundled payment contract.

	Model 0	SE	p-value	Model 1 (cg)	SE	p-value
Intercept	4438.3	36.9	<.0001	3100.0	46.2	<.0001
Age[19] (centered)				21.5	1.8	<.0001
Gender (ref. = female)				306.4	41.7	<.0001
Comorbidity (0-15)				2638.6	30.5	<.0001
Number of patients	104,561			104,561		
Number level-2	52			52		
Average number per level-2	2011			2011		
ICC	0.06%		0.0085	0.08%	0.0041	
-2 log likelihood	2,145,814			2,137,909		

SE=standard error, cg=care group.

Table A5.3 Cost increases in euros from 2007 to 2009 for diabetes patients (whether or not in diabetes management programmes) (N = 21,753).

		Model 0[20]	SE	p-value	Model 1	SE	p-value	Model 2	SE	p-value	Model 3	SE	p-value
Intercept		464.5	41.1	<0.0001	-558.3	65.0	<0.0001	334.9	51.1	<0.0001	-350.2	84.4	<0.0001
2007 baseline costs		-0.7	0.007	<0.0001	-0.7	0.007	<0.0001	-0.7	-0.007	<0.0001	-0.7	-0.007	<0.0001
Age[21] (centered)					16.4	3.7	<0.0001				16.3	3.7	<0.0001
Gender (ref. = female)					268.6	81.3	0.001				273.1	81.3	0.0008
Comorbidity (0-15)					1929.5	60.5	<0.0001				1926.5	60.5	<0.0001
Care program	No							ref.			ref.		
	Yes							365.6	85.9	<0.0001	-323.8	83.8	0.0001

SE=standard error.

[19] Reference age is 67.8.

[20] In the null-model without correction for baseline costs the intercept was €464.5 (SE=49.6). p-value was <0.0001.

[21] Reference age is 67.8.

Table A5.3 continued Cost increases in euros from 2007 to 2009 for diabetes patients (whether or not in diabetes management programmes) (N = 21,753).

		Model 4[22]	SE	p-value	Model 5[23]	SE	p-value	Model 6	SE	p-value	Model 7[24]	SE	p-value
Intercept		-673.4	71.7	<0.0001	--	--	--	-670.6	75.7	<0.0001	-673.0	72.1	<0.0001
2007 baseline costs		-0.7	-0.007	<0.0001	--	--	--	-0.7	-0.007	<0.0001	-0.7	-0.007	<0.0001
Age[25] (centered)		16.3	3.7	<0.0001	--	--	--	16.3	3.7	<0.0001	16.5	3.8	<0.0001
Gender (ref. = female)		273.2	81.3	0.0008	--	--	--	273.1	81.3	0.0008	268.1	82.2	0.0011
Comorbidity (0-15)		1926.6	60.5	<0.0001	--	--	--	1927.1	60.5	<0.0001	1932.0	61.1	<0.0001
Care program	No	ref.			--	--	--	ref.			ref.		
	Yes	322.6	84.4	0.0001	--	--	--	310.6	87.7	0.0004	344.6	86.1	<0.0001
ICC		0.04%			--	--	--	0.008%			0.05%		
Number of patients		21,753			--	--	--	21,753			21,324		
Number level-2	GPs	2005			--	--	--	--			2003		
	Insu-rers	--			--	--	--	21			--		
Average number per level-2		10.8			--	--	--	1035.9			10.6		
-2 log likelihood		439,511			--	--	--	439,511			430,879		

ICC= Intraclass Correlation coefficient; SE= standard error; GP= general practitioner.

[22] Also without comorbidity no significant difference between pricing schemes.
[23] The care group-level does not exist in the care-as-usual group. Therefore model 5 can not be executed.
[24] Exclusively A10B users included.
[25] Reference age is 67.8.

Table A5.4 Differences in total health care costs in euros from 2008 to 2009 for diabetes patients in same pricing system in both years (N = 64,033)[26].

		Model 1	SE	p-value	Model 2	SE	p-value	Model 3	SE	p-value
Intercept		85.7	35.3	0.0153	-802.7	38.3	<0.0001	-881.4	45.9	<0.0001
2008 baseline costs		-0.6	0.004	<0.0001				-0.7	0.004	<0.0001
Pricing schemes	BP	290.7	55.8	<0.0001				288.0	54.6	<0.0001
	MF	-30.4	63.3	0.6318				-73.9	62.1	0.2339
	CAU	ref.						ref.		
Age[27]					16.3	2.6	<0.0001	16.7	2.2	<0.0001
Gender (ref. = female)					288.7	48.1	<0.0001	295.6	48.1	<0.0001
Comorbidity					1813.3	36.1	<0.0001	1813.1	36.1	<0.0001

Table A5.4 continued Differences in total health care costs in euros from 2008 to 2009 for diabetes patients in same pricing system in both years (N = 64,033).

		Model 4	SE	p-value	Model 5[28]	SE	p-value	Mode 6[29]	SE	p-value	Model 7	SE	p-value
Intercept		-879.9	46.2	<0.0001	-884.9	46.6	<0.0001	--	--	--	-844.4	65.9	<0.0001
Pricing schemes	BP	287.2	55.8	<0.0001	295.9	57.5	<0.0001	--	--	--	314.3	58.7	<0.0001
	MF	-74.1	63.2	0.2407	-73.7	64.4	0.2524	--	--	--	-48.2	64.3	0.4540
	CAU	ref.			ref.						ref.		
Age[30]		16.7	2.2	<0.0001	16.7	2.2	<0.0001	--	--	--	16.7	2.2	<0.0001
Gender (ref. = female)		295.7	48.2	<0.0001	297.9	49	<0.0001	--	--	--	297.4	48.2	<0.0001
Comorbidity		1813.2	36.1	<0.0001	1819.4	36.7	<0.0001	--	--	--	1813.5	36.1	<0.0001
2008 baseline costs		-0.65	0.004	<0.0001	-0.7	0.004	<0.0001				-0.7	0.004	<0.0001
ICC		0.09%		0.1552	0.12%		0.1202	--	--	--	0.06%		0.0865
Number of patients		64,033			61,392			--	--	--	64,033		
Number level-2	GPs	3062			3058								
	Insurers											24	
Average number per level-2		20.9			20.1			--	--	--	2672.5		
-2 log likelihood		1,295,952			1,242,201			--	--	--	1,295,942		

BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual; ICC= Intraclass Correlation coefficient; SE= standard error; GP= general practitioner.

[26] Patient numbers differ slightly from those in Table 4.1 because some care groups had nonexistent provider codes.
[27] Reference age is 67.8.
[28] Exclusively A10B users included.
[29] The care group-level does not exist in the care-as-usual group. Therefore model 5 can not be executed.
[30] Reference age is 67.8.

Table A5.5 Differences in curative health care costs in euros from 2008 to 2009 for diabetes patients in management fee arrangements in 2008 (N = 14,666).

		Model 0	SE	p-value	Model 1	SE	p-value	Model 2	SE	p-value	Model 3	SE	p-value
Intercept		133.1	55.1	0.0157	127.9	255.5	0.6168	-760.0	74.8	<0.0001	-750.7	256.4	0.0034
2008 baseline costs		-0.6	0.008	0.0046	-0.6	0.007	<0.0001	-0.6	0.008	<0.0001	-0.6	0.008	<0.0001
Pricing schemes	BF				-133.1	351.8	0.7051				-92.4	344.1	0.7884
	MF				11.0	260.1	0.9661				-5.9	254.4	0.9814
	CAU				ref.						ref.		
Age[31]								18.4	4.1	<0.0001	18.4	4.1	<0.0001
Gender (ref. = female)								200.0	93.3	0.0320	199.6	93.3	0.0324
Comorbidity (1-15)								1703.2	69.7	<0.0001	1702.9	69.7	<0.0001
Difference between BP and MF[32]											-86.4		n.s.
Difference between BP and CAU[32]											-92.4		n.s.
Difference between MF en CAU[32]											-5.9		n.s.

[31] Reference age is 67.8.

[32] Based on Least Squares (LS) Means.

Table A5.5 continued: Differences in curative health care costs in euros from 2008 to 2009 for diabetes patients in management fee arrangements in 2008 (N = 14,666).

		Model 4	SE	p-value	Model 5[33]	SE	p-value	Model 6	SE	p-value
Intercept		-753.4	260.1	0.0039	-746	261.2	0.0045	-750.7	256.4	0.0080
2008 baseline costs		-0.6	0.008	<0.0001	-0.6	0.008	<0.0001	/	/	/
Age[35]		18.4	4.1	<0.0001	17.4	4.2	<0.0001	18.4	4.1	
Gender (ref. = female)		199.0	93.3	0.0329	192.8	95.8	0.0441	199.6	93.3	
Comorbidity (1-15)		1703.2	69.7	<0.0001	1692.5	71.2	<0.0001	1703.0	69.7	
Pricing schemes	BP	-88.8	349.3	0.7993	-110.7	356.7	0.7564	-92.4	344.1	
	MF	-1.3	258.4	0.9960	-0.3	259.5	0.9992	-5.9	254.4	
	CAU	ref.			ref.			ref.		
ICC		0.13%		0,2492	0.15%		0,2269	0.01%		0.4204
Number of patients		14,666			13,939					
Number level-2	GPs	563			561					
	Insurers							22		
Average number per level-2		26			24.8			666.6		
-2 log likelihood		294,529			279,960			294,529		

BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual; SE= standard error; GP= general practitioner.

Table A5.6: Differences in the use of hospital-based specialist care in 2009 by diabetes management patients as compared to care-as-usual patients (odds ratios) (N = 64,011).

	Model 0		Model 1	
	OR	95% CI	OR	95% CI
Disease management program[36] (ref. = no)	0.795	0.765-0.827	0.831	0.795-0.868
2008 specialist care utilisation (ref.= none)			8.959	8.560-9.378
Age[37] (centered)			1.014	1.012-1.016
Gender (ref. = female)			1.039	0.994-1.087
Comorbidity (0-15)			1.633	1.569-1.699

CI= Confidence Interval.

[33] Exclusively A10B users included.
[34] The care group-level does not exist in the care-as-usual group. Therefore model 5 can not be executed.
[35] Reference age is 67.8.
[36] Disease management program: Yes= bundled payment + Management Fee, No = Care as usual.
[37] Reference age is 67.8.

Table A5.7 Differences in the use of hospital-based diabetes specialist care in 2009 by diabetes management patients as compared to care-as-usual patients (odds ratios)(N = 64,011).

	Model 0		Model 1	
	OR	95% CI	OR	95% CI
Disease management program[38] (ref. = no)	0.569	0.541-0.599	0.583	0.533-0.614
2008 specialist care utilisation (ref.= none)			11.269	9.651-13.158
Age[39] (centered)			0.966	0.964-0.968
Gender (ref. = female)			1.139	1.082-1.200
Comorbidity (0-15)			1.348	1.302-1.395

CI= Confidence Interval.

Table A5.8 Differences in the use of outpatient care in 2009 by diabetes management patients as compared to care-as-usual patients (odds ratios) (N = 64,011).

	Model 0		Model 1	
	OR	95% CI	OR	95% CI
Disease management program[40] (ref. = no)	0.572	0.544-0.603	0.588	0.557-0.619
2008 specialist care utilisation (ref.= none)			11.858	10.089-13.938
Age[41] (centered)			0.965	0.963-0.968
Gender (ref. = female)			1.155	1.095-1.217
Comorbidity (0-15)			1.329	1.283-1.376

CI= Confidence Interval.

Table A5.9 Differences in the use of inpatient care in 2009 by diabetes management patients as compared to care-as-usual patients (odds ratios) (N = 64,011).

	Model 0		Model 1	
	OR	95% CI	OR	95% CI
Disease management program[42] (ref. = no)	0.714	0.567-0.899	0.724	0.574-0.911
2008 specialist care utilisation (ref.= none)			4.092	2.338-7.162
Age[43] (centered)			0.995	0.985-1.006
Gender (ref. = female)			1.047	0.830-1.321
Comorbidity (0-15)			1.923	1.699-2.175

CI= Confidence Interval.

[38] Disease management program: Yes= bundled payment + Management Fee, No = Care as usual.
[39] Reference age is 67.8.
[40] Disease management program: Yes= bundled payment + Management Fee, No = Care as usual.
[41] Reference age is 67.8.
[42] Disease management program: Yes= bundled payment + Management Fee, No = Care as usual.
[43] Reference age is 67.8.

Table A5.10 Differences in the use of hospital-based specialist care in 2009 by bundled payment patients and by management fee patients as compared to care-as-usual patients (odds ratios) (N = 64,011).

		Model 0		Model 1		Model 2	
		OR	95% CI	OR	95% CI	OR	95% CI
Pricing schemes	BP	0.748	0.716-0.782	0.800	0.761-0.841	ref.	
	MF	0.875	0.831-0.921	0.882	0.833-0.934	1.170	1.109-1.234
	CAU	ref.		ref.		1.337	1.279-1.397
2008 specialist care utilisation (ref.= none)				8.946	8.547-9.364		
Age[44] (centered)				1.014	1.012-1.016		
Gender (ref. = female)				1.038	0.993-1.085		
Comorbidity (0-15)				1.633	1.569-1.700		

BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual; CI= Confidence Interval.

Table A5.11 Differences in the use of hospital-based specialist care in 2009 by patients who were in the management fee group in 2008 as compared to care-as-usual patients (odds ratios) (N = 14,661).

		Model 0		Model 1	
		OR	95% CI	OR	95% CI
2008 specialist care utilisation (ref.= none)		9.170	8.353-10.066	8.245	7.500-9.064
Pricing schemes	BP			0.993	0.785-1.255
	MF			0.981	0.762-1.263
	CAU			ref.	
Age[45] (centered)				1.016	1.012-1.020
Gender (ref. = female)				1.052	0.960-1.153
Comorbidity (0-15)				1.617	1.490-1.754

BP= Bundled Payment; MF= Management Fee; CAU= Care As Usual; CI= Confidence Interval.

[44] Reference age is 67,8 jaar.

[45] Reference age is 67,8 jaar.

Figure A5.13 Data stream for the selection of the diabetes patient sample for the year 2010 in the 21 described steps.

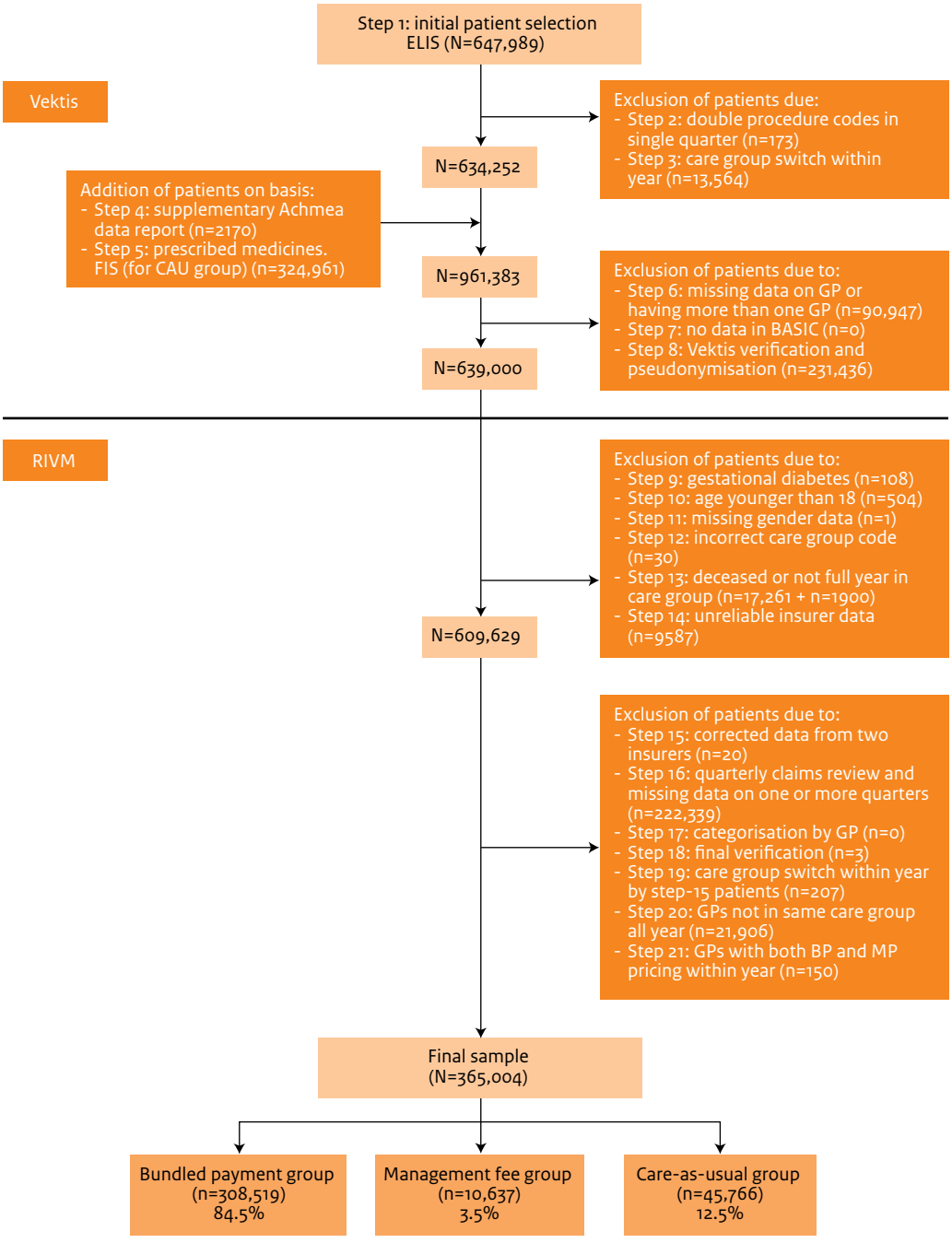


Figure A5.14 Data stream for the selection of the diabetes patient sample for the year 2008 in the 21 described steps.

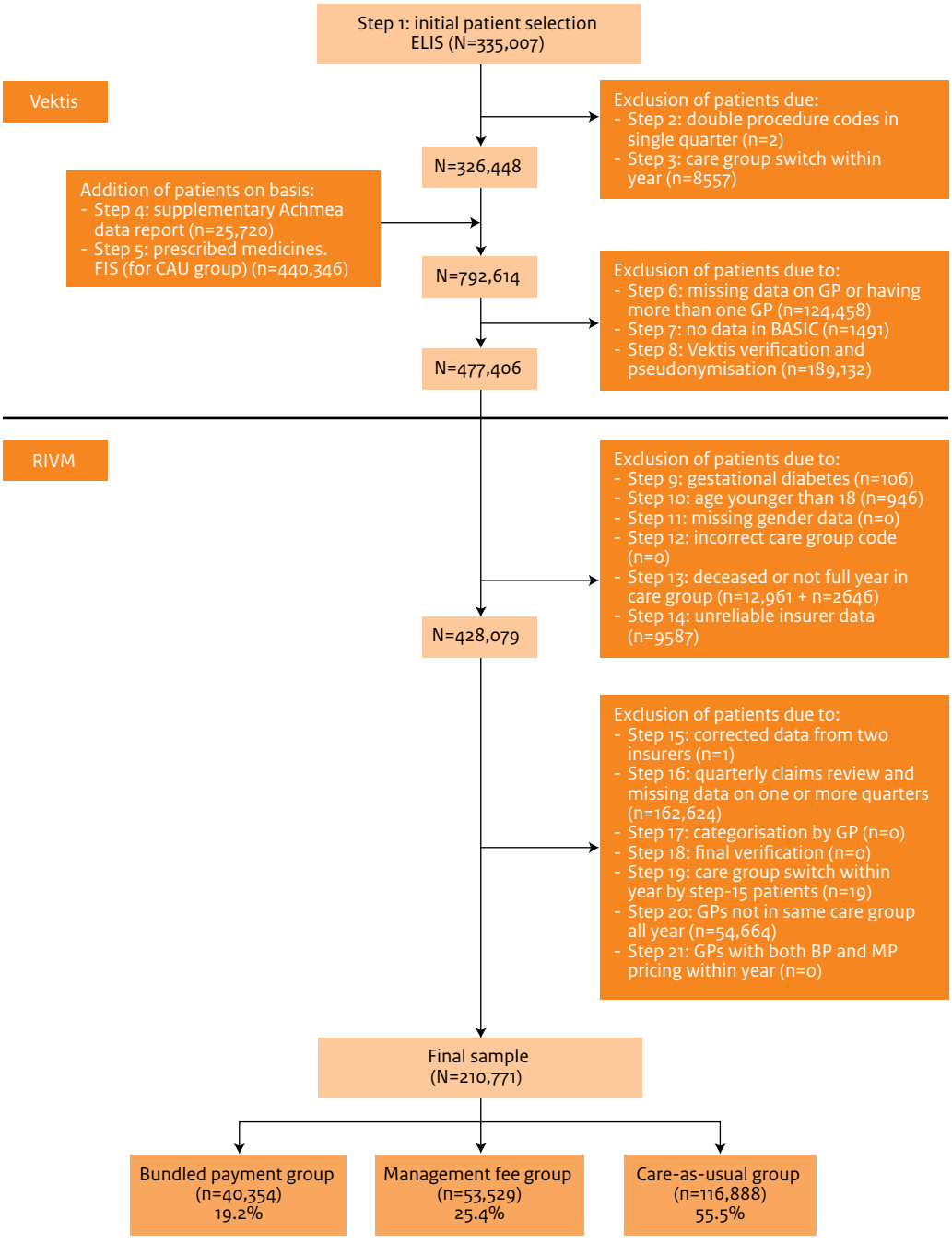


Figure A5.15 Data stream for the selection of the diabetes patient sample for the year 2007 in the 21 described steps.

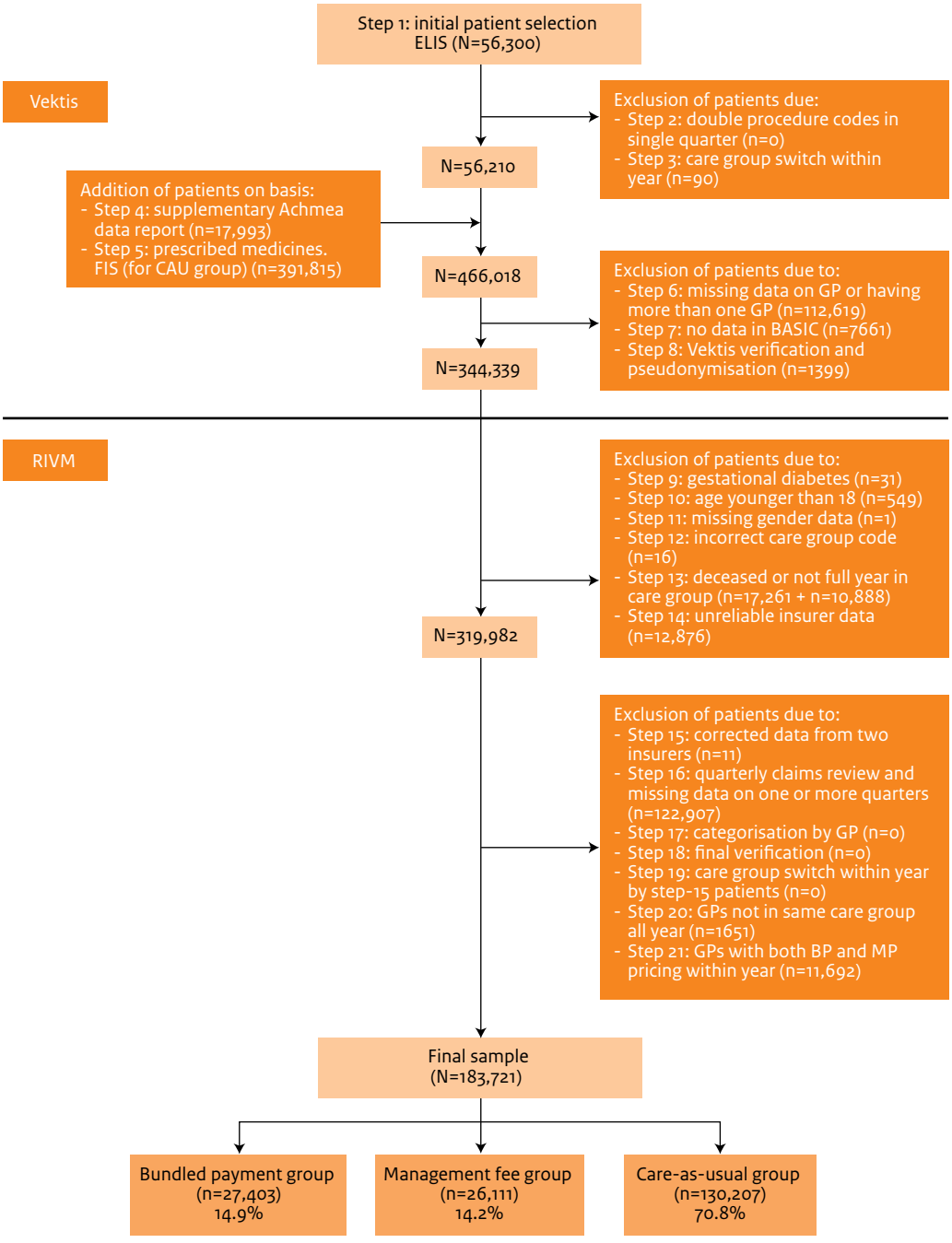
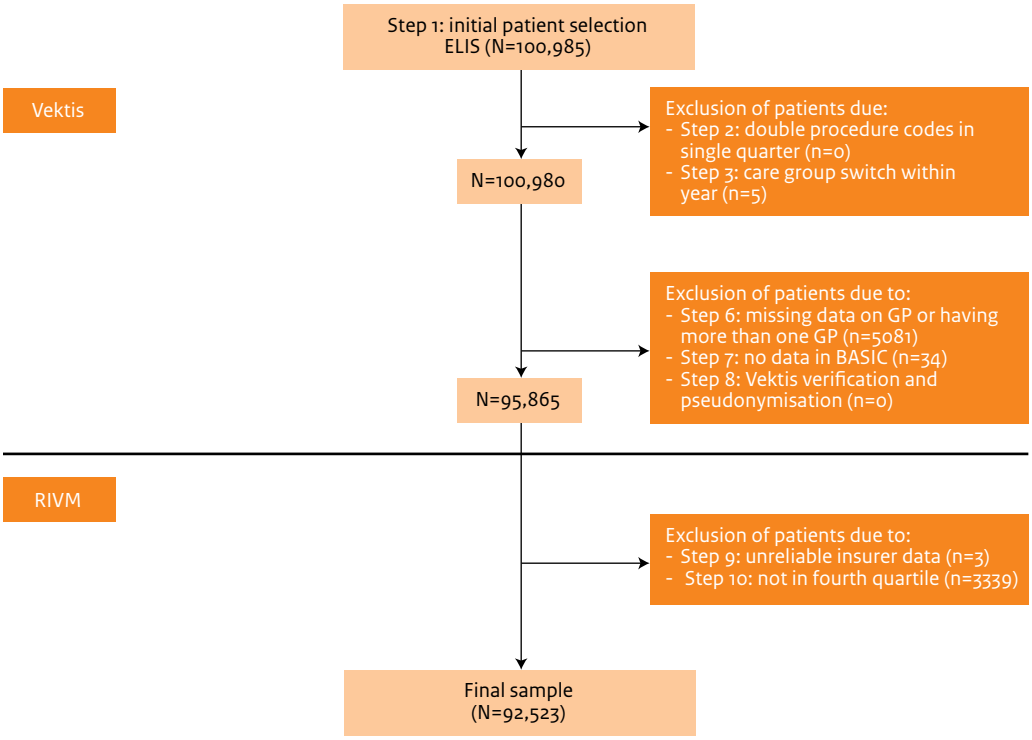


Figure A5.16 Data stream for the selection of the VRM patient sample for the year 2010 in the described steps.



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Report 260013001

A publication by the

National Institute for Public Health and the Environment
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www.rivm.nl

October 2012