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## A six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM GPs

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# Complementair werkende huisartsen en de kosten van zorg

Een klein aantal Nederlandse huisartsen heeft zich, naast het voltooiën van de reguliere huisartsenopleiding, aanvullend geschoold in complementaire behandelwijzen. De zorgkosten van de patiënten van deze complementaire huisartsen die gedekt worden door de basisverzekering zijn substantieel lager dan die van sociaal-economisch vergelijkbare patiënten met een reguliere huisarts, met name in het laatste levensjaar. Voor een goede sturing op kosten-effectiviteit in de zorg is verder onderzoek naar financiële en gezondheidseffecten van complementaire behandelwijzen gewenst.

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Een paar procent van de Nederlandse huisartsen heeft zich, naast het voltooiën van de reguliere huisartsenopleiding, aanvullend geschoold in complementaire geneeswijzen. De meest voorkomende aanvullende opleidingen zijn acupunctuur, antroposofische geneeskunde en homeopathie. Kenmerkend voor deze geneeswijzen is de holistische benadering van de mens (in tegenstelling tot een partiële of orgaan-specifieke benadering), terughoudendheid met betrekking tot de inzet van allopathische geneesmiddelen en het gebruik van *health promotion*-therapieën (zoals kunstzinnige therapie) die veelal niet door de basisverzekering gedekt worden. Gezien de toenemende noodzaak om zorguitgaven te verminderen en gezien de resultaten van een recente review over kosteneffecten van complementaire behandelwijzen (Herman *et al.*, 2012) en onze eigen studie naar kostenverschillen tussen patiënten van reguliere en van complementaire huisartsen (Kooreman en Baars, 2012), worden in dit artikel opnieuw de zorgkosten van de patiënten van deze twee typen huisartsen vergeleken, maar nu bij een veel grotere groep. Daarbij wordt alleen gekeken naar kosten die door de

zorgverzekeraar worden vergoed, met een onderscheid tussen de verplichte basisverzekering en de vrijwillige aanvullende verzekering.

## DE AGIS HEALTH DATABASE

Het onderzoek maakt gebruik van geanonimiseerde gegevens uit de Agis Health Database (Smeets *et al.*, 2010), waarin gegevens voor alle verzekerden van Agis zijn vastgelegd. Van elke verzekerde in dit databestand is bekend bij welke huisarts of huisartsenpraktijk hij of zij staat ingeschreven. Door deze informatie te vergelijken met die op de websites van de beroepsverenigingen van antroposofische artsen ([www.nvaa.nl](http://www.nvaa.nl)), arts-acupuncturisten ([www.acupunctuur.com](http://www.acupunctuur.com)) en arts-homeopaten ([www.vhan.nl](http://www.vhan.nl)) kan worden vastgesteld of een verzekerde een complementair werkende huisarts heeft. In het databestand komen 9.323 huisartsen en huisartsenpraktijken voor, waarvan 109 als complementair werkend konden worden geïdentificeerd. Het merendeel van de complementair werkende huisartsen in dit databestand zijn antroposofische huisartsen. Het bestand bevat zorgverzekeringsgegevens van ruim 1,5 miljoen verzekerden gedurende de jaren 2006–2011. Bijna 19.000 verzekerden daarvan, ofwel 1,2 procent, hadden gedurende de hele periode een complementair werkende huisarts. Ruim 10.000 andere verzekerden hadden in sommige jaren een reguliere en in andere jaren een complementair werkende huisarts. Zij zijn geïdentificeerd als overstappers. Gemiddeld was deze laatste groep verzekerden drie jaar bij een reguliere en drie jaar bij een complementair werkende huisarts ingeschreven. Kader 1 laat zien in welk opzicht de analyse verschilt van eerder kostenonderzoek naar complementair werkende huisartsen.

Tabel 1 vermeldt voor drie groepen patiënten in het Agis-bestand achtergrondkarakteristieken en de gemiddelde jaarlijkse zorgkosten: patiënten die uitsluitend bij een reguliere huisarts ingeschreven waren, patiënten die uitsluitend bij een complementair werkende arts ingeschreven waren, en patiënten die een of meer keren zijn overgestapt van het ene naar het andere type huisarts.

Tabel 1 laat allereerst zien dat verzekerden die uitsluitend bij een complementair werkende huisarts waren ingeschreven iets ouder en vaker vrouw zijn, en minder vaak afkomstig uit achterstandswijken. De verzekerden die uitsluitend bij een regulier werkende huisarts waren ingeschreven en de groep overstappers komen grotendeels overeen qua sociaal-economische karakteristieken.

De kosten gedekt door de basisverzekering van patiënten met uitsluitend een complementair werkende huisarts zijn gemiddeld 183 euro per jaar (10,1 procent) lager dan die van patiënten met uitsluitend een reguliere huisarts. Dat komt vooral door lagere kosten voor farmaceutische zorg en ziekenhuiszorg, zoals de uitsplitsing in tabel 1 laat zien. De kosten van overstappers zijn hoger. Dat suggereert dat overstappers meer met (chronische) ziektes te maken hebben; mogelijk is dat een aanleiding voor het maken van de overstap.

In het algemeen worden de meeste kosten gemaakt in het laatste levensjaar. Voor verzekerden die tussen 2007 en 2011 zijn overleden kunnen die kosten worden vastgesteld door te kijken naar het kwartaal van overlijden plus de drie voorgaande kwartalen. Deze zijn 1.451 euro (9,9 procent) lager wanneer de verzekerde een complementair werkende huisarts heeft.

#### ACHTERGRONDKENMERKEN

De betekenis van de gevonden verschillen is beperkt vanwege de verschillende achtergrondkarakteristieken van de twee groepen verzekerden. Daarom wordt gecorrigeerd voor geobserveerde kenmerken door middel van een regressieanalyse met diverse verklarende variabelen: leeftijd, geslacht, jaardum-

my's, dummy's voor de viercijferige postcode van de patiënt en een dummyvariabele voor het hebben van een complementair werkende huisarts. De geschatte coëfficiënten voor de laatstgenoemde variabele staan vermeld in tabel 2. De groep overstappers blijft in eerste instantie buiten beschouwing.

De kostenverschillen zijn nu fors groter dan in tabel 1. De kosten gedekt door de basisverzekering zijn gemiddeld 225 euro per jaar (12,4 procent) lager voor patiënten met een complementair werkende huisarts (significant op eenprocentniveau). Dat komt vooral door lagere kosten voor ziekenhuis- en farmaceutische zorg. Voor verzekerden in de leeftijdscategorie 50–75 jaar bedraagt het verschil eveneens ruim twaalf procent, maar gaat het om hogere absolute bedragen: 356 euro per jaar (significant op eenprocentniveau).

Tegenover lagere kosten gedekt door de basisverzekering staan hogere kosten gedekt door aanvullende verzekeringen, gemiddeld 33 euro per jaar. Per saldo zijn de door de verzekeraars vergoede kosten ruim lager ( $-225 + 33 = -192$  euro) voor verzekerden met een complementair werkende huisarts.

De kosten gedekt door de basisverzekering in het laatste levensjaar bij patiënten met een complementair werkende huisarts liggen, na correctie voor geobserveerde achtergrondkenmerken, 1.161 euro lager (significant op tienprocentniveau). Dat verschil wordt volledig veroorzaakt door lagere ziekenhuiskosten (1.250 euro, significant op eenprocentniveau). Dat gaat niet gepaard met hogere kosten gedekt door aanvullende verzekeringen.

In een regressie waarin de drie groepen verzekerden zijn samengevoegd, is de geschatte coëfficiënt voor het hebben van een complementair werkende arts  $-128$  voor de kosten in de basisverzekering en 32 voor de aanvullende verzekering (beide significant op eenprocentniveau).

#### Eerder kostenonderzoek

KADER 1

Eerder kostenonderzoek liet zien dat het verschil in kosten van een patiënt met een complementair werkende huisarts en een vergelijkbare patiënt met reguliere huisarts (zonder onderscheid tussen basis- en aanvullende verzekering) varieert tussen 0 en 30 procent, afhankelijk van het type complementaire huisarts en de leeftijdscategorie van de patiënt (Kooreman en Baars, 2012).

De belangrijkste verschillen tussen het Azivo-bestand en het nu gebruikte Agis-bestand zijn:

- Het Agis-bestand bevat gegevens van tienmaal zo veel verzekerden: ruim 1,5 miljoen versus ruim 150.000. Als gevolg daarvan worden de kostenverschillen in het nieuwe onderzoek geschat met een grotere statistische precisie.

- In tegenstelling tot in het Azivo-bestand wordt in het Agis-bestand onderscheid gemaakt tussen zorgkosten die door de basisverzekering van de Zorgverzekeringwet worden gedekt en kosten die worden gedekt vanuit een eventueel afgesloten vrijwillige aanvullende verzekering.

- Het Azivo-bestand had betrekking op de jaren 2006–2009; het Agis-bestand heeft betrekking op de jaren 2006–2011.

- In het werkgebied van Agis, voornamelijk Amsterdam en Midden-Nederland, bevinden zich verhoudingsgewijs minder complementair werkende huisartsen (ongeveer één procent) dan in het kleinere werkgebied van Azivo, dat bestaat uit Den Haag en omstreken (ongeveer vier procent).

- In het beschikbare Agis-bestand is de postcode-informatie minder gedetailleerd dan in het Azivo-bestand (vier in plaats van zes posities). Als gevolg daarvan kan minder goed worden gecorrigeerd voor de verschillen in achtergrondkarakteristieken van verzekerden.

#### Kenmerken en kosten in euro's per jaar van drie groepen verzekerden<sup>1</sup>

TABEL 1

	Alleen reguliere huisarts	Alleen complementair werkende huisarts	Overstappers
Leeftijd (jaar)	41,0	41,6	40,1
Vrouw	52,9%	55,2%	56,4%
'Vogelaarwijk'	15,7%	9,3%	17,1%
Aanvullend verzekerd	92,7%	93,4%	92,1%
Basisverzekering			
Totaal	1.821	1.638	1.989
Huisarts	133	128	140
Geneesmiddelen	402	357	474
Ziekenhuis	1.242	1.104	1.328
Paramedisch	44	48	47
Aanvullende verzekering	75	115	100
Aantal verzekerden	1.521.773	18.862	10.769

<sup>1</sup> Alle verschillen tussen de eerste twee kolommen zijn statistisch significant op het eenprocentniveau. De kosten van (ambulance)vervoer en verloskunde blijven buiten beschouwing.

## Geschatte kostenverschillen verzekerden bij complementair werkende versus reguliere huisarts, in euro's per jaar<sup>1</sup>

TABEL 2

	Basisverzekering					Aanvullende verzekering
	Totaal	Huisarts	Geneesmiddelen	Ziekenhuis	Paramedisch	
Alle leeftijden	-225***	-3***	-58***	-165***	1	33***
0-24	-80***	-3***	-2	-74***	-2	11***
25-49	-137***	-2**	-50***	-85**	1	32***
50-74	-356***	-1	-126***	-232***	3	52***
75+	-236*	11***	-38	-219**	10	24***
Laatste levensjaar	-1161*	-5	67	-1250**	27	3

<sup>1</sup>Analyse exclusief overstappers. Standaardfouten geclusterd op het niveau van de verzekerde.

\*/\*\*/\*\* Significant op respectievelijk tien-, vijf- en eenprocentniveau

### GEZONDHEIDSBATEN

De analyse tot nu toe beperkte zich tot kosten. In het databestand is slechts één – maar wel een belangrijke – uitkomstindicator beschikbaar, namelijk sterfte. In de data worden minimale verschillen gevonden tussen sterfte onder patiënten van de twee typen huisartsen. Na correctie voor patiëntkenmerken zijn er lichte aanwijzingen voor lagere sterfte onder patiënten met een complementair werkende huisarts op basis van een lineair kansmodel en een conditioneel logitmodel, maar geen aanwijzingen voor verschillen in sterfte op basis van een *proportional hazard*-model.

### MOGELIJK OORZAKEN VAN DE KOSTENVERSCHILLEN

Substitutie van zorg gedekt uit de basisverzekering door aanvullend verzekerde zorg die niet uit collectieve middelen wordt gefinancierd is – zo laten de gepresenteerde resultaten zien – een partiële verklaring voor de lagere kosten gedekt door de basisverzekering bij verzekerden met een complementair werkende huisarts. Een andere mogelijke verklaring zijn niet-waargenomen verschillen tussen de patiënten van de twee typen huisartsen. Zo is het denkbaar dat mensen die zo weinig mogelijk medische ingrepen willen of bewust een

gezonde leefstijl nastreven eerder voor een complementair werkende huisarts kiezen. Ander onderzoek laat echter zien dat bij complementair werkende artsen relatief veel patiënten met ernstige en chronische ziektes voorkomen (Melchart *et al.*, 2005). Daarom is het op voorhand onduidelijk wat het effect is van ongeobserveerde patiëntkenmerken op de kostenverschillen. Nog een mogelijke verklaring is dat patiënten met een complementair werkende huisarts onvoldoende zorg krijgen. De resultaten van de sterfteanalyse, evenals ander onderzoek naar klantervaringen met complementaire behandelwijzen, wijzen echter niet in die richting (Melchart *et al.*, 2005). Ten slotte zouden de resultaten het gevolg kunnen zijn van een kwalitatief betere praktijk van complementair werkende huisartsen, als gevolg van een sterkere focus op preventieve en curatieve gezondheidsbevordering, minder overbehandeling en betere communicatie en professionele relaties (Van Dulmen *et al.*, 2010).

### CONCLUSIES

In tegenstelling tot landen als Duitsland, Zwitserland en de Verenigde Staten staat de overheid in Nederland overwegend afhoudend tegenover complementaire geneeswijzen. Dit komt onder meer tot uitdrukking in het ontbreken van een systematisch onderzoeksbeleid rond zulke behandelwijzen. De resultaten van dit kostenonderzoek bevatten aanwijzingen dat complementaire geneeswijzen, toegepast onder supervisie van artsen die eerst een reguliere opleiding hebben voltooid, mogelijk een substituut kunnen zijn voor zorg die wordt gedekt door de basisverzekering zonder dat dit de gezondheid schaadt. Meer onderzoek is nodig om duidelijkheid te verkrijgen over het kwantitatieve belang van de diverse mogelijke verklaringen van de kostenverschillen. Vervolgonderzoek vereist de opbouw van een data-infrastructuur waarbij longitudinale informatie over de gezondheidstoestand op het niveau van individuele verzekerden wordt gekoppeld aan zorgkosten. Dit moet duidelijk maken of het opwerpen van drempels tegen het gebruik van complementaire geneeswijzen verstandig beleid is.

De overheid dient dit onderzoeksproces te faciliteren in plaats van af te remmen. Naast de eventuele gezondheidswinst kan dit leiden tot een aanzienlijke besparing op de kosten van collectief gefinancierde zorg.

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**Additional file 1**

EVEREST Statement: Checklist for health economics paper

	<b>Study section</b>	<b>Additional remarks</b>
<b>Study design</b>		
(1) The research question is stated	Introduction	
(2) The economic importance of the research question is stated	Introduction	
(3) The viewpoint(s) of the analysis are clearly stated and justified	Methods; Discussion	
(4) The rationale for choosing the alternative programmes or interventions compared is stated	Methods	
(5) The alternatives being compared are clearly described	Introduction; Methods	
(6) The form of economic evaluation used is stated	Introduction; Methods	
(7) The choice of form of economic evaluation is justified in relation to the questions addressed	Introduction; Methods; Discussion	
<b>Data collection</b>		
(8) The source(s) of effectiveness estimates used are stated	Methods	
(9) Details of the design and results of effectiveness study are given (if based on single study)	N/A	
(10) Details of the method of synthesis or meta-analysis of estimates are given (if based on an overview of a number of effectiveness studies)	N/A	
(11) The primary outcome measure(s) for the economic evaluation are clearly stated	Methods	
(12) Methods to value health states and other benefits are stated	Introduction; Methods	
(13) Details of the subjects from whom valuations were obtained are given	Methods	
(14) Productivity changes (if included) are reported separately	N/A	
(15) The relevance of productivity changes to the study question is discussed	N/A	
(16) Quantities of resources are reported separately from their unit costs	Methods; Tables 2-4	
(17) Methods for the estimation of quantities and unit costs are described	Methods; Tables 2-4	
(18) Currency and price data are recorded	Methods; Tables 2-4	
(19) Details of currency of price adjustments for	NA	

inflation or currency conversion are given		
(20) Details of any model used are given	Methods-Model overview	
(21) The choice of model used and the key parameters on which it is based are justified	Methods	
<b>Analysis and interpretation of results</b>		
(22) Time horizon of costs and benefits is stated	Methods; Discussion	
(23) The discount rate(s) is stated	N/A	
(24) The choice of rate(s) is justified	N/A	
(25) An explanation is given if costs or benefits are not discounted	N/A	
(26) Details of statistical tests and confidence intervals are given for stochastic data	N/A	
(27) The approach to sensitivity analysis is given	N/A	
(28) The choice of variables for sensitivity analysis is justified	Methods; Tables 2-4	Confidence intervals are given
(29) The ranges over which the variables are varied are stated	Tables 2-4	
(30) Relevant alternatives are compared	Introduction; Methods	
(31) Incremental analysis is reported	Discussion	We describe the extrapolation from the lower costs in the CAM group of patients to the Dutch population
(32) Major outcomes are presented in a disaggregated as well as aggregated form	Tables 2-4	
(33) The answer to the study question is given	Discussion; Conclusion	
(34) Conclusions follow from the data reported	Conclusion	
(35) Conclusions are accompanied by the appropriate caveats	Discussion; Conclusion	

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**Abstract**

**Objectives** To compare healthcare costs and mortality rates of Dutch patients with a conventional (CON) general practitioner (GP) and patients with a GP who has additionally completed training in complementary and alternative medicine (CAM).

**Design** Comparative economic evaluation.

**Setting** Database from the Dutch insurance company Agis.

**Participants** 1,521,773 patients (98.8%) from a CON practice and 18,862 patients (1.2%) from a CAM practice.

**Main outcome measures** Annual information on five types of healthcare costs for the years 2006 – 2011: care by GP, hospital care, pharmaceutical care, paramedic care and care covered by supplementary insurance. Healthcare costs in the last year of life. Mortality rates.

**Results** The mean annual compulsory and supplementary healthcare costs of CON patients are respectively 1,821 Euros (95% CI: 1,813 – 1,828) and 75.3 Euros (95% CI: 75.1 – 75.5). Compulsory healthcare costs of CAM patients are 225 Euros (95% CI: 169 – 281;  $p < 0.001$ ) (12,4%) lower and result mainly from lower hospital care costs (165 Euros) (95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros) (95% CI: 41 – 75;  $p < 0.001$ ), especially in the age categories 25 – 49 years and 50 – 74 years. The costs in the last year of life of patients with CAM GPs are 1,161 euro (95% CI: -138 – 2,461;  $p < 0.1$ ) lower. This difference is entirely due to lower hospital costs (1,250 Euros) (95% CI: 19 – 2,481;  $p < 0.05$ ). The mean annual supplementary costs of CAM patients are 33 Euros (95% CI: 30 – 37;  $p < 0.001$ ) (44%) higher. CAM patients do not have lower or higher mortality rates than CON patients.

**Conclusions** Dutch patients whose GP additionally completed training in CAM on average have 192 Euros (10.1%) lower annual total compulsory and supplementary healthcare costs and do not live longer or shorter than CON patients.



### Strengths and limitations of this study

- The study is based on a large sample size of patients and practices and a relatively long period of six years contributing to more precise estimations, and better representativeness and generalizability of the results.
- The study distinguishes between compulsory and supplementary costs providing a more complete picture of healthcare costs expenditure related to CAM.
- The study did not compare two treatments (conventional versus CAM) for a specific indication, in a controlled setting with other health related outcome parameters than mortality, prohibiting the possibility to detect causal relationships between interventions and (cost)effects.
- Since the analyses were at the level of the 4-digit postcode and not at the level of the 6-digit postcode, the results might not be optimally controlled for socio-economic status of the patients.
- The study concerns a limited dataset, since the dataset is from only one insurer and the data reflect the behaviour of only a small number of CAM modalities (most GP practices (64%) were anthroposophic). These facts challenge the generalizability of the results.

## Introduction

In most countries of the European Union the annual healthcare costs are rising faster than the economy [1]. Therefore, national healthcare policies are increasingly aiming at controlling and diminishing healthcare expenditures. This also applies to the situation in The Netherlands [2]. In 1972 8% of the Dutch national income (GDP) was used to finance public healthcare. In 2010 already 13% of GDP was used and The Netherlands were worldwide in second place of healthcare expenditures of countries. Without drastic measures, the estimated costs will be over 30% in 2040 [3]. Public spending on healthcare will rise from 61 billion Euros in 2012 to an estimated nearly 80 billion Euros in 2017 [4]. Dutch health economists and policy makers have largely ignored the possible contribution of Complementary and Alternative Medicine (CAM) and Integrative Medicine (IM) to the reduction of healthcare costs as an area of research and interest. The here presented economic study, a six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM general practitioners (GPs), contributes to the development of an evidence-based Dutch policy with regard to the role of CAM and IM in the reduction of healthcare expenditure growth.

### *The Dutch financing system*

The Dutch financing system contains two basic compulsory health insurances, that are for 80% paid for by income taxes: for curative care (Zorgverzekeringswet (ZvW)) and for long-term care (Algemene Wet Bijzondere Ziektekosten (AWBZ)). In addition, people in The Netherlands can buy supplementary insurance. The primary goal of supplementary insurance is to cover costs not covered by basic insurance (for example specific paramedic treatment, complementary therapies) [5]. The second goal of the supplementary insurance is to cover the costs of improvements over the standard level of care paid for by compulsory insurance (e.g., extra costs for a better room and service in case of hospitalisation).

### *Policies to reduce healthcare expenditure growth*

The vast majority of expenditure growth is due to innovations in healthcare. The Cultureel Planbureau (CPB) anticipates that the total costs of curative care will rise from 36 billion Euros this year to 49 billion Euros in 2017. The rising costs of curative care, according to the

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3 CPB is largely due to the ‘creeping expansion’ of the compulsory health insurance; ‘Year  
4 after year, new medical techniques and drugs appear on the market that are often better, but  
5 also more expensive’, especially, since more patients will be treated with the new techniques  
6 [3]. Of the total growth of public healthcare expenditure, about a quarter is the result of  
7 aging. In 2040 more than 22% of the Dutch population will be older than 65, whereas  
8 currently this is 16%. As people grow older, on average the costs of healthcare will increase  
9 (on the level of the whole older population).  
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15 Which policies can be deployed to control the risk of rising costs? The measures  
16 aimed at reducing healthcare expenditures are, without being complete: more efficiency and  
17 higher productivity in healthcare (including reducing management layers), more competition  
18 between healthcare institutions, fewer hospitals (specialization and concentration), more  
19 ‘neighbourhood care’ by general practitioners (GPs), more remote care (e-health), preventing  
20 overtreatment/ less (extra) care, more responsible behaviour of consumers (more self-care),  
21 more emphasis on healthy living (prevention), higher co-payments, higher deductibles and  
22 already saving for higher health care expenditure in the old days (precautionary savings) [3].  
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30 In July 2013 the Dutch healthcare minister Schippers reached an agreement with  
31 hospitals, medical specialists, mental healthcare providers, general practitioners, health  
32 insurers and patients’ organizations to reduce the growth rate of healthcare spending: to 1.5%  
33 in 2014 and 1% per year from 2015 to 2017. This reduction represents a total additional  
34 savings of approximately 1 billion Euros. To achieve the reduced expenditure growth extra  
35 measures will be taken that increase the efficiency and improve the quality of care: more care  
36 of medical specialists goes to the GP and from the GP to self-care; concentration of complex  
37 care; tighter application of medical guidelines and care standards; treatments are given  
38 according the standards of the medical profession itself; access to the claims of the  
39 compulsory health insurances is tightened; and more transparency about quality and cost of  
40 care [6].  
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### 51 *The contribution of Complementary and Alternative Medicine*

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53 According to the National Center for Complementary and Alternative Medicine (NCCAM),  
54 CAM is a group of diverse medical and healthcare systems, practices, and products that are  
55 not generally considered part of conventional medicine [7]. The Cochrane Collaboration  
56 definition of complementary medicine is that it includes all such practices and ideas that are  
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3 outside the domain of conventional medicine in several countries and defined by its users as  
4 preventing or treating illness, or promoting health and well-being. These practices  
5 complement mainstream medicine by satisfying a demand not met by conventional practices  
6 and diversifying the conceptual framework of medicine [8]. “Integrative Medicine is the  
7 practice of medicine that reaffirms the importance of the relationship between practitioner  
8 and patient, focuses on the whole person, is informed by evidence, and makes use of all  
9 appropriate therapeutic approaches, healthcare professionals and disciplines to achieve  
10 optimal health and healing.” In addition, IM emphasizes the active role of the patient in  
11 prevention (lifestyle), well-being and therapy and healing processes, and the use of healing  
12 environments [9].  
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21 Herman et al. [10] performed a systematic review of economic evaluations on  
22 complementary and integrative medicine (CIM). This study identified 338 economic  
23 evaluations of CIM, including 114 full evaluations, published between 2001 and 2010. All  
24 recent (and likely most cost-relevant) full economic evaluations published from 2001 to 2010  
25 were subjected to several measures of quality. Detailed results of higher-quality studies were  
26 reported. The cost-utility analyses found were of similar or better quality to those published  
27 across all medicine. Of the 56 comparisons made in the higher-quality studies, 16 (29%)  
28 show a health improvement with cost savings for the CIM therapy versus usual  
29 (conventional) care. Study quality of the cost-utility analyses (CUAs) of CIM was generally  
30 comparable to that seen in CUAs across all medicine according to several measures, and the  
31 quality of the cost-saving studies was slightly, but not significantly, lower than those showing  
32 cost increases (85% vs 88%,  $p = 0.460$ ).  
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41 In The Netherlands, a few percent of the GPs have followed an additional training in  
42 CAM. In 2010, we performed a first economic evaluation, comparing the healthcare costs of  
43 patients from Dutch conventional (CON) GPs and CAM GPs [11]. A dataset from a Dutch  
44 health insurer Azivo was used containing quarterly information on healthcare costs (GP care,  
45 hospital care, pharmaceutical care, and paramedic care), dates of birth and death (if  
46 applicable), gender and 6-digit postcode of all approximately 150,000 insurees, for the years  
47 2006–2009. Data from 1,913 conventional GPs were compared with data from 79 GPs with  
48 additional CAM training in acupuncture ( $n=25$ ), homeopathy ( $n=28$ ), and anthroposophic  
49 medicine ( $n=26$ ). Results were that patients whose GP has additionally completed training in  
50 CAM training had 0–30% lower healthcare costs and mortality rates, depending on age  
51 groups and type of CAM. The lower costs resulted from fewer hospital stays and fewer  
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3 prescription drugs. It was concluded that more controlled studies (replication studies,  
4 research based on more comprehensive data, cost-effectiveness studies on CAM for specific  
5 diagnostic categories) were indicated.  
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### 10 11 *This study*

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13 Given the current need to diminish healthcare expenditures in The Netherlands and based on  
14 the positive results from both the review of Herman et al. [10] and our own study [11], we  
15 decided to perform a replication study comparing the healthcare costs of patients from  
16 conventional (CON) GPs and CAM GPs with a larger dataset from a Dutch health insurer, to  
17 analyse the robustness of the results of the first study. The research questions of the study  
18 were:  
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24 1. Is there a statistically significant difference in healthcare costs (care by GP, hospital  
25 care, pharmaceutical care, paramedic care, care covered by supplementary insurance,  
26 and healthcare costs in the last year of life) of patients from CON GPs and CAM  
27 GPs?  
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31 2. Is there a statistically significant difference in mortality rates of patients from CON  
32 GPs and CAM GPs?  
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### 37 **Methods**

#### 38 39 *Comparative economic evaluation*

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41 Full economic evaluations compare the costs (resource use) associated with one or more  
42 alternative interventions (e.g. intervention X versus comparator Y) with their consequences  
43 (outcomes, effects). In this study we were able to measure five types of costs in two  
44 categories: (1) care covered by compulsory insurance: care by GP, hospital care,  
45 pharmaceutical care, paramedic care, and (2) costs covered by supplementary insurance.  
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47 Alternative interventions were: conventional GP care compared to care from GPs that know  
48 CAM. Outcomes were: differences in healthcare costs and annual mortality rates.  
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### *Model overview*

Costs were analysed at the patient level using linear and loglinear regression analysis. The cost analysis has been performed for the total sample, as well as separately for the age groups 0–24, 25–49, 50–74, and  $\geq 75$ , given the large average differences in health and healthcare needs across age groups. Effects on mortality rates are analysed using a linear probability model (LPM), a Logit model, and a Cox proportional hazard model (CPH). In all models, the explanatory variables are gender, age (linear, within each age category), dummies for CAM and ‘Vogelaarwijk’ (city areas with known lower socio-economic status of inhabitants), year dummies, and postal code fixed effects. In the cost regressions and the LPM model, fixed effects at the 2-digit insuree postcode level were controlled for. In the Logit and CPH model 2-digit postcode level fixed effects were included, as estimation with more detailed fixed effects appeared to be numerically infeasible.

### *Dataset on healthcare costs and demographics*

A dataset was analyzed from health insurer Agis, a subsidiary company of Achmea. Achmea has a share in the market of 31% (5.18 million insured) of the Dutch population in 2013; while the share of Agis is 9,2% (1.54 million insured) The dataset contains quarterly information on the healthcare costs of all Agis insures, which was aggregated to annual information for the years 2006 up to 2011. In addition, it contains the date of birth of the insuree, date of death (if applicable), gender, and 4-digit postcode of the insured’s residence. For each insuree year combination, information on the costs of five different types of care is available: care by GP, hospital care, pharmaceutical care, paramedic care (like physical therapy), and care covered by supplementary insurance.

### *General practitioners and patients*

The dataset also contains the names and addresses of the general practitioners who have patients who are insured by Agis, which allows us to distinguish between CON GPs and CAM GPs. We defined a general practitioner as anthroposophic CAM GP if his or her name appears in the list of general practitioners with additional training in anthroposophic medicine (AM) as provided by their professional association [14]. CAM GPs with homeopathy (HOM) [15] and CAM GPs with acupuncture [16] are defined similarly.

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3 Patients were regarded CON patients and CAM patients if they were patient of  
4 respectively a CON GP or a CAM GP during all of the years they appear in the dataset.  
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6 Patients that transferred from a CON GP to a CAM GP or vice versa , were regarded to be a  
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8 member of a third group called ‘Switchers’ and were excluded from all analyses.  
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### 10 11 12 *Statistical analyses*

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14 Significance of coefficients is tested using Student t tests, with clustering of standard errors at  
15 the level of the insured. Calculations were made using StataSE 10.0. Means with 95%  
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17 confidence intervals and p-values ( $< 0.1$ ,  $< 0.05$ , and  $< 0.01$ ) are presented.  
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### 20 21 22 *Ethical approval*

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24 Since the study involved no experimental treatment, patients were not recruited. Since patient  
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26 data were anonymized, no ethical approval was necessary.  
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## 29 30 31 **Results**

### 32 33 *GP practices and patients*

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35 The dataset contained 9,126 GP practices: 9,016 CON practices and 110 CAM practices. Due  
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37 to the systematics of the insurance company, one individual GP can appear as different  
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39 practices, so the actual number of GPs is lower than the number of GP practices. Contrarily,  
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41 each patient is never counted more than once. The majority of the CAM GPs are  
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43 anthroposophic GPs (70 AM practices (64%) with 17,257 patients (91%)).  
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### 46 47 *Healthcare costs*

#### 48 49 **The dataset**

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51 The dataset contains information of more than 1.5 million insurees during the years 2006-  
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53 2011 (Table 1). Nearly 19,000 insurees (1.2%) had throughout this whole period a CAM GP.  
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55 More than 10,000 other insurees had in some years a CON GP and in other years a CAM GP  
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57 (‘Switchers’). On average, the Switchers group had three years a CON GP and three years a  
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CAM GP. The insurees had a mean age of 41.0 (SD=23.5). 53% are women. These patients live in 4,014 different 4-digit postal codes.

Without controlling for relevant differences between the groups, the comparison demonstrates: higher percentages of females in in the CAM GP and Switchers groups; higher percentages of insurees living in the ‘Vogelaarwijk’ in the CON and Switchers group; 183 Euros lower and 168 Euros higher total compulsory costs in respectively the CAM and the Switchers group; and 40 Euros and 25 Euros higher supplementary costs in costs in respectively the CAM and the Switchers group.

Since the aim of the study was to compare the costs of patients with a CON GP and a

	CON GP	CAM GP	Switchers
Age (year)	41.0	41.6	40.1
Female (percentage)	52.9%	55.2%	56.4%
‘Vogelaarwijk’ (percentage)	15.7%	9.3%	17.1%
Supplementary insured (percentage)	92.7%	93.4%	92.1%
Compulsory insurance costs (Euros)			
<i>Total costs</i>	1,821	1,638	1,989
<i>GP costs</i>	133	128	140
<i>Pharmaceutical costs</i>	402	357	474
<i>Hospital costs</i>	1,242	1,104	1,328
<i>Paramedical costs</i>	44	48	47
Supplementary insurance costs (Euros)	75	115	100
Insurees (n)	1,521,773	18,862	10,769



CAM GP, the data of the Switchers group were left out of the further regression analyses.

### **Annual total compulsory and supplementary insurance costs**

The mean annual total costs of patients treated in CON practices covered by the compulsory insurance were 1,821 Euros (95% CI: 1,813 – 1,828) (Table 1). After correction for observed differences between the groups by means of linear regression analyses, the mean annual total compulsory insurance costs of patients of CAM GP practices are 225 Euros (95% CI: 169 – 281;  $p < 0.001$ ) (12.4%) lower. These lower costs are mainly due to lower hospital costs (165 Euros; 95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros; 95% CI: 41 – 75;  $p < 0.001$ ).

The mean annual total supplementary costs for patients treated in CON practices were 75.3 Euros (95% CI: 75.1 – 75.5). (The mean is calculated over all patients, including those (less than 8%) without supplementary insurance.) For patients treated in CAM practices these costs are 33 Euros (95% CI: 31 – 37;  $p < 0.001$ ) (44%) higher and were highest in the third age group (50 – 74 years) (52 Euros (95% CI: 31 – 37;  $p < 0.001$ )). Taken together, the mean total annual compulsory and supplementary insurance costs are 192 Euros (10.1%) lower for the CAM group of patients.

The log linear analyses of the mean total annual compulsory and supplementary insurance costs (Table 3) provide the same lower costs for the CAM group of patients as found in the linear analyses (Table 2). In addition, higher paramedic costs are found for the CAM group of patients.

### **Costs per age category and insurance category**

Lower total compulsory costs were found in all age categories (Table 2): 80 Euro (95% CI: 21 – 140;  $p < 0.01$ ) in the first group (0-24 years); 137 Euros (95% CI: 54 – 219;  $p < 0.01$ ) in the second group (25 – 49 years); 356 Euros (95% CI: 227 – 485;  $p < 0.001$ ) in the third group (50 – 74 years), and 236 Euros (95% CI: -9 – 481;  $p < 0.1$ ) in the last group (75+ years). Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50 Euros; 95% CI: 23 – 77;  $p < 0.001$ ) and the third age group (50 – 74 years) (126 Euros; 95% CI: 88 – 164;  $p < 0.001$ ). Lower hospital costs were found in all age groups, with the largest

differences in the third age group (50 – 74 years) (232 Euros; 95% CI: 124 – 341;  $p < 0.001$ ) and the last age group (75+ years) (219 Euros; 95% CI: 7 – 431;  $p < 0.05$ ). In addition, the

largest difference in total compulsory costs was found in the last year of life (1,161 Euros; 95% CI: -138 – 2461;  $p < 0.1$ ), which is completely the result of lower hospital costs (1,250 Euros; 95% CI: 19 – 2481;  $p < 0.05$ ).

The log linear analyses of the mean total annual compulsory and supplementary insurance costs (Table 3) provide the same lower costs for the separate age groups of CAM patients as found in the linear analyses (Table 2). In addition, now there are also significant lower costs for the CAM group of patients with regard to GP costs in the third age group (50 – 74), lower pharmaceutical costs in the first (0 – 24) and the last age group (75+); and higher paramedic costs in the second (25 – 49) and third (50 – 74) age group (Table 3).

Table 2. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (linear regression model)

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-225***	-3***	-58***	-165***	1	33***
0-24	-80***	-3***	-2	-74***	-2	11***
25-49	-137***	-2**	-50***	-85**	1	32***
50-74	-356***	-1	-126***	-232***	3	52***
75+	-236*	11***	-38	-219**	10	24***
Last year of life	-1,161*	5	67	-1,250**	27	3

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

Table 3. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (loglinear regression model)

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-.114***	-.121***	-.281***	-.185***	.028**	.496***
0-24	-.071***	-.018**	-.169***	-.152***	.017	.344***
25-49	-.088***	-0.14**	-.267***	-.153***	.021*	.433***
50-74	-.173***	-.025***	-.418***	-.220***	.036*	.653***
75+	-.072**	.026*	-.176***	-.124**	.055	.355***
Last year of life	-.146**	.026	-.143	-.287**	.178	.134

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

#### *Mortality rates*

In the present dataset, the only information available on health outcomes is mortality. During the period 2006-2011 80,543 patients died in the CON group (5.26%) and 973 in the CAM group (5.14%). After controlling for all relevant variables (age, postal codes, etcetera), we find that patients with a CAM GP have significantly lower mortality rates in all LMP analyses (Table 4). However, the differences are very small: total group: 0.004 (95% CI: 0.001 – 0.007;  $p < 0.05$ ); men: 0.004 (95% CI: 0.001 – 0.008;  $p < 0.1$ ); women: 0.007 (95% CI: 0.003 – 0.011;  $p < 0.05$ ). The Logit analyses resulted in a significantly higher mortality rate for the total group at the 10% level (but not at the 5% level). (0.066; 95% CI: -0.143 – 0.011;  $p < 0.1$ ), but no significant differences for men and women separately. The Cox proportional hazard analyses resulted in significant higher mortality rates at the 10% level (but not at the 5% level), both for the total group: 1.059 (95% CI: 0.994 – 1.129;  $p < 0.1$ ), and the group of women: 1.072 (95% CI: 0.987 – 1.165;  $p < 0.1$ ), but no significant difference for men were found.

Based on all results, taking into account the small differences in the LPM analyses, the low p-values ( $p < 0.1$ ) in the Logit and Cox proportional hazard analyses and the contradictory outcomes between the LPM analyses on the one hand and the Logit and Cox

proportional hazard analyses on the other hand, we conclude that there is no difference in mortality rates between the CON and CAM group of patients.

	Total	Men	Women
LPM with fixed effects	-0.004**	-0.004*	-0.007**
Logit with fixed effects	0.066*	0.081	0.049
Cox proportional hazard	1.059*	1.043	1.072*
*: p-value < 0.1; **: p-value < 0.05; ***: p-value < 0.01			

### Conclusions

The comparison of the healthcare costs of insurees of CON GPs and CAM GPs in a database with data of 1,540,635 patients from the Dutch insurance company Agis during the period 2006-2011 demonstrates:

1. On average annual total compulsory and supplementary healthcare costs of patients treated by a CAM GP are 192 Euros (10.1%) lower than the costs of patients treated by conventional GPs as a result of 225 Euros (12.4%) lower compulsory costs and 33 Euros (44%) higher supplementary costs.
2. The lower mean annual total compulsory healthcare costs are mainly due to lower hospital care costs (165 Euros) and lower pharmaceutical care costs (58 Euros).
3. Lower mean annual total compulsory healthcare costs are demonstrated in all age categories, but are highest in the third age group (50 – 74 years) (total costs: 356 Euros; hospital care: 232 Euros; pharmaceutical care: 126 Euros) and in the last year of life (total costs: 1,093 Euros; hospital care: 1,223 Euros).
4. Patients with a CAM GP do not have significantly lower or higher mortality rates than patients with a CON GP.

### Discussion

In this study the mean annual total compulsory costs, supplementary costs, costs during the last year of life and mortality rates of patients with a conventional (CON) GP (n = 1.52

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3 million; 98.8%) and patients with GPs that know complementary and alternative medicine  
4 (CAM) (n = 18,862; 1.2%) were compared in a dataset from the Dutch insurance company  
5 Agis over a six year period (2006 – 2011) by means of regression analyses. The mean annual  
6 compulsory healthcare costs of patients treated by a conventional GP are 1,821 Euros (95%  
7 CI: 1,813 – 1,828). On average annual total compulsory healthcare costs of patients treated  
8 by a CAM GP are 225 Euros (95% CI: 169 – 281; p < 0.001) (12.4%) lower than patients  
9 treated by conventional GPs. Lower total compulsory costs were found in all age categories.  
10 Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50 Euros;  
11 95% CI: 23 – 77; p < 0.001) and the third age group (50 – 74 years) (126 Euros; 95% CI: 88  
12 – 164; p < 0.001). Lower hospital costs were found in all age groups. The largest difference  
13 in total compulsory costs was found in the last year of life (1,161 Euros; 95% CI: -138 –  
14 2461; p < 0.1), which is completely the result of lower hospital costs (1,250 Euros; 95% CI:  
15 19 – 2481; p < 0.05). The mean annual supplementary insurance costs of patients treated by a  
16 conventional GP are 75.3 Euros (95% CI: 75.1 – 75.5). On average annual supplementary  
17 healthcare costs of patients treated by a CAM GP are 33 Euros (95% CI: 31 – 37; p < 0.001)  
18 (44%) higher. The absolute lower compulsory costs for all patients for the six years period  
19 (2006 – 2011) for the CAM group is 25,463,700 Euros (or on average 4,243,950 Euros per  
20 year) compared to the CON group. The extrapolation of the lower costs in the CAM group of  
21 patients to the Dutch population (16.8 million inhabitants), if applicable, would result in 3.78  
22 billion Euros lower annual compulsory costs. The absolute lower compulsory and  
23 supplementary costs for all patients for the six years period (2006 -2011) for the CAM group  
24 is 21,729,024 Euros (or on average 3,621,504 Euros per year) compared to the CON group.  
25 The extrapolation of the lower costs in the CAM group of patients to the Dutch population  
26 (16.8 million inhabitants), if applicable, would result in 3.23 billion Euros lower annual  
27 compulsory and supplementary costs. Patients with a CAM GP do not have significantly  
28 lower or higher mortality rates than patients with a conventional GP.  
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47 The first strength of the study is the large sample size of patients and practices.  
48 Approximately 9.2% of the Dutch population (1.54/ 16.8 million), and 29.7% of the insurees  
49 of Achmea (1.54/ 5.18 million) were included in the study. Compared to the first pilot study  
50 [11] there were 10 times more patients from a CON GP (151,952 versus 1,521,773), three  
51 times more patients from a CAM GP (5,922 versus 18,862), 4,5 times more CON GP  
52 practices (1,913 versus 9,016) and about 1,5 times more CAM practices (79 versus 110). This  
53 large sample size allows a more precise estimate of costs and mortality rate differences and  
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3 increases the representativeness of the sample and the generalizability of the results [13]. The  
4 second strength is that the results are based on a relatively long period of six years, also  
5 contributing to more precise estimations, and better representativeness and generalizability of  
6 the results. Thirdly, this study, unlike the first pilot study [11], distinguishes between  
7 compulsory and supplementary costs providing a more complete picture of healthcare costs  
8 expenditure related to CAM. The first limitation of the study is that it did not compare two  
9 treatments (CON versus CAM) for a specific indication, in a controlled setting with other  
10 health related outcome parameters than mortality, prohibiting the possibility to detect causal  
11 relationships between interventions and (cost)effects. Missing information includes costs of  
12 out-of pocket expenses, morbidity, work absence, objective disease related outcome  
13 measures, subjective health and patient satisfaction. A second limitation is, contrary to the  
14 first pilot study [11], that we were not able to analyse at the level of the 6-digit postcode but  
15 only at the level of the 4-digit postcode. As a result, the results might not be optimally  
16 controlled for socio-economic status of the patients. However, a reanalysis of the data of the  
17 first pilot study [11] demonstrated very small differences in results between the analyses with  
18 the 6-digit postcode and the analyses with the 4-digit postcode. Another limitation of the  
19 study concerns the limited dataset, since the dataset is from only one insurer and the data  
20 reflect the behaviour of only a small number of CAM modalities (most GP practices (64%)  
21 were anthroposophic). These facts challenge the generalizability of the results.  
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35 The current results with regard to differences in healthcare costs confirm the results of  
36 our first smaller pilot study [11] with only 153,000 insurees and observations during a four-  
37 year period. In addition, the current study with 10 times as many patients and a two-year  
38 longer period of observations, enabled to estimate the cost differences more precisely.  
39 Whereas in this first study estimation of mean annual total compulsory costs of CAM patients  
40 were in the range of 0 – 30% lower than these of patients of CON GPs, the mean cost  
41 differences are now estimated to be 12.4% lower (range: 9.3 – 15.4%) for the CAM group.  
42 Like in the first study, the lower total compulsory costs are mainly the result from lower  
43 hospital and pharmaceutical costs. Lower costs for CAM in this study are also in line with the  
44 results of the recent review of Herman et al. [10] on economic evaluation of CAM and CIM,  
45 demonstrating that 29% of comparisons made in the 56 higher-quality studies showed a  
46 health improvement with cost savings for the CIM therapy versus usual (conventional) care.  
47 Since most CAM patients in the current study were treated in an anthroposophic practice,  
48 comparison with other economic studies on anthroposophic medicine (AM) is justified.  
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3 Kienle et al. [13,15] reviewed the few economic investigations on AM, demonstrating less or  
4 equal costs in AM compared to CON treatment, due to reduced hospital admissions and less  
5 prescriptions of medications. Hamre et al. [15] found that in patients starting anthroposophic  
6 therapies for chronic disease, total healthcare costs did not increase in the first year, and were  
7 significantly reduced in the second year by 416 Euros (95% CI: 264 – 960) compared to the  
8 pre-study year. This reduction was largely explained by a decrease of inpatient  
9 hospitalisation. With regard to differences in mortality rates between CON and CAM  
10 patients, the results do not confirm the (weak) evidence of lower mortality rates that were  
11 found in the first study [11]. The conclusion is now that CAM patients do not have lower or  
12 higher mortality rates than CON patients.  
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21 With regard to the healthcare costs differences reported in the Results section, we can  
22 hypothesize four types of explanations. First, the differences could be due to selection on  
23 unobservables in patients' GP choice. For example, patients who are healthier and more  
24 health-conscious or patients with a strong preference to minimize exposure to medical  
25 interventions might be more likely to choose a CAM GP. In both cases, costs will be lower  
26 due to lower demand for healthcare. A standard approach to control for selection on  
27 unobservables in a non-experimental setting is to use Instrumental Variables (IV). A potential  
28 instrumental variable in this case is the distance between a patient's home and the various  
29 GPs, cq. a change in distance as a result of a move of a patient or practice. We intend to  
30 explore this approach in future work. With respect to selection, several studies that compare  
31 the health status of patients treated in CAM and in conventional medicine in primary care  
32 settings find that patients treated in CAM practices suffer more often from severe and chronic  
33 illnesses (e.g., [16, 17]). This suggests that if we could control for severity and chronicity of  
34 illnesses (with additional data), the estimated compulsory cost differences might be larger.  
35 Second, the results could be due to undertreatment by CAM GPs. In the present dataset, we  
36 were only able to analyse mortality and found that patients with a CAM GP tend to have  
37 equal mortality rates. However, a number of studies have reported that patients seeking CAM  
38 or anthroposophic care have longer lasting and more severe health problems than patients in  
39 conventional care. At the same time, these patients report fewer adverse side effects of  
40 treatments and higher patient satisfaction (e.g., [16-18]). These findings combined with the  
41 results in this study provide some indication that undertreatment by CAM GPs is unlikely.  
42 Firmer conclusions require more detailed data on outcomes. Thirdly, the results could be due  
43 to better practices of CAM due to a stronger focus on preventive and curative health  
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3 promotion, less overtreatment and better communication and professional relationships. For  
4 example, a CAM GP might try a low-cost CAM treatment first. As mentioned, the primary  
5 professional orientation of CAM doctors is to strengthen the self-healing capacity of the body  
6 and the self-management of the patient. This approach is associated with prescribing fewer  
7 conventional pharmaceuticals, tests and operations. Nissen et al. [19, p. 14], based on a  
8 review of the literature on citizens' attitudes and needs concerning CAM in Europe,  
9 concluded that 'many citizens in Europe value the practice of CAM, particularly the CAM  
10 provider-patient relationship, and the patient-centred and holistic approach aspired to by  
11 many CAM providers.' Van Dulmen [20] concluded in a Dutch study comparing patients  
12 visiting conventional general practitioners (GPs) and three types of CAM GPs (homeopathy,  
13 acupuncture and naturopathy), that, contrary to expectations, patients do not consult a CAM  
14 physician because they are disappointed with mainstream GP care. CAM patients primarily  
15 appear to be seeking a physician who takes the time to talk with them and who will treat their  
16 complaints from a holistic viewpoint. Ernst and Hung [21] described the published evidence  
17 on the expectations of CAM users (in order of prevalence): hope to influence the natural  
18 history of the disease; disease prevention and health/ general well-being promotion; fewer  
19 side effects; being in control over one's health; symptom relief; boosting the immune system;  
20 emotional support; holistic care; improving quality of life; relief of side effects of  
21 conventional medicine; positive therapeutic relationship; obtaining information; coping better  
22 with illness; supporting the natural healing process; and the availability of treatment. In  
23 addition CAM GPs might focus more on the relationship and communication. For example  
24 Esch et al. [16] found that AM patients appreciated that their physicians listened to them  
25 (80.0% vs. 67.1%,  $p < 0.001$ ), spent more time (76.5% vs. 61.7%,  $p < 0.001$ ), had more  
26 interest in their personal situation (74.6% vs. 60.3%,  $p < 0.001$ ), involved them more in  
27 decisions about their medical care (67.8% vs. 58.4%,  $p = 0.022$ ), and made it easy to tell the  
28 physician about their problems (71.6% vs. 62.9%,  $p = 0.023$ ). AM patients gave significantly  
29 better rating as to information and support (in 3 of 4 items  $p < 0.05$ ) and for thoroughness  
30 (70.4% vs. 56.5%,  $p < 0.001$ ). AM patients showed significantly higher treatment satisfaction  
31 in all of the five items than CON patients. These results are consistent with other studies  
32 demonstrating high patient satisfaction with AM [13,14]. For instance, in a Dutch survey  
33 (Consumer Quality Index, a national standard to measure healthcare quality from the  
34 perspective of healthcare users), 2,099 patients reported very high satisfaction with  
35 anthroposophic GP practices (8.4 and 8.3 on a scale: 0-10, 10 indicating the best possible  
36 score) [18]. These results are consistent with AM theory, which emphasizes relationship and  
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3 communication, as well as shared decision-making [14]. More AM patients expressed a  
4 general treatment satisfaction (56.1% vs. 43.4%,  $p < 0.001$ ) and saw their expectations  
5 completely fulfilled at follow-up (38.7% vs. 32.6%,  $p < 0.001$ ). AM patients reported  
6 significantly fewer adverse side effects (9.3% vs. 15.4%,  $p = 0.003$ ), and more other positive  
7 effects from treatment (31.7% vs. 17.1%,  $p < 0.001$ ). Fourthly, the lower costs could be  
8 related to the fact that patients interested in CAM might have higher out-of pocket expenses  
9 since not all CAM treatments are covered by supplementary insurance. Clarifying the role of  
10 out-of-pocket expenses is an empirical issue that requires additional data.  
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17 The major implication of this study and other economic evaluations of CAM is that  
18 there is sufficient evidence now to justify more professional interest in CAM from  
19 conventional healthcare professionals and policymakers. We can also conclude that there is  
20 sufficient good evidence that CAM can be cost-effective compared to conventional medicine,  
21 that the contribution of CAM might result in substantial diminishing of healthcare costs and  
22 therefore can provide a contribution to national healthcare policies aiming at controlling and  
23 diminishing healthcare expenditures. Therefore more investment in the study of the cost-  
24 effectiveness of CAM modalities with their additional health promotion medicines and  
25 therapies is indicated. The main unanswered questions in the current study are: where do the  
26 cost differences come from (to which indications and which therapies do they pertain to?) and  
27 what are the health-related effects of CAM treatment (objective parameters (e.g. lowering of  
28 blood pressure), quality of life, patient-reported outcomes, sick-leave, etc.)? Future research  
29 should therefore focus on and (1) exploring to what extent selection on unobservables and  
30 causal effects explain the lower costs of patients with a CAM GP, (2) exploring in more  
31 depth the costs differences between patients of CON GPs and CAM GPs in order to develop  
32 adequate, testable hypothesis of cost-effectiveness of specific CAM treatment for specific  
33 indications, and to transfer the cost differences related knowledge from CAM to CON GP  
34 practices in order to diminish healthcare expenditures in CON practices; (3) designing and  
35 executing highly controlled, comparative effectiveness research projects [22] with more  
36 health related outcome parameters than mortality rate only; (4) replication studies based on  
37 similar, large datasets with other CAM modalities (acupuncture, TCM herbal treatment, etc.)  
38 and with other insurance companies to explore and confirm the present results;  
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### Competing interests

We have read and understood the BMJ Group policy on declaration of interests and declare the following interests:

- Dr. Erik W. Baars receives a part of his salary from the Professorship Anthroposophic Healthcare of the University of Applied Sciences Leiden, The Netherlands. The professorship works closely with those in the AH professional field and works on practical problems using applied research which focuses on three main categories: (1) investigating efficacy and safety, (2) developing and delivering optimal quality, and (3) improving communication about AH.

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### Transparency declaration

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

### Contributors

PK was the project lead for the statistical analyses. EB and PK wrote the manuscript. All authors reviewed the manuscript and contributed to manuscript revisions. EB is the guarantor for this study.

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### Role of the study sponsors

Not applicable.

### Statement of independence of researchers from funders

Funders played no part in article selection, analysis, interpretation, or decision to publish.

### Data sharing

Details of how to obtain additional data from the study can be obtained from EB (baars.e@hsleiden.nl).

### Previous publication

A part of the content of our study results was published in February 2014 as a Dutch article in the Dutch journal Economisch Statistische Berichten for economists in the Netherlands [23].

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# BMJ Open

## A six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM GPs

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Manuscripts

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3 A six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch  
4 patients from conventional and CAM GPs  
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**Abstract**

**Objectives** To compare healthcare costs and mortality rates of Dutch patients with a conventional (CON) general practitioner (GP) and patients with a GP who has additionally completed training in complementary and alternative medicine (CAM).

**Design** Comparative economic evaluation.

**Setting** Database from the Dutch insurance company Agis.

**Participants** 1,521,773 patients (98.8%) from a CON practice and 18,862 patients (1.2%) from a CAM practice.

**Main outcome measures** Annual information on five types of healthcare costs for the years 2006 – 2011: care by GP, hospital care, pharmaceutical care, paramedic care and care covered by supplementary insurance. Healthcare costs in the last year of life. Mortality rates.

**Results** The mean annual compulsory and supplementary healthcare costs of CON patients are respectively 1,821 Euros (95% CI: 1,813 – 1,828) and 75.3 Euros (95% CI: 75.1 – 75.5). Compulsory healthcare costs of CAM patients are 225 Euros (95% CI: 169 – 281;  $p < 0.001$ ) (12,4%) lower and result mainly from lower hospital care costs (165 Euros) (95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros) (95% CI: 41 – 75;  $p < 0.001$ ), especially in the age categories 25 – 49 years and 50 – 74 years. The costs in the last year of life of patients with CAM GPs are 1,161 euro (95% CI: -138 – 2,461;  $p < 0.1$ ) lower. This difference is entirely due to lower hospital costs (1,250 Euros) (95% CI: 19 – 2,481;  $p < 0.05$ ). The mean annual supplementary costs of CAM patients are 33 Euros (95% CI: 30 – 37;  $p < 0.001$ ) (44%) higher. CAM patients do not have lower or higher mortality rates than CON patients.

**Conclusions** Dutch patients whose GP additionally completed training in CAM on average have 192 Euros (10.1%) lower annual total compulsory and supplementary healthcare costs and do not live longer or shorter than CON patients.



### Strengths and limitations of this study

- The study is based on a large sample size of patients and practices and a relatively long period of six years contributing to more precise estimations, and better representativeness and generalizability of the results.
- The study distinguishes between compulsory and supplementary costs providing a more complete picture of healthcare costs expenditure related to CAM.
- The study did not compare two treatment (conventional versus CAM) for a specific indication, in a controlled setting with other health related outcome parameters than mortality, reducing the ability to detect causal relationships between interventions and (cost)effects.
- Since the analyses were at the level of the 4-digit postcode and not at the level of the 6-digit postcode, the results might not be optimally controlled for socio-economic status of the patients.
- The study concerns a limited dataset, since the dataset is from only one insurer and the data reflect the behaviour of only a small number of CAM modalities (most GP practices (64%) were anthroposophic). These facts challenge the generalizability of the results.

## Introduction

In most countries of the European Union the annual healthcare costs are rising faster than the economy [1]. Therefore, national healthcare policies are increasingly aiming at controlling and diminishing healthcare expenditures. This also applies to the situation in The Netherlands [2]. In 1972 8% of the Dutch national income (GDP) was used to finance public healthcare. In 2010 already 13% of GDP was used and The Netherlands were worldwide in second place of healthcare expenditures of countries. Without drastic measures, the estimated costs will be over 30% in 2040 [3]. Public spending on healthcare will rise from 61 billion Euros in 2012 to an estimated nearly 80 billion Euros in 2017 [4]. Dutch health economists and policy makers have largely ignored the possible contribution of Complementary and Alternative Medicine (CAM) and Integrative Medicine (IM) to the reduction of healthcare costs as an area of research and interest. The here presented economic study, a six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM general practitioners (GPs), contributes to the development of an evidence-based Dutch policy with regard to the role of CAM and IM in the reduction of healthcare expenditure growth.

### *The Dutch financing system*

The Dutch financing system contains two basic compulsory health insurances, that are for 80% paid for through income taxes: for curative care (Zorgverzekeringswet (ZvW)) and for long-term care (Algemene Wet Bijzondere Ziektekosten (AWBZ)). The compulsory health insurances cover costs of most of GP, pharmaceutical and hospital care and some paramedic care. In addition, people in The Netherlands can buy supplementary insurance. Supplementary insurance covers costs not covered by basic insurance (for example specific or additional paramedic treatment, complementary therapies) (e.g., costs of CAM treatment is paid for up to 500 Euros/ year) [5]. Many supplementary insurances cover costs of CAM treatments like anthroposophic medicine, acupuncture and homeopathy. Supplementary insurance can also cover costs of improvements over the standard level of care paid for by compulsory insurance (e.g., extra costs for a better room and service in case of hospitalisation).

### *Policies to reduce healthcare expenditure growth*

The vast majority of expenditure growth is due to innovations in healthcare. The Cultureel Planbureau (CPB) anticipates that the total costs of curative care will rise from 36 billion Euros this year to 49 billion Euros in 2017. The rising costs of curative care, according to the CPB is largely due to the ‘creeping expansion’ of the compulsory health insurance; ‘Year after year, new medical techniques and drugs appear on the market that are often better, but also more expensive’, especially, since more patients will be treated with the new techniques [3]. Of the total growth of public healthcare expenditure, about a quarter is the result of aging. In 2040 more than 22% of the Dutch population will be older than 65, whereas currently this is 16%. As people grow older, on average the costs of healthcare will increase (on the level of the whole older population).

Which policies can be deployed to control the risk of rising costs? The measures aimed at reducing healthcare expenditures are, without being complete: more efficiency and higher productivity in healthcare (including reducing management layers), more competition between healthcare institutions, fewer hospitals (specialization and concentration), more ‘neighbourhood care’ by general practitioners (GPs), more remote care (e-health), preventing overtreatment/ less (extra) care, more responsible behaviour of consumers (more self-care), more emphasis on healthy living (prevention), higher co-payments, higher deductibles and already saving for higher healthcare expenditure in the old days (precautionary savings) [3].

In July 2013 the Dutch healthcare minister Schippers reached an agreement with hospitals, medical specialists, mental healthcare providers, general practitioners, health insurers and patients’ organizations to reduce the growth rate of healthcare spending: to 1.5% in 2014 and 1% per year from 2015 to 2017. This reduction represents a total additional savings of approximately 1 billion Euros. To achieve the reduced expenditure growth, extra measures will be taken that increase the efficiency and improve the quality of care: more care of medical specialists goes to the GP and from the GP to self-care; concentration of complex care; tighter application of medical guidelines and care standards; treatments are given according the standards of the medical profession itself; access to the claims of the compulsory health insurances is tightened; and more transparency about quality and cost of care [6].

### *The contribution of Complementary and Alternative Medicine*

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3 According to the National Center for Complementary and Alternative Medicine (NCCAM),  
4 CAM is a group of diverse medical and healthcare systems, practices, and products that are  
5 not generally considered part of conventional medicine [7]. The Cochrane Collaboration  
6 definition of complementary medicine is that it includes all such practices and ideas that are  
7 outside the domain of conventional medicine in several countries and defined by its users as  
8 preventing or treating illness, or promoting health and well-being. These practices  
9 complement mainstream medicine by satisfying a demand not met by conventional practices  
10 and diversifying the conceptual framework of medicine [8]. “Integrative Medicine is the  
11 practice of medicine that reaffirms the importance of the relationship between practitioner  
12 and patient, focuses on the whole person, is informed by evidence, and makes use of all  
13 appropriate therapeutic approaches, healthcare professionals and disciplines to achieve  
14 optimal health and healing.” [9] In addition, IM emphasizes the active role of the patient in  
15 prevention (lifestyle), well-being and therapy and healing processes, and the use of healing  
16 environments [9].

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27 Herman et al. [10] performed a systematic review of economic evaluations on  
28 complementary and integrative medicine (CIM). This study identified 338 economic  
29 evaluations of CIM, including 114 full evaluations, published between 2001 and 2010. All  
30 recent (and likely most cost-relevant) full economic evaluations published from 2001 to 2010  
31 were subjected to several measures of quality. Detailed results of higher-quality studies were  
32 reported. The cost-utility analyses found were of similar or better quality to those published  
33 across all medicine. Of the 56 comparisons made in the higher-quality studies, 16 (29%)  
34 show a health improvement with cost savings for the CIM therapy versus usual  
35 (conventional) care. Study quality of the cost-utility analyses (CUAs) of CIM was generally  
36 comparable to that seen in CUAs across all medicine according to several measures, and the  
37 quality of the cost-saving studies was slightly, but not significantly, lower than those showing  
38 cost increases (85% vs 88%,  $p = 0.460$ ).

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47 In The Netherlands, a few percent of the GPs have followed an additional training in  
48 CAM. In 2010, we performed an initial economic evaluation, comparing the healthcare costs  
49 of patients from Dutch conventional (CON) GPs and CAM GPs [11]. A dataset from a Dutch  
50 health insurer Azivo was used containing quarterly information on healthcare costs (GP care,  
51 hospital care, pharmaceutical care, and paramedic care), dates of birth and death (if  
52 applicable), gender and 6-digit postcode of all approximately 150,000 insurees, for the years  
53 2006–2009. Data from 1,913 conventional GPs were compared with data from 79 GPs with  
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3 additional CAM training in acupuncture (n=25), homeopathy (n=28), and anthroposophic  
4 medicine (n=26). Results were that patients whose GP has additionally completed training in  
5 CAM training had 0–30% lower healthcare costs and mortality rates, depending on age  
6 groups and type of CAM. The lower costs resulted from fewer hospital stays and fewer  
7 prescription drugs. It was concluded that more controlled studies (replication studies,  
8 research based on more comprehensive data, cost-effectiveness studies on CAM for specific  
9 diagnostic categories) were indicated.  
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### 14 15 16 17 18 *This study*

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20 Given the current need to diminish healthcare expenditures in The Netherlands and based on  
21 the positive results from both the review of Herman et al. [10] and our own study [11], we  
22 decided to perform a replication study comparing the healthcare costs of patients from  
23 conventional (CON) GPs and CAM GPs with a larger dataset from a Dutch health insurer, to  
24 analyse the robustness of the results of the first study. The research questions of the study  
25 were:  
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- 30 1. Is there a statistically significant difference in healthcare costs (care by GP, hospital  
31 care, pharmaceutical care, paramedic care, care covered by supplementary insurance,  
32 and healthcare costs in the last year of life) of patients from CON GPs and CAM  
33 GPs?  
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- 36 2. Is there a statistically significant difference in mortality rates of patients from CON  
37 GPs and CAM GPs?  
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### 43 **Methods**

#### 44 *Comparative economic evaluation*

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46 Full economic evaluations compare the costs (resource use) associated with one or more  
47 alternative interventions (e.g., intervention X versus comparator Y) with their consequences  
48 (outcomes, effects). In this study we were able to measure five types of costs in two  
49 categories: (1) care covered by compulsory insurance: care by GP, hospital care,  
50 pharmaceutical care, paramedic care, and (2) costs covered by supplementary insurance.  
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3 Alternative interventions were: conventional GP care compared to care from GPs that know  
4 CAM. Outcomes were: differences in healthcare costs and annual mortality rates.  
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### 8 9 *Model overview*

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11 Costs were analysed at the patient level using linear and loglinear regression analysis. The  
12 cost analysis has been performed for the total sample, as well as separately for the age groups  
13 0–24, 25–49, 50–74, and  $\geq 75$ , given the large average differences in health and healthcare  
14 needs across age groups. Effects on mortality rates are analysed using a linear probability  
15 model (LPM), a Logit model, and a Cox proportional hazard model (CPH). In all models, the  
16 explanatory variables are gender, age (linear, within each age category), dummies for CAM  
17 and ‘Vogelaarwijk’ (city areas with known lower socio-economic status of inhabitants), year  
18 dummies, and postal code fixed effects. In the cost regressions and the LPM model, fixed  
19 effects at the 4-digit insuree postcode level were controlled for. In the Logit and CPH model  
20 2-digit postcode level fixed effects were included, as estimation with more detailed fixed  
21 effects appeared to be numerically infeasible.  
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31 The regression approach is standard practice in health economics and yields results similar to  
32 those of matching procedures (both are unable to correct for unobserved differences between  
33 groups of patients). Given the large sample sizes Students’ t tests are asymptotically valid by  
34 virtue of the central limit theorem, independent of whether the underlying distributions are  
35 normal or non-normal. Standard errors are clustered at the level of the insured to control for  
36 the statistical dependence of observations pertaining to a given insured person (i.e.  
37 observations are independent ‘between’ individuals but dependent ‘within’ individuals).  
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44 With regard to the six years of data the data set was used as a panel. This means that if an  
45 insured person is observed for all six years, six observations of annual costs of this person are  
46 used in the analysis (taking into account the ‘within’-person correlation by clustering  
47 standard errors at the level of the individual). The reported differences can be interpreted as  
48 the average of cost differences across years. Any trends are controlled for by the year dummy  
49 variables.  
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### 55 56 *Dataset on healthcare costs and demographics*

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3 A dataset was analyzed from health insurer Agis, a subsidiary company of Achmea. Achmea  
4 has a share in the market of 31% (5.18 million insured) of the Dutch population in 2013;  
5 while the share of Agis is 9,2% (1.54 million insured) The dataset contains quarterly  
6 information on the healthcare costs of all Agis insurees, which was aggregated to annual  
7 information for the years 2006 up to 2011. In addition, it contains the date of birth of the  
8 insuree, date of death (if applicable), gender, and 4-digit postcode of the insured's residence.  
9 For each insuree year combination, information on the costs of five different types of care is  
10 available: care by GP, hospital care, pharmaceutical care, paramedic care (like physical  
11 therapy), and care covered by supplementary insurance.  
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### 21 *General practitioners and patients*

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23 The dataset also contains the names and addresses of the general practitioners who have  
24 patients who are insured by Agis, which allows us to distinguish between CON GPs and  
25 CAM GPs. We defined a general practitioner as anthroposophic CAM GP if his or her name  
26 appears in the list of general practitioners with additional training in anthroposophic medicine  
27 (AM) as provided by their professional association [14]. CAM GPs with homeopathy (HOM)  
28 [15] and CAM GPs with acupuncture [16] are defined similarly.  
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34 Patients were regarded CON patients and CAM patients if they were patient of  
35 respectively a CON GP or a CAM GP during all of the years they appear in the dataset.  
36 Patients that transferred from a CON GP to a CAM GP or vice versa , were regarded to be a  
37 member of a third group called 'Switchers' and were excluded from all analyses.  
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### 43 *Statistical analyses*

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45 Significance of coefficients is tested using Student t tests, with clustering of standard errors at  
46 the level of the insured. Given the large sample sizes available here, asymptotic t-testing for  
47 differences in means is appropriate by virtue of the central limit theorem. Calculations were  
48 made using StataSE 10.0. Means with 95% confidence intervals and p-values ( $< 0.1$ ,  $< 0.05$ ,  
49 and  $< 0.01$ ) are presented.  
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### 56 *Ethical approval*

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3 Since the study involved no experimental treatment, patients were not recruited. Since patient  
4 data were anonymized, no ethical approval was necessary.  
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## 8 9 **Results**

### 10 *GP practices and patients*

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13 The dataset contained 9,126 GP practices: 9,016 CON practices and 110 CAM practices. Due  
14 to the systematics of the insurance company, one individual GP can appear as different  
15 practices, so the actual number of GPs is lower than the number of GP practices. Contrarily,  
16 each patient is never counted more than once. The majority of the CAM GPs are  
17 anthroposophic GPs (70 AM practices (64%). Other CAM GPs were specialized in  
18 acupuncture (15%) and homeopathy (25%). Since some GPs were specialized in more than  
19 one CAM modality the total percentage of CAM GPs is larger than 100%. Exact numbers and  
20 percentages of CAM GPs vary a little over the years.  
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### 28 29 *Healthcare costs*

#### 30 31 **The dataset**

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34 The dataset contains information of more than 1.5 million insurees during the years 2006-  
35 2011 (Table 1). Nearly 19,000 insurees (1.2%) had throughout this whole period a CAM GP.  
36 More than 10,000 other insurees had in some years a CON GP and in other years a CAM GP  
37 ('Switchers'). On average, the Switchers group had three years a CON GP and three years a  
38 CAM GP. The insurees had a mean age of 41.0 (SD=23.5). 53% are women. These patients  
39 live in 4,014 different 4-digit postal codes.  
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45 Without controlling for relevant differences between the groups, the comparison  
46 demonstrates: higher percentages of females in in the CAM GP and Switchers groups; higher  
47 percentages of insurees living in the 'Vogelaarwijk' in the CON and Switchers group; 183  
48 Euros lower and 168 Euros higher total compulsory costs in respectively the CAM and the  
49 Switchers group; and 40 Euros and 25 Euros higher supplementary costs in costs in  
50 respectively the CAM and the Switchers group. The percentages of patients with a  
51 supplementary insurance were almost the same (CON GPs: 92.7%; CAM GPs: 93.4% and  
52 Switchers: 92.1%).  
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Since the aim of the study was to compare the costs of patients with a CON GP and a CAM GP, the data of the Switchers group were left out of the further regression analyses (Appendix 1).

	CON GP	CAM GP	Switchers
Insured (n)	1,521,773	18,862	10,769
Age (year)	41.0	41.6	40.1
Female (percentage)	52.9%	55.2%	56.4%
'Vogelaarwijk' (percentage)	15.7%	9.3%	17.1%
Supplementary insured (percentage)	92.7%	93.4%	92.1%
Compulsory insurance costs (Euros)			
<i>Total costs</i>	1,821	1,638	1,989
<i>GP costs</i>	133	128	140
<i>Pharmaceutical costs</i>	402	357	474
<i>Hospital costs</i>	1,242	1,104	1,328
<i>Paramedical costs</i>	44	48	47
Supplementary insurance costs (Euros)	75	115	100

#### Annual total compulsory and supplementary insurance costs

The mean annual total costs of patients treated in CON practices covered by the compulsory insurance were 1,821 Euros (95% CI: 1,813 – 1,828) (Table 1). After correction for observed differences between the groups by means of linear regression analyses, the mean annual total compulsory insurance costs of patients of CAM GP practices are 225 Euros (95% CI: 169 –

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3 281;  $p < 0.001$ ) (12.4%) lower. These lower costs are mainly due to lower hospital costs (165  
4 Euros; 95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros; 95%  
5 CI: 41 – 75;  $p < 0.001$ ).  
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9 The mean annual total supplementary costs for patients treated in CON practices were  
10 75.3 Euros (95% CI: 75.1 – 75.5). (The mean is calculated over all patients, including those  
11 (less than 8%) without supplementary insurance.) For patients treated in CAM practices these  
12 costs are 33 Euros (95% CI: 31 – 37;  $p < 0.001$ ) (44%) higher and were highest in the third  
13 age group (50 – 74 years) (52 Euros (95% CI: 31 – 37;  $p < 0.001$ )). Taken together, the mean  
14 total annual compulsory and supplementary insurance costs are 192 Euros (10.1%) lower for  
15 the CAM group of patients.  
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21 The log linear analyses of the mean total annual compulsory and supplementary  
22 insurance costs (Table 3) provide the same lower costs for the CAM group of patients as  
23 found in the linear analyses (Table 2). In addition, higher paramedic costs are found for the  
24 CAM group of patients.  
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### 30 31 **Costs per age category and insurance category**

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33 Lower total compulsory costs were found in all age categories (Table 2): 80 Euro (95% CI:  
34 21 – 140;  $p < 0.01$ ) in the first group (0-24 years); 137 Euros (95% CI: 54 – 219;  $p < 0.01$ ) in  
35 the second group (25 – 49 years); 356 Euros (95% CI: 227 – 485;  $p < 0.001$ ) in the third  
36 group (50 – 74 years), and 236 Euros (95% CI: -9 – 481;  $p < 0.1$ ) in the last group (75+  
37 years). Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50  
38 Euros; 95% CI: 23 – 77;  $p < 0.001$ ) and the third age group (50 – 74 years) (126 Euros; 95%  
39 CI: 88 – 164;  $p < 0.001$ ). Lower hospital costs were found in all age groups, with the largest  
40 differences in the third age group (50 – 74 years) (232 Euros; 95% CI: 124 – 341;  $p < 0.001$ )  
41 and the last age group (75+ years) (219 Euros; 95% CI: 7 – 431;  $p < 0.05$ ). In addition, the  
42 largest difference in total compulsory costs was found in the last year of life (1,161 Euros;  
43 95% CI: -138 – 2461;  $p < 0.1$ ), which is completely the result of lower hospital costs (1,250  
44 Euros; 95% CI: 19 – 2481;  $p < 0.05$ ).  
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54 The log linear analyses of the mean total annual compulsory and supplementary  
55 insurance costs (Appendix 2. Table 4) provide the same lower costs for the separate age  
56 groups of CAM patients as found in the linear analyses (Table 2). In addition, now there are  
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### Mortality rates

In the present dataset, the only information available on health outcomes is mortality. During the period 2006-2011 80,543 patients died in the CON group (5.26%) and 973 in the CAM group (5.14%). After controlling for all relevant variables (age, postal codes, etcetera), we find that patients with a CAM GP have significantly lower mortality rates in all LMP analyses (Table 3). However, the differences are very small: total group: 0.004 (95% CI: 0.001 – 0.007;  $p < 0.05$ ); men: 0.004 (95% CI: 0.001 – 0.008;  $p < 0.1$ ); women: 0.007 (95% CI: 0.003 – 0.011;  $p < 0.05$ ). The Logit analyses resulted in a significantly higher mortality rate for the total group at the 10% level (but not at the 5% level) (0.066; 95% CI: -0.143 – 0.011;  $p < 0.1$ ), but no significant differences for men and women separately. The Cox proportional hazard analyses resulted in significant higher mortality rates at the 10% level (but not at the 5% level), both for the total group: 1.059 (95% CI: 0.994 – 1.129;  $p < 0.1$ ), and the group of women: 1.072 (95% CI: 0.987 – 1.165;  $p < 0.1$ ), but no significant difference for men were found.

Based on all results, taking into account the small differences in the LPM analyses, the high  $p$ -values ( $p < 0.1$ ) in the Logit and Cox proportional hazard analyses and the contradictory outcomes between the LPM analyses on the one hand and the Logit and Cox proportional hazard analyses on the other hand, we conclude that there is no difference in mortality rates between the CON and CAM group of patients.

	Total	Men	Women
LPM with fixed effects	-0.004**	-0.004*	-0.007**
Logit with fixed effects	0.066*	0.081	0.049
Cox proportional hazard	1.059*	1.043	1.072*
*: $p$ -value $< 0.1$ ; **: $p$ -value $< 0.05$ ; ***: $p$ -value $< 0.01$			

### Conclusions

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3 The comparison of the healthcare costs of insurees of CON GPs and CAM GPs in a database  
4 with data of 1,540,635 patients from the Dutch insurance company Agis during the period  
5 2006-2011 demonstrates:  
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- 8 1. On average annual total compulsory and supplementary healthcare costs of patients  
9 treated by a CAM GP are 192 Euros (10.1%) lower than the costs of patients treated  
10 by conventional GPs as a result of 225 Euros (12.4%) lower compulsory costs and 33  
11 Euros (44%) higher supplementary costs.  
12
- 13 2. The lower mean annual total compulsory healthcare costs are mainly due to lower  
14 hospital care costs (165 Euros) and lower pharmaceutical care costs (58 Euros).  
15
- 16 3. Lower mean annual total compulsory healthcare costs are demonstrated in all age  
17 categories, but the differences are largest in the third age group (50 – 74 years) (total  
18 costs: 356 Euros; hospital care: 232 Euros; pharmaceutical care: 126 Euros) and in the  
19 last year of life (total costs: 1,093 Euros; hospital care: 1,223 Euros).  
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- 21 4. Patients with a CAM GP do not have significantly lower or higher mortality rates than  
22 patients with a CON GP.  
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## 32 Discussion

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34 In this study the mean annual total compulsory costs, supplementary costs, costs during the  
35 last year of life and mortality rates of patients with a conventional (CON) GP (n = 1.52  
36 million; 98.8%) and patients with GPs that know complementary and alternative medicine  
37 (CAM) (n = 18,862; 1.2%) were compared in a dataset from the Dutch insurance company  
38 Agis over a six year period (2006 – 2011) by means of regression analyses. The mean annual  
39 compulsory healthcare costs of patients treated by a conventional GP are 1,821 Euros (95%  
40 CI: 1,813 – 1,828). On average annual total compulsory healthcare costs of patients treated  
41 by a CAM GP are 225 Euros (95% CI: 169 – 281; p < 0.001) (12.4%) lower than patients  
42 treated by conventional GPs. Lower total compulsory costs were found in all age categories.  
43 Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50 Euros;  
44 95% CI: 23 – 77; p < 0.001) and the third age group (50 – 74 years) (126 Euros; 95% CI: 88  
45 – 164; p < 0.001). Lower hospital costs were found in all age groups. The largest difference  
46 in total compulsory costs was found in the last year of life (1,161 Euros; 95% CI: -138 –  
47 2461; p < 0.1), which is completely the result of lower hospital costs (1,250 Euros; 95% CI:  
48 19 – 2481; p < 0.05). The mean annual supplementary insurance costs of patients treated by a  
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3 conventional GP are 75.3 Euros (95% CI: 75.1 – 75.5). On average annual supplementary  
4 healthcare costs of patients treated by a CAM GP are 33 Euros (95% CI: 31 – 37;  $p < 0.001$ )  
5 (44%) higher. The absolute lower compulsory costs for all patients for the six years period  
6 (2006 – 2011) for the CAM group is 25,463,700 Euros (or on average 4,243,950 Euros per  
7 year) compared to the CON group. The extrapolation of the lower costs in the CAM group of  
8 patients to the Dutch population (16.8 million inhabitants), if applicable, would result in 3.78  
9 billion Euros lower annual compulsory costs. The absolute lower compulsory and  
10 supplementary costs for all patients for the six years period (2006 -2011) for the CAM group  
11 is 21,729,024 Euros (or on average 3,621,504 Euros per year) compared to the CON group.  
12 The extrapolation of the lower costs in the CAM group of patients to the Dutch population  
13 (16.8 million inhabitants), if applicable, would result in 3.23 billion Euros lower annual  
14 compulsory and supplementary costs. Patients with a CAM GP do not have significantly  
15 lower or higher mortality rates than patients with a conventional GP.  
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25 The first strength of the study is the large sample size of patients and practices.  
26 Approximately 9.2% of the Dutch population (1.54/ 16.8 million), and 29.7% of the insurees  
27 of Achmea (1.54/ 5.18 million) were included in the study. Compared to the first pilot study  
28 [11] there were 10 times more patients from a CON GP (151,952 versus 1,521,773), three  
29 times more patients from a CAM GP (5,922 versus 18,862), 4,5 times more CON GP  
30 practices (1,913 versus 9,016) and about 1,5 times more CAM practices (79 versus 110). This  
31 large sample size allows a more precise estimate of costs and mortality rate differences and  
32 increases the representativeness of the sample and the generalizability of the results [13]. The  
33 second strength is that the results are based on a relatively long period of six years, also  
34 contributing to more precise estimations, and better representativeness and generalizability of  
35 the results. Thirdly, this study, unlike the first pilot study [11], distinguishes between  
36 compulsory and supplementary costs providing a more complete picture of healthcare costs  
37 expenditure related to CAM. The first limitation of the study is that it did not compare two  
38 treatments (CON versus CAM) for a specific indication, in a controlled setting with other  
39 health related outcome parameters than mortality, reducing the ability to detect causal  
40 relationships between interventions and (cost)effects. Missing information includes costs of  
41 out-of pocket expenses, morbidity, work absence, objective disease related outcome  
42 measures, subjective health and patient satisfaction. A second limitation is, contrary to the  
43 first pilot study [11], that we were not able to analyse at the level of the 6-digit postcode but  
44 only at the level of the 4-digit postcode. As a result, the results might not be optimally  
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3 controlled for socio-economic status of the patients. However, a reanalysis of the data of the  
4 first pilot study [11] demonstrated very small differences in results between the analyses with  
5 the 6-digit postcode and the analyses with the 4-digit postcode. Another limitation of the  
6 study concerns the limited dataset, since the dataset is from only one insurer and the data  
7 reflect the behaviour of only a small number of CAM modalities (most GP practices (64%)  
8 were anthroposophic). These facts challenge the generalizability of the results.  
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14 The current results with regard to differences in healthcare costs confirm the results of  
15 our first smaller pilot study [11] with only 153,000 insurees and observations during a four-  
16 year period. In addition, the current study with 10 times as many patients and a two-year  
17 longer period of observations, enabled to estimate the cost differences more precisely.  
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19 Whereas in this first study estimation of mean annual total compulsory costs of CAM patients  
20 were in the range of 0 – 30% lower than these of patients of CON GPs, the mean cost  
21 differences are now estimated to be 12.4% lower (range: 9.3 – 15.4%) for the CAM group.  
22 Like in the first study, the lower total compulsory costs are mainly the result from lower  
23 hospital and pharmaceutical costs. Lower costs for CAM in this study are also in line with the  
24 results of the recent review of Herman et al. [10] on economic evaluation of CAM and CIM,  
25 demonstrating that 29% of comparisons made in the 56 higher-quality studies showed a  
26 health improvement with cost savings for the CIM therapy versus usual (conventional) care.  
27 Since most CAM patients in the current study were treated in an anthroposophic practice,  
28 comparison with other economic studies on anthroposophic medicine (AM) is justified.  
29 Kienle et al. [13,15] reviewed the few economic investigations on AM, demonstrating less or  
30 equal costs in AM compared to CON treatment, due to reduced hospital admissions and less  
31 prescriptions of medications. Hamre et al. [15] found that in patients starting anthroposophic  
32 therapies for chronic disease, total healthcare costs did not increase in the first year, and were  
33 significantly reduced in the second year by 416 Euros (95% CI: 264 – 960) compared to the  
34 pre-study year. This reduction was largely explained by a decrease of inpatient  
35 hospitalisation. With regard to differences in mortality rates between CON and CAM  
36 patients, the results do not confirm the (weak) evidence of lower mortality rates that were  
37 found in the first study [11]. The conclusion is now that CAM patients do not have lower or  
38 higher mortality rates than CON patients.  
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54 With regard to the healthcare costs differences reported in the Results section, we can  
55 hypothesize four types of explanations. First, the differences could be due to selection on  
56 unobservables in patients' GP choice. For example, patients who are healthier and more  
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3 health-conscious or patients with a strong preference to minimize exposure to medical  
4 interventions might be more likely to choose a CAM GP. In both cases, costs will be lower  
5 due to lower demand for healthcare. A standard approach to control for selection on  
6 unobservables in a non-experimental setting is to use Instrumental Variables (IV). A potential  
7 instrumental variable in this case is the distance between a patient's home and the various  
8 GPs, c.q. a change in distance as a result of a move of a patient or practice. We intend to  
9 explore this approach in future work. With respect to selection, several studies that compare  
10 the health status of patients treated in CAM and in conventional medicine in primary care  
11 settings find that patients treated in CAM practices suffer more often from severe and chronic  
12 illnesses (e.g., [16, 17]). This suggests that if we could control for severity and chronicity of  
13 illnesses (with additional data), the estimated compulsory cost differences might be larger.  
14 Second, the results could be due to undertreatment by CAM GPs. In the present dataset, we  
15 were only able to analyse mortality and found that patients with a CAM GP tend to have  
16 equal mortality rates. However, a number of studies have reported that patients seeking CAM  
17 or anthroposophic care have longer lasting and more severe health problems than patients in  
18 conventional care. At the same time, these patients report fewer adverse side effects of  
19 treatments and higher patient satisfaction (e.g., [16-18]). These findings combined with the  
20 results in this study provide some indication that undertreatment by CAM GPs is unlikely.  
21 Firmer conclusions require more detailed data on outcomes. Thirdly, the results could be due  
22 to better practices of CAM due to a stronger focus on preventive and curative health  
23 promotion, less overtreatment and better communication and professional relationships. For  
24 example, a CAM GP might try a low-cost CAM treatment first. As mentioned, the primary  
25 professional orientation of CAM doctors is to strengthen the self-healing capacity of the body  
26 and the self-management of the patient. This approach is associated with prescribing fewer  
27 conventional pharmaceuticals, tests and operations. Nissen et al. [19, p. 14], based on a  
28 review of the literature on citizens' attitudes and needs concerning CAM in Europe,  
29 concluded that 'many citizens in Europe value the practice of CAM, particularly the CAM  
30 provider-patient relationship, and the patient-centred and holistic approach aspired to by  
31 many CAM providers.' Van Dulmen [20] concluded in a Dutch study comparing patients  
32 visiting conventional general practitioners (GPs) and three types of CAM GPs (homeopathy,  
33 acupuncture and naturopathy), that, contrary to expectations, patients do not consult a CAM  
34 physician because they are disappointed with mainstream GP care. CAM patients primarily  
35 appear to be seeking a physician who takes the time to talk with them and who will treat their  
36 complaints from a holistic viewpoint. Ernst and Hung [21] described the published evidence  
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3 on the expectations of CAM users (in order of prevalence): hope to influence the natural  
4 history of the disease; disease prevention and health/ general well-being promotion; fewer  
5 side effects; being in control over one's health; symptom relief; boosting the immune system;  
6 emotional support; holistic care; improving quality of life; relief of side effects of  
7 conventional medicine; positive therapeutic relationship; obtaining information; coping better  
8 with illness; supporting the natural healing process; and the availability of treatment. In  
9 addition CAM GPs might focus more on the relationship and communication. For example  
10 Esch et al. [16] found that AM patients appreciated that their physicians listened to them  
11 (80.0% vs. 67.1%,  $p < 0.001$ ), spent more time (76.5% vs. 61.7%,  $p < 0.001$ ), had more  
12 interest in their personal situation (74.6% vs. 60.3%,  $p < 0.001$ ), involved them more in  
13 decisions about their medical care (67.8% vs. 58.4%,  $p = 0.022$ ), and made it easy to tell the  
14 physician about their problems (71.6% vs. 62.9%,  $p = 0.023$ ). AM patients gave significantly  
15 better rating as to information and support (in 3 of 4 items  $p < 0.05$ ) and for thoroughness  
16 (70.4% vs. 56.5%,  $p < 0.001$ ). AM patients showed significantly higher treatment satisfaction  
17 in all of the five items than CON patients. These results are consistent with other studies  
18 demonstrating high patient satisfaction with AM [13,14]. For instance, in a Dutch survey  
19 (Consumer Quality Index, a national standard to measure healthcare quality from the  
20 perspective of healthcare users), 2,099 patients reported very high satisfaction with  
21 anthroposophic GP practices (8.4 and 8.3 on a scale: 0-10, 10 indicating the best possible  
22 score) [18]. These results are consistent with AM theory, which emphasizes relationship and  
23 communication, as well as shared decision-making [14]. More AM patients expressed a  
24 general treatment satisfaction (56.1% vs. 43.4%,  $p < 0.001$ ) and saw their expectations  
25 completely fulfilled at follow-up (38.7% vs. 32.6%,  $p < 0.001$ ). AM patients reported  
26 significantly fewer adverse side effects (9.3% vs. 15.4%,  $p = 0.003$ ), and more other positive  
27 effects from treatment (31.7% vs. 17.1%,  $p < 0.001$ ). Fourthly, the lower costs could be  
28 related to the fact that patients interested in CAM might have higher out-of-pocket expenses  
29 since not all CAM treatments are covered by supplementary insurance. Clarifying the role of  
30 out-of-pocket expenses is an empirical issue that requires additional data.

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50 The major implication of this study and other economic evaluations of CAM is that  
51 there is sufficient evidence now to justify more professional interest in CAM from  
52 conventional healthcare professionals and policymakers. We can also conclude that there is  
53 sufficient good evidence that CAM can be cost-effective compared to conventional medicine,  
54 that the contribution of CAM might result in substantial diminishing of healthcare costs and  
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3 therefore can provide a contribution to national healthcare policies aiming at controlling and  
4 diminishing healthcare expenditures. Therefore more investment in the study of the cost-  
5 effectiveness of CAM modalities with their additional health promotion medicines and  
6 therapies is indicated. The main unanswered questions in the current study are: where do the  
7 cost differences come from (to which indications and which therapies do they pertain to?) and  
8 what are the health-related effects of CAM treatment (objective parameters (e.g. lowering of  
9 blood pressure), quality of life, patient-reported outcomes, sick-leave, etc.)? Future research  
10 should therefore focus on and (1) exploring to what extent selection on unobservables and  
11 causal effects explain the lower costs of patients with a CAM GP, (2) exploring in more  
12 depth the costs differences between patients of CON GPs and CAM GPs in order to develop  
13 adequate, testable hypothesis of cost-effectiveness of specific CAM treatment for specific  
14 indications, and to transfer the cost differences related knowledge from CAM to CON GP  
15 practices in order to diminish healthcare expenditures in CON practices; (3) designing and  
16 executing highly controlled, comparative effectiveness research projects [22] with more  
17 health related outcome parameters than mortality rate only; (4) replication studies based on  
18 similar, large datasets with other CAM modalities (acupuncture, TCM herbal treatment, etc.)  
19 and with other insurance companies to explore and confirm the present results;  
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### 34 **Acknowledgements**

35  
36 We would like to thank Agis (Achmea) and especially Dr. Hugo Smeets and Mr. Henk Evers  
37 for providing the dataset for the study.  
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39

### 40 **Competing interests**

41  
42 We have read and understood the BMJ Group policy on declaration of interests and declare  
43 the following interests:  
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- 46  
47 - Dr. Erik W. Baars receives a part of his salary from the Professorship Anthroposophic  
48 Healthcare of the University of Applied Sciences Leiden, The Netherlands. The  
49 professorship works closely with those in the AH professional field and works on  
50 practical problems using applied research which focuses on three main categories: (1)  
51 investigating efficacy and safety, (2) developing and delivering optimal quality, and  
52 (3) improving communication about AH.  
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### **Transparency declaration**

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

### **Competing Interests**

We have read and understood the BMJ Group policy on declaration of interests and declare the following interests:

- Dr. Erik W. Baars receives a part of his salary from the Professorship Anthroposophic Healthcare of the University of Applied Sciences Leiden, The Netherlands. The professorship works closely with those in the AH professional field and works on practical problems using applied research which focuses on three main categories: (1) investigating efficacy and safety, (2) developing and delivering optimal quality, and (3) improving communication about AH.

### **Contributors**

PK was the project lead for the statistical analyses. EB and PK wrote the manuscript. All authors reviewed the manuscript and contributed to manuscript revisions. EB is the guarantor for this study.

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### **Role of the study sponsors**

Not applicable.

### **Statement of independence of researchers from funders**

Funders played no part in article selection, analysis, interpretation, or decision to publish.

**Data sharing**

Details of how to obtain additional data from the study can be obtained from EB ([baars.e@hsleiden.nl](mailto:baars.e@hsleiden.nl)).

**Previous publication**

A part of the content of our study results was published in February 2014 as a Dutch article in the Dutch journal Economisch Statistische Berichten for economists in The Netherlands [23].

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7 A six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch  
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**Abstract**

**Objectives** To compare healthcare costs and mortality rates of Dutch patients with a conventional (CON) general practitioner (GP) and patients with a GP who has additionally completed training in complementary and alternative medicine (CAM).

**Design** Comparative economic evaluation.

**Setting** Database from the Dutch insurance company Agis.

**Participants** 1,521,773 patients (98.8%) from a CON practice and 18,862 patients (1.2%) from a CAM practice.

**Main outcome measures** Annual information on five types of healthcare costs for the years 2006 – 2011: care by GP, hospital care, pharmaceutical care, paramedic care and care covered by supplementary insurance. Healthcare costs in the last year of life. Mortality rates.

**Results** The mean annual compulsory and supplementary healthcare costs of CON patients are respectively 1,821 Euros (95% CI: 1,813 – 1,828) and 75.3 Euros (95% CI: 75.1 – 75.5). Compulsory healthcare costs of CAM patients are 225 Euros (95% CI: 169 – 281;  $p < 0.001$ ) (12,4%) lower and result mainly from lower hospital care costs (165 Euros) (95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros) (95% CI: 41 – 75;  $p < 0.001$ ), especially in the age categories 25 – 49 years and 50 – 74 years. The costs in the last year of life of patients with CAM GPs are 1,161 euro (95% CI: -138 – 2,461;  $p < 0.1$ ) lower. This difference is entirely due to lower hospital costs (1,250 Euros) (95% CI: 19 – 2,481;  $p < 0.05$ ). The mean annual supplementary costs of CAM patients are 33 Euros (95% CI: 30 – 37;  $p < 0.001$ ) (44%) higher. CAM patients do not have lower or higher mortality rates than CON patients.

**Conclusions** Dutch patients whose GP additionally completed training in CAM on average have 192 Euros (10.1%) lower annual total compulsory and supplementary healthcare costs and do not live longer or shorter than CON patients.

### Strengths and limitations of this study

- The study is based on a large sample size of patients and practices and a relatively long period of six years contributing to more precise estimations, and better representativeness and generalizability of the results.
- The study distinguishes between compulsory and supplementary costs providing a more complete picture of healthcare costs expenditure related to CAM.
- The study did not compare two treatment (conventional versus CAM) for a specific indication, in a controlled setting with other health related outcome parameters than mortality, ~~reducing the prohibiting the possibility-ability~~ to detect causal relationships between interventions and (cost)effects.
- Since the analyses were at the level of the 4-digit postcode and not at the level of the 6-digit postcode, the results might not be optimally controlled for socio-economic status of the patients.
- The study concerns a limited dataset, since the dataset is from only one insurer and the data reflect the behaviour of only a small number of CAM modalities (most GP practices (64%) were anthroposophic). These facts challenge the generalizability of the results.

## Introduction

In most countries of the European Union the annual healthcare costs are rising faster than the economy [1]. Therefore, national healthcare policies are increasingly aiming at controlling and diminishing healthcare expenditures. This also applies to the situation in The Netherlands [2]. In 1972 8% of the Dutch national income (GDP) was used to finance public healthcare. In 2010 already 13% of GDP was used and The Netherlands were worldwide in second place of healthcare expenditures of countries. Without drastic measures, the estimated costs will be over 30% in 2040 [3]. Public spending on healthcare will rise from 61 billion Euros in 2012 to an estimated nearly 80 billion Euros in 2017 [4]. Dutch health economists and policy makers have largely ignored the possible contribution of Complementary and Alternative Medicine (CAM) and Integrative Medicine (IM) to the reduction of healthcare costs as an area of research and interest. The here presented economic study, a six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM general practitioners (GPs), contributes to the development of an evidence-based Dutch policy with regard to the role of CAM and IM in the reduction of healthcare expenditure growth.

### *The Dutch financing system*

The Dutch financing system contains two basic compulsory health insurances, that are for 80% paid for ~~through~~by income taxes: for curative care (Zorgverzekeringswet (ZvW)) and for long-term care (Algemene Wet Bijzondere Ziektekosten (AWBZ)). The compulsory health insurances cover costs of most of all-GP, pharmaceutical and hospital care and a part some of paramedic care (until a certain amount). In addition, people in The Netherlands can buy supplementary insurance. ~~The primary goal of s~~Supplementary insurance ~~is to covers~~ costs not covered by basic insurance (for example specific or additional paramedic treatment, complementary therapies) (e.g., costs of CAM treatment is paid for up to 500 Euros/ year) [5]. ~~Many supplementary insurances cover costs of CAM treatments like anthroposophic medicine, acupuncture and homeopathy. The second goal of the s~~Supplementary insurance ~~is to cover the can also cover~~ costs of improvements over the standard level of care paid for by compulsory insurance (e.g., extra costs for a better room and service in case of hospitalisation).

### *Policies to reduce healthcare expenditure growth*

The vast majority of expenditure growth is due to innovations in healthcare. The Cultureel Planbureau (CPB) anticipates that the total costs of curative care will rise from 36 billion Euros this year to 49 billion Euros in 2017. The rising costs of curative care, according to the CPB is largely due to the 'creeping expansion' of the compulsory health insurance; 'Year after year, new medical techniques and drugs appear on the market that are often better, but also more expensive', especially, since more patients will be treated with the new techniques [3]. Of the total growth of public healthcare expenditure, about a quarter is the result of aging. In 2040 more than 22% of the Dutch population will be older than 65, whereas currently this is 16%. As people grow older, on average the costs of healthcare will increase (on the level of the whole older population).

Which policies can be deployed to control the risk of rising costs? The measures aimed at reducing healthcare expenditures are, without being complete: more efficiency and higher productivity in healthcare (including reducing management layers), more competition between healthcare institutions, fewer hospitals (specialization and concentration), more 'neighbourhood care' by general practitioners (GPs), more remote care (e-health), preventing overtreatment/ less (extra) care, more responsible behaviour of consumers (more self-care), more emphasis on healthy living (prevention), higher co-payments, higher deductibles and already saving for higher health-care expenditure in the old days (precautionary savings) [3].

In July 2013 the Dutch healthcare minister Schippers reached an agreement with hospitals, medical specialists, mental healthcare providers, general practitioners, health insurers and patients' organizations to reduce the growth rate of healthcare spending: to 1.5% in 2014 and 1% per year from 2015 to 2017. This reduction represents a total additional savings of approximately 1 billion Euros. To achieve the reduced expenditure growth, extra measures will be taken that increase the efficiency and improve the quality of care: more care of medical specialists goes to the GP and from the GP to self-care; concentration of complex care; tighter application of medical guidelines and care standards; treatments are given according to the standards of the medical profession itself; access to the claims of the compulsory health insurances is tightened; and more transparency about quality and cost of care [6].

### *The contribution of Complementary and Alternative Medicine*

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7 According to the National Center for Complementary and Alternative Medicine (NCCAM),  
8 CAM is a group of diverse medical and healthcare systems, practices, and products that are  
9 not generally considered part of conventional medicine [7]. The Cochrane Collaboration  
10 definition of complementary medicine is that it includes all such practices and ideas that are  
11 outside the domain of conventional medicine in several countries and defined by its users as  
12 preventing or treating illness, or promoting health and well-being. These practices  
13 complement mainstream medicine by satisfying a demand not met by conventional practices  
14 and diversifying the conceptual framework of medicine [8]. “Integrative Medicine is the  
15 practice of medicine that reaffirms the importance of the relationship between practitioner  
16 and patient, focuses on the whole person, is informed by evidence, and makes use of all  
17 appropriate therapeutic approaches, healthcare professionals and disciplines to achieve  
18 optimal health and healing.” [9] In addition, IM emphasizes the active role of the patient in  
19 prevention (lifestyle), well-being and therapy and healing processes, and the use of healing  
20 environments [9].  
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28 Herman et al. [10] performed a systematic review of economic evaluations on  
29 complementary and integrative medicine (CIM). This study identified 338 economic  
30 evaluations of CIM, including 114 full evaluations, published between 2001 and 2010. All  
31 recent (and likely most cost-relevant) full economic evaluations published from 2001 to 2010  
32 were subjected to several measures of quality. Detailed results of higher-quality studies were  
33 reported. The cost-utility analyses found were of similar or better quality to those published  
34 across all medicine. Of the 56 comparisons made in the higher-quality studies, 16 (29%)  
35 show a health improvement with cost savings for the CIM therapy versus usual  
36 (conventional) care. Study quality of the cost-utility analyses (CUAs) of CIM was generally  
37 comparable to that seen in CUAs across all medicine according to several measures, and the  
38 quality of the cost-saving studies was slightly, but not significantly, lower than those showing  
39 cost increases (85% vs 88%,  $p = 0.460$ ).  
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46 In The Netherlands, a few percent of the GPs have followed an additional training in  
47 CAM. In 2010, we performed an [initial-first](#) economic evaluation, comparing the healthcare  
48 costs of patients from Dutch conventional (CON) GPs and CAM GPs [11]. A dataset from a  
49 Dutch health insurer Azivo was used containing quarterly information on healthcare costs  
50 (GP care, hospital care, pharmaceutical care, and paramedic care), dates of birth and death (if  
51 applicable), gender and 6-digit postcode of all approximately 150,000 insurees, for the years  
52 2006–2009. Data from 1,913 conventional GPs were compared with data from 79 GPs with  
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7 additional CAM training in acupuncture (n=25), homeopathy (n=28), and anthroposophic  
8 medicine (n=26). Results were that patients whose GP has additionally completed training in  
9 CAM training had 0–30% lower healthcare costs and mortality rates, depending on age  
10 groups and type of CAM. The lower costs resulted from fewer hospital stays and fewer  
11 prescription drugs. It was concluded that more controlled studies (replication studies,  
12 research based on more comprehensive data, cost-effectiveness studies on CAM for specific  
13 diagnostic categories) were indicated.  
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### 18 19 *This study*

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21 Given the current need to diminish healthcare expenditures in The Netherlands and based on  
22 the positive results from both the review of Herman et al. [10] and our own study [11], we  
23 decided to perform a replication study comparing the healthcare costs of patients from  
24 conventional (CON) GPs and CAM GPs with a larger dataset from a Dutch health insurer, to  
25 analyse the robustness of the results of the first study. The research questions of the study  
26 were:  
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- 30 1. Is there a statistically significant difference in healthcare costs (care by GP, hospital  
31 care, pharmaceutical care, paramedic care, care covered by supplementary insurance,  
32 and healthcare costs in the last year of life) of patients from CON GPs and CAM  
33 GPs?  
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- 35 2. Is there a statistically significant difference in mortality rates of patients from CON  
36 GPs and CAM GPs?  
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## 42 **Methods**

### 43 *Comparative economic evaluation*

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45 Full economic evaluations compare the costs (resource use) associated with one or more  
46 alternative interventions (e.g. intervention X versus comparator Y) with their consequences  
47 (outcomes, effects). In this study we were able to measure five types of costs in two  
48 categories: (1) care covered by compulsory insurance: care by GP, hospital care,  
49 pharmaceutical care, paramedic care, and (2) costs covered by supplementary insurance.  
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Alternative interventions were: conventional GP care compared to care from GPs that know CAM. Outcomes were: differences in healthcare costs and annual mortality rates.

### *Model overview*

Costs were analysed at the patient level using linear and loglinear regression analysis. The cost analysis has been performed for the total sample, as well as separately for the age groups 0–24, 25–49, 50–74, and  $\geq 75$ , given the large average differences in health and healthcare needs across age groups. Effects on mortality rates are analysed using a linear probability model (LPM), a Logit model, and a Cox proportional hazard model (CPH). In all models, the explanatory variables are gender, age (linear, within each age category), dummies for CAM and ‘Vogelaarwijk’ (city areas with known lower socio-economic status of inhabitants), year dummies, and postal code fixed effects. In the cost regressions and the LPM model, fixed effects at the 42-digit insured postcode level were controlled for. In the Logit and CPH model 2-digit postcode level fixed effects were included, as estimation with more detailed fixed effects appeared to be numerically infeasible.

The regression approach is standard practice in health economics and yields results similar to those of matching procedures (both are unable to correct for unobserved differences between groups of patients). Given the large sample sizes Students’ t tests are asymptotically valid by virtue of the central limit theorem, independent of whether the underlying distributions are normal or non-normal. Standard errors are clustered at the level of the insured to control for the statistical dependence of observations pertaining to a given insured person (i.e. observations are independent ‘between’ individuals but dependent ‘within’ individuals).

With regard to the six years of data the data set was used as a panel. This means that if an insured person is observed for all six years, six observations of annual costs of this person are used in the analysis (taking into account the ‘within’-person correlation by clustering standard errors at the level of the individual). The reported differences can be interpreted as the average of cost differences across years. Any trends are controlled for by the year dummy variables.

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### *Dataset on healthcare costs and demographics*

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7 A dataset was analyzed from health insurer Agis, a subsidiary company of Achmea. Achmea  
8 has a share in the market of 31% (5.18 million insured) of the Dutch population in 2013;  
9 while the share of Agis is 9,2% (1.54 million insured) The dataset contains quarterly  
10 information on the healthcare costs of all Agis insurees, which was aggregated to annual  
11 information for the years 2006 up to 2011. In addition, it contains the date of birth of the  
12 insuree, date of death (if applicable), gender, and 4-digit postcode of the insured's residence.  
13 For each insuree year combination, information on the costs of five different types of care is  
14 available: care by GP, hospital care, pharmaceutical care, paramedic care (like physical  
15 therapy), and care covered by supplementary insurance.  
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### 22 *General practitioners and patients*

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24 The dataset also contains the names and addresses of the general practitioners who have  
25 patients who are insured by Agis, which allows us to distinguish between CON GPs and  
26 CAM GPs. We defined a general practitioner as anthroposophic CAM GP if his or her name  
27 appears in the list of general practitioners with additional training in anthroposophic medicine  
28 (AM) as provided by their professional association [14]. CAM GPs with homeopathy (HOM)  
29 [15] and CAM GPs with acupuncture [16] are defined similarly.  
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34 Patients were regarded CON patients and CAM patients if they were patient of  
35 respectively a CON GP or a CAM GP during all of the years they appear in the dataset.  
36 Patients that transferred from a CON GP to a CAM GP or vice versa , were regarded to be a  
37 member of a third group called 'Switchers' and were excluded from all analyses.  
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### 42 *Statistical analyses*

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44 Significance of coefficients is tested using Student t tests, with clustering of standard errors at  
45 the level of the insured. [Given the large sample sizes available here, asymptotic t-testing for](#)  
46 [differences in means is appropriate by virtue of the central limit theorem.](#) Calculations were  
47 made using StataSE 10.0. Means with 95% confidence intervals and p-values ( $< 0.1$ ,  $< 0.05$ ,  
48 and  $< 0.01$ ) are presented.  
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### 52 *Ethical approval*



Since the study involved no experimental treatment, patients were not recruited. Since patient data were anonymized, no ethical approval was necessary.

## Results

### *GP practices and patients*

The dataset contained 9,126 GP practices: 9,016 CON practices and 110 CAM practices. Due to the systematics of the insurance company, one individual GP can appear as different practices, so the actual number of GPs is lower than the number of GP practices. Contrarily, each patient is never counted more than once. The majority of the CAM GPs are anthroposophic GPs (70 AM practices (64%) with 17,257 patients (91%)). Other CAM GPs were specialized in acupuncture (15%) and homeopathy (25%). Since some GPs were specialized in more than one CAM modality the total percentage of CAM GPs is larger than 100%. Exact numbers and percentages of CAM GPs vary a little over the years.

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### *Healthcare costs*

#### **The dataset**

The dataset contains information of more than 1.5 million insurees during the years 2006-2011 (Table 1). Nearly 19,000 insurees (1.2%) had throughout this whole period a CAM GP. More than 10,000 other insurees had in some years a CON GP and in other years a CAM GP ('Switchers'). On average, the Switchers group had three years a CON GP and three years a CAM GP. The insurees had a mean age of 41.0 (SD=23.5). 53% are women. These patients live in 4,014 different 4-digit postal codes.

Without controlling for relevant differences between the groups, the comparison demonstrates: higher percentages of females in in the CAM GP and Switchers groups; higher percentages of insurees living in the 'Vogelaarwijk' in the CON and Switchers group; 183 Euros lower and 168 Euros higher total compulsory costs in respectively the CAM and the Switchers group; and 40 Euros and 25 Euros higher supplementary costs in costs in respectively the CAM and the Switchers group. The percentages of patients with a supplementary insurance were almost the same (CON GPs: 92.7%; CAM GPs: 93.4% and Switchers: 92.1%).

Since the aim of the study was to compare the costs of patients with a CON GP and a CAM GP, the data of the Switchers group were left out of the further regression analyses (Appendix 1).

Table 1. Descriptive statistics of the dataset

	CON GP	CAM GP	Switchers
<u>Insuredes (n)</u>	<u>1,521,773</u>	<u>18,862</u>	<u>10,769</u>
Age (year)	41.0	41.6	40.1
Female (percentage)	52.9%	55.2%	56.4%
'Vogelaarwijk' (percentage)	15.7%	9.3%	17.1%
Supplementary insured (percentage)	92.7%	93.4%	92.1%
Compulsory insurance costs (Euros)			
<i>Total costs</i>	1,821	1,638	1,989
<i>GP costs</i>	133	128	140
<i>Pharmaceutical costs</i>	402	357	474
<i>Hospital costs</i>	1,242	1,104	1,328
<i>Paramedical costs</i>	44	48	47
Supplementary insurance costs (Euros)	75	115	100
<u>Insuredes (n)</u>	<u>1,521,773</u>	<u>18,862</u>	<u>10,769</u>

#### Annual total compulsory and supplementary insurance costs

The mean annual total costs of patients treated in CON practices covered by the compulsory insurance were 1,821 Euros (95% CI: 1,813 – 1,828) (Table 1). After correction for observed

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7 differences between the groups by means of linear regression analyses, the mean annual total  
8 compulsory insurance costs of patients of CAM GP practices are 225 Euros (95% CI: 169 –  
9 281;  $p < 0.001$ ) (12.4%) lower. These lower costs are mainly due to lower hospital costs (165  
10 Euros; 95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros; 95%  
11 CI: 41 – 75;  $p < 0.001$ ).  
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14 The mean annual total supplementary costs for patients treated in CON practices were  
15 75.3 Euros (95% CI: 75.1 – 75.5). (The mean is calculated over all patients, including those  
16 (less than 8%) without supplementary insurance.) For patients treated in CAM practices these  
17 costs are 33 Euros (95% CI: 31 – 37;  $p < 0.001$ ) (44%) higher and were highest in the third  
18 age group (50 – 74 years) (52 Euros (95% CI: 31 – 37;  $p < 0.001$ ). Taken together, the mean  
19 total annual compulsory and supplementary insurance costs are 192 Euros (10.1%) lower for  
20 the CAM group of patients.  
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23 The log linear analyses of the mean total annual compulsory and supplementary  
24 insurance costs (Table 3) provide the same lower costs for the CAM group of patients as  
25 found in the linear analyses (Table 2). In addition, higher paramedic costs are found for the  
26 CAM group of patients.  
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### 32 33 **Costs per age category and insurance category**

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35 Lower total compulsory costs were found in all age categories (Table 2): 80 Euro (95% CI:  
36 21 – 140;  $p < 0.01$ ) in the first group (0-24 years); 137 Euros (95% CI: 54 – 219;  $p < 0.01$ ) in  
37 the second group (25 – 49 years); 356 Euros (95% CI: 227 – 485;  $p < 0.001$ ) in the third  
38 group (50 – 74 years), and 236 Euros (95% CI: -9 – 481;  $p < 0.1$ ) in the last group (75+  
39 years). Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50  
40 Euros; 95% CI: 23 – 77;  $p < 0.001$ ) and the third age group (50 – 74 years) (126 Euros; 95%  
41 CI: 88 – 164;  $p < 0.001$ ). Lower hospital costs were found in all age groups, with the largest  
42 differences in the third age group (50 – 74 years) (232 Euros; 95% CI: 124 – 341;  $p < 0.001$ )  
43 and the last age group (75+ years) (219 Euros; 95% CI: 7 – 431;  $p < 0.05$ ). In addition, the  
44 largest difference in total compulsory costs was found in the last year of life (1,161 Euros;  
45 95% CI: -138 – 2461;  $p < 0.1$ ), which is completely the result of lower hospital costs (1,250  
46 Euros; 95% CI: 19 – 2481;  $p < 0.05$ ).  
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The log linear analyses of the mean total annual compulsory and supplementary insurance costs (Table 3 Appendix 2. Table 4) provide the same lower costs for the separate age groups of CAM patients as found in the linear analyses (Table 2). In addition, now there are also significant lower costs for the CAM group of patients with regard to GP costs in the third age group (50 – 74), lower pharmaceutical costs in the first (0 – 24) and the last age group (75+); and higher paramedic costs in the second (25 – 49) and third (50 – 74) age group (Table 3).

Table 2. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (linear regression model)

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-225***	-3***	-58***	-165***	1	33***
0-24	-80***	-3***	-2	-74***	-2	11***
25-49	-137***	-2**	-50***	-85**	1	32***
50-74	-356***	-1	-126***	-232***	3	52***
75+	-236*	11***	-38	-219**	10	24***
Last year of life	-1,161*	5	67	-1,250**	27	3

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

Table 3. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (loglinear regression model)

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-.114***	-.121***	-.281***	-.185***	.028**	-.496***
0-24	-.071***	-.018**	-.169***	-.152***	.017	-.344***
25-49	-.088***	-0.14**	-.267***	-.153***	-.021*	-.433***
50-74	-.173***	-.025***	-.418***	-.220***	-.036*	-.653***

	75+	-.072**	-.026*	-.176***	-.124**	-.055	-.355***
Last year of life		-.146**	-.026	-.143	-.287**	-.178	-.134
*: p-value < 0.1; **: p-value < 0.05; ***: p-value < 0.01							

### Mortality rates

In the present dataset, the only information available on health outcomes is mortality. During the period 2006-2011 80,543 patients died in the CON group (5.26%) and 973 in the CAM group (5.14%). After controlling for all relevant variables (age, postal codes, etcetera), we find that patients with a CAM GP have significantly lower mortality rates in all LMP analyses (Table 34). However, the differences are very small: total group: 0.004 (95% CI: 0.001 – 0.007;  $p < 0.05$ ); men: 0.004 (95% CI: 0.001 – 0.008;  $p < 0.1$ ); women: 0.007 (95% CI: 0.003 – 0.011;  $p < 0.05$ ). The Logit analyses resulted in a significantly higher mortality rate -for the total group at the 10% level (but not at the 5% level)- (0.066; 95% CI: -0.143 – 0.011;  $p < 0.1$ ), but no significant differences for men and women separately. The Cox proportional hazard analyses resulted in significant higher mortality rates at the 10% level (but not at the 5% level), both for the total group: 1.059 (95% CI: 0.994 – 1.129;  $p < 0.1$ ), and the group of women: 1.072 (95% CI: 0.987 – 1.165;  $p < 0.1$ ), but no significant difference for men were found.

Based on all results, taking into account the small differences in the LPM analyses, the high low-p-values ( $p < 0.1$ ) in the Logit and Cox proportional hazard analyses and the contradictory outcomes between the LPM analyses on the one hand and the Logit and Cox proportional hazard analyses on the other hand, we conclude that there is no difference in mortality rates between the CON and CAM group of patients.

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	Total	Men	Women
LPM with fixed effects	-0.004**	-0.004*	-0.007**
Logit with fixed effects	0.066*	0.081	0.049
Cox proportional hazard	1.059*	1.043	1.072*

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\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

### Conclusions

The comparison of the healthcare costs of insurees of CON GPs and CAM GPs in a database with data of 1,540,635 patients from the Dutch insurance company Agis during the period 2006-2011 demonstrates:

1. On average annual total compulsory and supplementary healthcare costs of patients treated by a CAM GP are 192 Euros (10.1%) lower than the costs of patients treated by conventional GPs as a result of 225 Euros (12.4%) lower compulsory costs and 33 Euros (44%) higher supplementary costs.
2. The lower mean annual total compulsory healthcare costs are mainly due to lower hospital care costs (165 Euros) and lower pharmaceutical care costs (58 Euros).
3. Lower mean annual total compulsory healthcare costs are demonstrated in all age categories, but the differences are largest ~~are highest~~ in the third age group (50 – 74 years) (total costs: 356 Euros; hospital care: 232 Euros; pharmaceutical care: 126 Euros) and in the last year of life (total costs: 1,093 Euros; hospital care: 1,223 Euros).
4. Patients with a CAM GP do not have significantly lower or higher mortality rates than patients with a CON GP.

### Discussion

In this study the mean annual total compulsory costs, supplementary costs, costs during the last year of life and mortality rates of patients with a conventional (CON) GP (n = 1.52

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7 million; 98.8%) and patients with GPs that know complementary and alternative medicine  
8 (CAM) (n = 18,862; 1.2%) were compared in a dataset from the Dutch insurance company  
9 Agis over a six year period (2006 – 2011) by means of regression analyses. The mean annual  
10 compulsory healthcare costs of patients treated by a conventional GP are 1,821 Euros (95%  
11 CI: 1,813 – 1,828). On average annual total compulsory healthcare costs of patients treated  
12 by a CAM GP are 225 Euros (95% CI: 169 – 281; p < 0.001) (12.4%) lower than patients  
13 treated by conventional GPs. Lower total compulsory costs were found in all age categories.  
14 Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50 Euros;  
15 95% CI: 23 – 77; p < 0.001) and the third age group (50 – 74 years) (126 Euros; 95% CI: 88  
16 – 164; p < 0.001). Lower hospital costs were found in all age groups. The largest difference  
17 in total compulsory costs was found in the last year of life (1,161 Euros; 95% CI: -138 –  
18 2461; p < 0.1), which is completely the result of lower hospital costs (1,250 Euros; 95% CI:  
19 19 – 2481; p < 0.05). The mean annual supplementary insurance costs of patients treated by a  
20 conventional GP are 75.3 Euros (95% CI: 75.1 – 75.5). On average annual supplementary  
21 healthcare costs of patients treated by a CAM GP are 33 Euros (95% CI: 31 – 37; p < 0.001)  
22 (44%) higher. The absolute lower compulsory costs for all patients for the six years period  
23 (2006 – 2011) for the CAM group is 25,463,700 Euros (or on average 4,243,950 Euros per  
24 year) compared to the CON group. The extrapolation of the lower costs in the CAM group of  
25 patients to the Dutch population (16.8 million inhabitants), if applicable, would result in 3.78  
26 billion Euros lower annual compulsory costs. The absolute lower compulsory and  
27 supplementary costs for all patients for the six years period (2006 -2011) for the CAM group  
28 is 21,729,024 Euros (or on average 3,621,504 Euros per year) compared to the CON group.  
29 The extrapolation of the lower costs in the CAM group of patients to the Dutch population  
30 (16.8 million inhabitants), if applicable, would result in 3.23 billion Euros lower annual  
31 compulsory and supplementary costs. Patients with a CAM GP do not have significantly  
32 lower or higher mortality rates than patients with a conventional GP.  
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45 The first strength of the study is the large sample size of patients and practices.  
46 Approximately 9.2% of the Dutch population (1.54/ 16.8 million), and 29.7% of the insurees  
47 of Achmea (1.54/ 5.18 million) were included in the study. Compared to the first pilot study  
48 [11] there were 10 times more patients from a CON GP (151,952 versus 1,521,773), three  
49 times more patients from a CAM GP (5,922 versus 18,862), 4,5 times more CON GP  
50 practices (1,913 versus 9,016) and about 1,5 times more CAM practices (79 versus 110). This  
51 large sample size allows a more precise estimate of costs and mortality rate differences and  
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7 increases the representativeness of the sample and the generalizability of the results [13]. The  
8 second strength is that the results are based on a relatively long period of six years, also  
9 contributing to more precise estimations, and better representativeness and generalizability of  
10 the results. Thirdly, this study, unlike the first pilot study [11], distinguishes between  
11 compulsory and supplementary costs providing a more complete picture of healthcare costs  
12 expenditure related to CAM. The first limitation of the study is that it did not compare two  
13 treatments (CON versus CAM) for a specific indication, in a controlled setting with other  
14 health related outcome parameters than mortality, ~~reducing prohibiting~~ the possibility-ability  
15 to detect causal relationships between interventions and (cost)effects. Missing information  
16 includes costs of out-of-pocket expenses, morbidity, work absence, objective disease related  
17 outcome measures, subjective health and patient satisfaction. A second limitation is, contrary  
18 to the first pilot study [11], that we were not able to analyse at the level of the 6-digit  
19 postcode but only at the level of the 4-digit postcode. As a result, the results might not be  
20 optimally controlled for socio-economic status of the patients. However, a reanalysis of the  
21 data of the first pilot study [11] demonstrated very small differences in results between the  
22 analyses with the 6-digit postcode and the analyses with the 4-digit postcode. Another  
23 limitation of the study concerns the limited dataset, since the dataset is from only one insurer  
24 and the data reflect the behaviour of only a small number of CAM modalities (most GP  
25 practices (64%) were anthroposophic). These facts challenge the generalizability of the  
26 results.  
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36 The current results with regard to differences in healthcare costs confirm the results of  
37 our first smaller pilot study [11] with only 153,000 insurees and observations during a four-  
38 year period. In addition, the current study with 10 times as many patients and a two-year  
39 longer period of observations, enabled to estimate the cost differences more precisely.  
40 Whereas in this first study estimation of mean annual total compulsory costs of CAM patients  
41 were in the range of 0 – 30% lower than these of patients of CON GPs, the mean cost  
42 differences are now estimated to be 12.4% lower (range: 9.3 – 15.4%) for the CAM group.  
43 Like in the first study, the lower total compulsory costs are mainly the result from lower  
44 hospital and pharmaceutical costs. Lower costs for CAM in this study are also in line with the  
45 results of the recent review of Herman et al. [10] on economic evaluation of CAM and CIM,  
46 demonstrating that 29% of comparisons made in the 56 higher-quality studies showed a  
47 health improvement with cost savings for the CIM therapy versus usual (conventional) care.  
48 Since most CAM patients in the current study were treated in an anthroposophic practice,  
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7 comparison with other economic studies on anthroposophic medicine (AM) is justified.  
8 Kienle et al. [13,15] reviewed the few economic investigations on AM, demonstrating less or  
9 equal costs in AM compared to CON treatment, due to reduced hospital admissions and less  
10 prescriptions of medications. Hamre et al. [15] found that in patients starting anthroposophic  
11 therapies for chronic disease, total healthcare costs did not increase in the first year, and were  
12 significantly reduced in the second year by 416 Euros (95% CI: 264 – 960) compared to the  
13 pre-study year. This reduction was largely explained by a decrease of inpatient  
14 hospitalisation. With regard to differences in mortality rates between CON and CAM  
15 patients, the results do not confirm the (weak) evidence of lower mortality rates that were  
16 found in the first study [11]. The conclusion is now that CAM patients do not have lower or  
17 higher mortality rates than CON patients.  
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23 With regard to the healthcare costs differences reported in the Results section, we can  
24 hypothesize four types of explanations. First, the differences could be due to selection on  
25 unobservables in patients' GP choice. For example, patients who are healthier and more  
26 health-conscious or patients with a strong preference to minimize exposure to medical  
27 interventions might be more likely to choose a CAM GP. In both cases, costs will be lower  
28 due to lower demand for healthcare. A standard approach to control for selection on  
29 unobservables in a non-experimental setting is to use Instrumental Variables (IV). A potential  
30 instrumental variable in this case is the distance between a patient's home and the various  
31 GPs, e.g. a change in distance as a result of a move of a patient or practice. We intend to  
32 explore this approach in future work. With respect to selection, several studies that compare  
33 the health status of patients treated in CAM and in conventional medicine in primary care  
34 settings find that patients treated in CAM practices suffer more often from severe and chronic  
35 illnesses (e.g., [16, 17]). This suggests that if we could control for severity and chronicity of  
36 illnesses (with additional data), the estimated compulsory cost differences might be larger.  
37 Second, the results could be due to undertreatment by CAM GPs. In the present dataset, we  
38 were only able to analyse mortality and found that patients with a CAM GP tend to have  
39 equal mortality rates. However, a number of studies have reported that patients seeking CAM  
40 or anthroposophic care have longer lasting and more severe health problems than patients in  
41 conventional care. At the same time, these patients report fewer adverse side effects of  
42 treatments and higher patient satisfaction (e.g., [16-18]). These findings combined with the  
43 results in this study provide some indication that undertreatment by CAM GPs is unlikely.  
44 Firmer conclusions require more detailed data on outcomes. Thirdly, the results could be due  
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7 to better practices of CAM due to a stronger focus on preventive and curative health  
8 promotion, less overtreatment and better communication and professional relationships. For  
9 example, a CAM GP might try a low-cost CAM treatment first. As mentioned, the primary  
10 professional orientation of CAM doctors is to strengthen the self-healing capacity of the body  
11 and the self-management of the patient. This approach is associated with prescribing fewer  
12 conventional pharmaceuticals, tests and operations. Nissen et al. [19, p. 14], based on a  
13 review of the literature on citizens' attitudes and needs concerning CAM in Europe,  
14 concluded that 'many citizens in Europe value the practice of CAM, particularly the CAM  
15 provider-patient relationship, and the patient-centred and holistic approach aspired to by  
16 many CAM providers.' Van Dulmen [20] concluded in a Dutch study comparing patients  
17 visiting conventional general practitioners (GPs) and three types of CAM GPs (homeopathy,  
18 acupuncture and naturopathy), that, contrary to expectations, patients do not consult a CAM  
19 physician because they are disappointed with mainstream GP care. CAM patients primarily  
20 appear to be seeking a physician who takes the time to talk with them and who will treat their  
21 complaints from a holistic viewpoint. Ernst and Hung [21] described the published evidence  
22 on the expectations of CAM users (in order of prevalence): hope to influence the natural  
23 history of the disease; disease prevention and health/ general well-being promotion; fewer  
24 side effects; being in control over one's health; symptom relief; boosting the immune system;  
25 emotional support; holistic care; improving quality of life; relief of side effects of  
26 conventional medicine; positive therapeutic relationship; obtaining information; coping better  
27 with illness; supporting the natural healing process; and the availability of treatment. In  
28 addition CAM GPs might focus more on the relationship and communication. For example  
29 Esch et al. [16] found that AM patients appreciated that their physicians listened to them  
30 (80.0% vs. 67.1%,  $p < 0.001$ ), spent more time (76.5% vs. 61.7%,  $p < 0.001$ ), had more  
31 interest in their personal situation (74.6% vs. 60.3%,  $p < 0.001$ ), involved them more in  
32 decisions about their medical care (67.8% vs. 58.4%,  $p = 0.022$ ), and made it easy to tell the  
33 physician about their problems (71.6% vs. 62.9%,  $p = 0.023$ ). AM patients gave significantly  
34 better rating as to information and support (in 3 of 4 items  $p < 0.05$ ) and for thoroughness  
35 (70.4% vs. 56.5%,  $p < 0.001$ ). AM patients showed significantly higher treatment satisfaction  
36 in all of the five items than CON patients. These results are consistent with other studies  
37 demonstrating high patient satisfaction with AM [13,14]. For instance, in a Dutch survey  
38 (Consumer Quality Index, a national standard to measure healthcare quality from the  
39 perspective of healthcare users), 2,099 patients reported very high satisfaction with  
40 anthroposophic GP practices (8.4 and 8.3 on a scale: 0-10, 10 indicating the best possible  
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score) [18]. These results are consistent with AM theory, which emphasizes relationship and communication, as well as shared decision-making [14]. More AM patients expressed a general treatment satisfaction (56.1% vs. 43.4%,  $p < 0.001$ ) and saw their expectations completely fulfilled at follow-up (38.7% vs. 32.6%,  $p < 0.001$ ). AM patients reported significantly fewer adverse side effects (9.3% vs. 15.4%,  $p = 0.003$ ), and more other positive effects from treatment (31.7% vs. 17.1%,  $p < 0.001$ ). Fourthly, the lower costs could be related to the fact that patients interested in CAM might have higher out-of-pocket expenses since not all CAM treatments are covered by supplementary insurance. Clarifying the role of out-of-pocket expenses is an empirical issue that requires additional data.

The major implication of this study and other economic evaluations of CAM is that there is sufficient evidence now to justify more professional interest in CAM from conventional healthcare professionals and policymakers. We can also conclude that there is sufficient good evidence that CAM can be cost-effective compared to conventional medicine, that the contribution of CAM might result in substantial diminishing of healthcare costs and therefore can provide a contribution to national healthcare policies aiming at controlling and diminishing healthcare expenditures. Therefore more investment in the study of the cost-effectiveness of CAM modalities with their additional health promotion medicines and therapies is indicated. The main unanswered questions in the current study are: where do the cost differences come from (to which indications and which therapies do they pertain to?) and what are the health-related effects of CAM treatment (objective parameters (e.g. lowering of blood pressure), quality of life, patient-reported outcomes, sick-leave, etc.)? Future research should therefore focus on and (1) exploring to what extent selection on unobservables and causal effects explain the lower costs of patients with a CAM GP, (2) exploring in more depth the costs differences between patients of CON GPs and CAM GPs in order to develop adequate, testable hypothesis of cost-effectiveness of specific CAM treatment for specific indications, and to transfer the cost differences related knowledge from CAM to CON GP practices in order to diminish healthcare expenditures in CON practices; (3) designing and executing highly controlled, comparative effectiveness research projects [22] with more health related outcome parameters than mortality rate only; (4) replication studies based on similar, large datasets with other CAM modalities (acupuncture, TCM herbal treatment, etc.) and with other insurance companies to explore and confirm the present results;

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### Competing interests

We have read and understood the BMJ Group policy on declaration of interests and declare the following interests:

- Dr. Erik W. Baars receives a part of his salary from the Professorship Anthroposophic Healthcare of the University of Applied Sciences Leiden, The Netherlands. The professorship works closely with those in the AH professional field and works on practical problems using applied research which focuses on three main categories: (1) investigating efficacy and safety, (2) developing and delivering optimal quality, and (3) improving communication about AH.

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### Transparency declaration

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

**Contributors**

PK was the project lead for the statistical analyses. EB and PK wrote the manuscript. All authors reviewed the manuscript and contributed to manuscript revisions. EB is the guarantor for this study.

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**Role of the study sponsors**

Not applicable.

**Statement of independence of researchers from funders**

Funders played no part in article selection, analysis, interpretation, or decision to publish.

**Data sharing**

Details of how to obtain additional data from the study can be obtained from EB ([baars.e@hsleiden.nl](mailto:baars.e@hsleiden.nl)).

**Previous publication**

A part of the content of our study results was published in February 2014 as a Dutch article in the Dutch journal Economisch Statistische Berichten for economists in The Netherlands [23].

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## Appendix 1

### The Switcher group

From the total group of 10,769 Switchers, during the period 2006-2011, 6,224 patients switched one time; 2,992 patients switched two times (= back to their first type of GP); 1,282 patients switched three times; 241 patients switched four times and 30 patients switched five times. From the Switchers group that started with a CAM GP, 69.3% ends up with a CON GP. From the Switchers group that started with a CON GP, 70.5% ends up with a CAM GP. As a result the total percentages of CAM patients and CON patients hardly change.

When we analyze the changes in compulsory costs after switching in the subgroup that switched only one time, the total compulsory costs after switching are higher, independent of the direction of the switch. Switching from a CON to a CAM GP results in 337 Euros higher costs ( $p < 0.001$ ), switching from a CAM to a CON GP results in 372 Euros higher costs ( $p < 0.001$ ). After correction for observed differences between the groups by means of linear regression analyses, switching from a CON to a CAM GP results in 34 Euros lower costs (not significant:  $p = 0.83$ ) and switching from a CAM to a CON GP results in 360 Euros higher costs ( $p < 0.079$ ).

When we analyze the changes in supplementary costs after switching in the subgroup that switched only one time, we see that switching from a CON to a CAM GP results in 23 Euros higher costs ( $p < 0.001$ ), and that switching from a CAM to a CON GP results in 1 Euro lower costs (not significant:  $p = 0.78$ ). After correction for observed differences between the groups by means of linear regression analyses, switching from a CON to a CAM GP results in 1 Euro higher costs (not significant:  $p = 0.816$ ) and switching from a CAM to a CON GP results in 2 Euros higher costs (not significant:  $p = 0.803$ ).

Since we are mainly interested in the differences in costs between patients that have a CAM GP and patient that have a CON GP for the whole period of six years (2006-2011), the Switcher group is left out of the following analyses.



## Appendix 2

**Table 43. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (loglinear regression model)**

	<u>Compulsory insurance costs</u>					<u>Supplementary insurance costs</u>
	<u>Total</u>	<u>GP</u>	<u>Pharmaceutical</u>	<u>Hospital</u>	<u>Paramedic</u>	
<u>All ages</u>	<u>-.114***</u>	<u>-.121***</u>	<u>-.281***</u>	<u>-.185***</u>	<u>.028**</u>	<u>.496***</u>
<u>0-24</u>	<u>-.071***</u>	<u>-.018**</u>	<u>-.169***</u>	<u>-.152***</u>	<u>.017</u>	<u>.344***</u>
<u>25-49</u>	<u>-.088***</u>	<u>-0.14**</u>	<u>-.267***</u>	<u>-.153***</u>	<u>.021*</u>	<u>.433***</u>
<u>50-74</u>	<u>-.173***</u>	<u>-.025***</u>	<u>-.418***</u>	<u>-.220***</u>	<u>.036*</u>	<u>.653***</u>
<u>75+</u>	<u>-.072**</u>	<u>.026*</u>	<u>-.176***</u>	<u>-.124**</u>	<u>.055</u>	<u>.355***</u>
<u>Last year of life</u>	<u>-.146**</u>	<u>.026</u>	<u>-.143</u>	<u>-.287**</u>	<u>.178</u>	<u>.134</u>

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

## Appendix 1

### The Switcher group

From the total group of 10,769 Switchers, during the period 2006-2011, 6,224 patients switched one time; 2,992 patients switched two times (= back to their first type of GP); 1,282 patients switched three times; 241 patients switched four times and 30 patients switched five times. From the Switchers group that started with a CAM GP, 69.3% ends up with a CON GP. From the Switchers group that started with a CON GP, 70.5% ends up with a CAM GP. As a result the total percentages of CAM patients and CON patients hardly change.

When we analyze the changes in compulsory costs after switching in the subgroup that switched only one time, the total compulsory costs after switching are higher, independent of the direction of the switch. Switching from a CON to a CAM GP results in 337 Euros higher costs ( $p < 0.001$ ), switching from a CAM to a CON GP results in 372 Euros higher costs ( $p < 0.001$ ). After correction for observed differences between the groups by means of linear regression analyses, switching from a CON to a CAM GP results in 34 Euros lower costs (not significant:  $p = 0.83$ ) and switching from a CAM to a CON GP results in 360 Euros higher costs ( $p < 0.079$ ).

When we analyze the changes in supplementary costs after switching in the subgroup that switched only one time, we see that switching from a CON to a CAM GP results in 23 Euros higher costs ( $p < 0.001$ ), and that switching from a CAM to a CON GP results in 1 Euro lower costs (not significant:  $p = 0.78$ ). After correction for observed differences between the groups by means of linear regression analyses, switching from a CON to a CAM GP results in 1 Euro higher costs (not significant:  $p = 0.816$ ) and switching from a CAM to a CON GP results in 2 Euros higher costs (not significant:  $p = 0.803$ ).

Since we are mainly interested in the differences in costs between patients that have a CAM GP and patient that have a CON GP for the whole period of six years (2006-2011), the Switcher group is left out of the following analyses.

## Appendix 2

Table 4. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (loglinear regression model)

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-.114***	-.121***	-.281***	-.185***	.028**	.496***
0-24	-.071***	-.018**	-.169***	-.152***	.017	.344***
25-49	-.088***	-0.14**	-.267***	-.153***	.021*	.433***
50-74	-.173***	-.025***	-.418***	-.220***	.036*	.653***
75+	-.072**	.026*	-.176***	-.124**	.055	.355***
Last year of life	-.146**	.026	-.143	-.287**	.178	.134

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

**Additional file 1**

EVEREST Statement: Checklist for health economics paper

	<b>Study section</b>	<b>Additional remarks</b>
<b>Study design</b>		
(1) The research question is stated	Introduction	
(2) The economic importance of the research question is stated	Introduction	
(3) The viewpoint(s) of the analysis are clearly stated and justified	Methods; Discussion	
(4) The rationale for choosing the alternative programmes or interventions compared is stated	Methods	
(5) The alternatives being compared are clearly described	Introduction; Methods	
(6) The form of economic evaluation used is stated	Introduction; Methods	
(7) The choice of form of economic evaluation is justified in relation to the questions addressed	Introduction; Methods; Discussion	
<b>Data collection</b>		
(8) The source(s) of effectiveness estimates used are stated	Methods	
(9) Details of the design and results of effectiveness study are given (if based on single study)	N/A	
(10) Details of the method of synthesis or meta-analysis of estimates are given (if based on an overview of a number of effectiveness studies)	N/A	
(11) The primary outcome measure(s) for the economic evaluation are clearly stated	Methods	
(12) Methods to value health states and other benefits are stated	Introduction; Methods	
(13) Details of the subjects from whom valuations were obtained are given	Methods	
(14) Productivity changes (if included) are reported separately	N/A	
(15) The relevance of productivity changes to the study question is discussed	N/A	
(16) Quantities of resources are reported separately from their unit costs	Methods; Tables 2-4	
(17) Methods for the estimation of quantities and unit costs are described	Methods; Tables 2-4	
(18) Currency and price data are recorded	Methods; Tables 2-4	
(19) Details of currency of price adjustments for	NA	

inflation or currency conversion are given		
(20) Details of any model used are given	Methods-Model overview	
(21) The choice of model used and the key parameters on which it is based are justified	Methods	
<b>Analysis and interpretation of results</b>		
(22) Time horizon of costs and benefits is stated	Methods; Discussion	
(23) The discount rate(s) is stated	N/A	
(24) The choice of rate(s) is justified	N/A	
(25) An explanation is given if costs or benefits are not discounted	N/A	
(26) Details of statistical tests and confidence intervals are given for stochastic data	N/A	
(27) The approach to sensitivity analysis is given	N/A	
(28) The choice of variables for sensitivity analysis is justified	Methods; Tables 2-4	Confidence intervals are given
(29) The ranges over which the variables are varied are stated	Tables 2-4	
(30) Relevant alternatives are compared	Introduction; Methods	
(31) Incremental analysis is reported	Discussion	We describe the extrapolation from the lower costs in the CAM group of patients to the Dutch population
(32) Major outcomes are presented in a disaggregated as well as aggregated form	Tables 2-4	
(33) The answer to the study question is given	Discussion; Conclusion	
(34) Conclusions follow from the data reported	Conclusion	
(35) Conclusions are accompanied by the appropriate caveats	Discussion; Conclusion	

# BMJ Open

## A six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM GPs

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3 **A six-year comparative economic evaluation of healthcare costs and mortality rates of**  
4 **Dutch patients from conventional and CAM GPs**  
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**Abstract**

**Objectives** To compare healthcare costs and mortality rates of Dutch patients with a conventional (CON) general practitioner (GP) and patients with a GP who has additionally completed training in complementary and alternative medicine (CAM).

**Design** Comparative economic evaluation.

**Setting** Database from the Dutch insurance company Agis.

**Participants** 1,521,773 patients (98.8%) from a CON practice and 18,862 patients (1.2%) from a CAM practice.

**Main outcome measures** Annual information on five types of healthcare costs for the years 2006 – 2011: care by GP, hospital care, pharmaceutical care, paramedic care and care covered by supplementary insurance. Healthcare costs in the last year of life. Mortality rates.

**Results** The mean annual compulsory and supplementary healthcare costs of CON patients are respectively 1,821 Euros (95% CI: 1,813 – 1,828) and 75.3 Euros (95% CI: 75.1 – 75.5). Compulsory healthcare costs of CAM patients are 225 Euros (95% CI: 169 – 281;  $p < 0.001$ ) (12,4%) lower and result mainly from lower hospital care costs (165 Euros) (95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros) (95% CI: 41 – 75;  $p < 0.001$ ), especially in the age categories 25 – 49 years and 50 – 74 years. The costs in the last year of life of patients with CAM GPs are 1,161 euro (95% CI: -138 – 2,461;  $p < 0.1$ ) lower. This difference is entirely due to lower hospital costs (1,250 Euros) (95% CI: 19 – 2,481;  $p < 0.05$ ). The mean annual supplementary costs of CAM patients are 33 Euros (95% CI: 30 – 37;  $p < 0.001$ ) (44%) higher. CAM patients do not have lower or higher mortality rates than CON patients.

**Conclusions** Dutch patients whose GP additionally completed training in CAM on average have 192 Euros (10.1%) lower annual total compulsory and supplementary healthcare costs and do not live longer or shorter than CON patients.



### Strengths and limitations of this study

- The study is based on a large sample size of patients and practices and a relatively long period of six years contributing to more precise estimations, and better representativeness and generalizability of the results.
- The study distinguishes between compulsory and supplementary costs providing a more complete picture of healthcare costs expenditure related to CAM.
- The study did not compare two treatments (conventional versus CAM) for a specific indication, in a controlled setting with other health related outcome parameters than mortality, reducing the ability to detect causal relationships between interventions and (cost)effects.
- Since the analyses were at the level of the 4-digit postcode and not at the level of the 6-digit postcode, the results might not be optimally controlled for socio-economic status of the patients.
- The study concerns a limited dataset, since the dataset is from only one insurer and the data reflect the behaviour of only a small number of CAM modalities (most GP practices (64%) were anthroposophic). These facts challenge the generalizability of the results.

## Introduction

In most countries of the European Union the annual healthcare costs are rising faster than the economy [1]. Therefore, national healthcare policies are increasingly aiming at controlling and diminishing healthcare expenditures. This also applies to the situation in The Netherlands [2]. In 1972 8% of the Dutch national income (GDP) was used to finance public healthcare. In 2010 already 13% of GDP was used and The Netherlands were worldwide in second place of healthcare expenditures of countries. Without drastic measures, the estimated costs will be over 30% in 2040 [3]. Public spending on healthcare will rise from 61 billion Euros in 2012 to an estimated nearly 80 billion Euros in 2017 [4]. Dutch health economists and policy makers have largely ignored the possible contribution of Complementary and Alternative Medicine (CAM) and Integrative Medicine (IM) to the reduction of healthcare costs as an area of research and interest. The here presented economic study, a six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM general practitioners (GPs), contributes to the development of an evidence-based Dutch policy with regard to the role of CAM and IM in the reduction of healthcare expenditure growth.

### *The Dutch financing system*

The Dutch financing system contains two basic compulsory health insurances, that are for 80% paid for through income taxes: for curative care (Zorgverzekeringswet (ZvW)) and for long-term care (Algemene Wet Bijzondere Ziektekosten (AWBZ)). The compulsory health insurances cover costs of most of GP, pharmaceutical and hospital care and some paramedic care. In addition, people in The Netherlands can buy supplementary insurance. Supplementary insurance covers costs not covered by basic insurance (for example specific or additional paramedic treatment, complementary therapies) (e.g., costs of CAM treatment is paid for up to 500 Euros/ year) [5]. Many supplementary insurances cover costs of CAM treatments like anthroposophic medicine, acupuncture and homeopathy. Supplementary insurance can also cover costs of improvements over the standard level of care paid for by compulsory insurance (e.g., extra costs for a better room and service in case of hospitalisation).

### *Policies to reduce healthcare expenditure growth*

The vast majority of expenditure growth is due to innovations in healthcare. The Cultureel Planbureau (CPB) anticipates that the total costs of curative care will rise from 36 billion Euros this year to 49 billion Euros in 2017. The rising costs of curative care, according to the CPB is largely due to the ‘creeping expansion’ of the compulsory health insurance; ‘Year after year, new medical techniques and drugs appear on the market that are often better, but also more expensive’, especially, since more patients will be treated with the new techniques [3]. Of the total growth of public healthcare expenditure, about a quarter is the result of aging. In 2040 more than 22% of the Dutch population will be older than 65, whereas currently this is 16%. As people grow older, on average the costs of healthcare will increase (on the level of the whole older population).

Which policies can be deployed to control the risk of rising costs? The measures aimed at reducing healthcare expenditures are, without being complete: more efficiency and higher productivity in healthcare (including reducing management layers), more competition between healthcare institutions, fewer hospitals (specialization and concentration), more ‘neighbourhood care’ by general practitioners (GPs), more remote care (e-health), preventing overtreatment/ less (extra) care, more responsible behaviour of consumers (more self-care), more emphasis on healthy living (prevention), higher co-payments, higher deductibles and already saving for higher healthcare expenditure in the old days (precautionary savings) [3].

In July 2013 the Dutch healthcare minister Schippers reached an agreement with hospitals, medical specialists, mental healthcare providers, general practitioners, health insurers and patients’ organizations to reduce the growth rate of healthcare spending: to 1.5% in 2014 and 1% per year from 2015 to 2017. This reduction represents a total additional savings of approximately 1 billion Euros. To achieve the reduced expenditure growth, extra measures will be taken that increase the efficiency and improve the quality of care: more care of medical specialists goes to the GP and from the GP to self-care; concentration of complex care; tighter application of medical guidelines and care standards; treatments are given according the standards of the medical profession itself; access to the claims of the compulsory health insurances is tightened; and more transparency about quality and cost of care [6].

### *The contribution of Complementary and Alternative Medicine*

According to the National Center for Complementary and Alternative Medicine (NCCAM), CAM is a group of diverse medical and healthcare systems, practices, and products that are not generally considered part of conventional medicine [7]. The Cochrane Collaboration definition of complementary medicine is that it includes all such practices and ideas that are outside the domain of conventional medicine in several countries and defined by its users as preventing or treating illness, or promoting health and well-being. These practices complement mainstream medicine by satisfying a demand not met by conventional practices and diversifying the conceptual framework of medicine [8]. “Integrative Medicine is the practice of medicine that reaffirms the importance of the relationship between practitioner and patient, focuses on the whole person, is informed by evidence, and makes use of all appropriate therapeutic approaches, healthcare professionals and disciplines to achieve optimal health and healing.” [9] In addition, IM emphasizes the active role of the patient in prevention (lifestyle), well-being and therapy and healing processes, and the use of healing environments [9].

Herman et al. [10] performed a systematic review of economic evaluations on complementary and integrative medicine (CIM). This study identified 338 economic evaluations of CIM, including 114 full evaluations, published between 2001 and 2010. All recent (and likely most cost-relevant) full economic evaluations published from 2001 to 2010 were subjected to several measures of quality. Detailed results of higher-quality studies were reported. The cost-utility analyses found were of similar or better quality to those published across all medicine. Of the 56 comparisons made in the higher-quality studies, 16 (29%) show a health improvement with cost savings for the CIM therapy versus usual (conventional) care. Study quality of the cost-utility analyses (CUAs) of CIM was generally comparable to that seen in CUAs across all medicine according to several measures, and the quality of the cost-saving studies was slightly, but not significantly, lower than those showing cost increases (85% vs 88%,  $p = 0.460$ ).

In The Netherlands, a few percent of the GPs have followed an additional training in CAM. In 2010, we performed an initial economic evaluation, comparing the healthcare costs of patients from Dutch conventional (CON) GPs and CAM GPs [11]. A dataset from a Dutch health insurer Azivo was used containing quarterly information on healthcare costs (GP care, hospital care, pharmaceutical care, and paramedic care), dates of birth and death (if

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3 applicable), gender and 6-digit postcode of all approximately 150,000 insurees, for the years  
4 2006–2009. Data from 1,913 conventional GPs were compared with data from 79 GPs with  
5 additional CAM training in acupuncture (n=25), homeopathy (n=28), and anthroposophic  
6 medicine (n=26). Results were that patients whose GP has additionally completed training in  
7 CAM training had 0–30% lower healthcare costs and mortality rates, depending on age  
8 groups and type of CAM. The lower costs resulted from fewer hospital stays and fewer  
9 prescription drugs. It was concluded that more controlled studies (replication studies,  
10 research based on more comprehensive data, cost-effectiveness studies on CAM for specific  
11 diagnostic categories) were indicated.  
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### 21 *This study*

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23 Given the current need to diminish healthcare expenditures in The Netherlands and based on  
24 the positive results from both the review of Herman et al. [10] and our own study [11], we  
25 decided to perform a replication study comparing the healthcare costs of patients from  
26 conventional (CON) GPs and CAM GPs with a larger dataset from a Dutch health insurer, to  
27 analyse the robustness of the results of the first study. The research questions of the study  
28 were:  
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- 34 1. Is there a statistically significant difference in healthcare costs (care by GP, hospital  
35 care, pharmaceutical care, paramedic care, care covered by supplementary insurance,  
36 and healthcare costs in the last year of life) of patients from CON GPs and CAM  
37 GPs?  
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- 39 2. Is there a statistically significant difference in mortality rates of patients from CON  
40 GPs and CAM GPs?  
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### 47 **Methods**

#### 48 *Comparative economic evaluation*

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50 Full economic evaluations compare the costs (resource use) associated with one or more  
51 alternative interventions (e.g., intervention X versus comparator Y) with their consequences  
52 (outcomes, effects). In this study we were able to measure five types of costs in two  
53 categories: (1) care covered by compulsory insurance: care by GP, hospital care,  
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3 pharmaceutical care, paramedic care, and (2) costs covered by supplementary insurance.  
4 Alternative interventions were: conventional GP care compared to care from GPs that know  
5 CAM. Outcomes were: differences in healthcare costs and annual mortality rates.  
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### 10 *Model overview*

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13 Costs were analysed at the patient level using linear and loglinear regression analysis. The  
14 cost analysis has been performed for the total sample, as well as separately for the age groups  
15 0–24, 25–49, 50–74, and  $\geq 75$ , given the large average differences in health and healthcare  
16 needs across age groups. Effects on mortality rates are analysed using a linear probability  
17 model (LPM), a Logit model, and a Cox proportional hazard model (CPH). In all models, the  
18 explanatory variables are gender, age (linear, within each age category), dummies for CAM  
19 and ‘Vogelaarwijk’ (city areas with known lower socio-economic status of inhabitants), year  
20 dummies, and postal code fixed effects. In the cost regressions and the LPM model, fixed  
21 effects at the 4-digit insured postcode level were controlled for. In the Logit and CPH model  
22 2-digit postcode level fixed effects were included, as estimation with more detailed fixed  
23 effects appeared to be numerically infeasible.  
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32 The regression approach is standard practice in health economics and yields results similar to  
33 those of matching procedures (both are unable to correct for unobserved differences between  
34 groups of patients). Given the large sample sizes Student’s t tests are asymptotically valid by  
35 virtue of the central limit theorem, independent of whether the underlying distributions are  
36 normal or non-normal. Standard errors are clustered at the level of the insured to control for  
37 the statistical dependence of observations pertaining to a given insured person (i.e.  
38 observations are independent ‘between’ individuals but dependent ‘within’ individuals).  
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44 With regard to the six years of data the data set was used as a panel. This means that if an  
45 insured person is observed for all six years, six observations of annual costs of this person are  
46 used in the analysis (taking into account the ‘within’-person correlation by clustering  
47 standard errors at the level of the individual). The reported differences can be interpreted as  
48 the average of cost differences across years. Any trends are controlled for by the year dummy  
49 variables.  
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### *Dataset on healthcare costs and demographics*

A dataset was analyzed from health insurer Agis, a subsidiary company of Achmea. Achmea has a share in the market of 31% (5.18 million insured) of the Dutch population in 2013; while the share of Agis is 9,2% (1.54 million insured). The dataset contains quarterly information on the healthcare costs of all Agis insurees, which was aggregated to annual information for the years 2006 up to 2011. In addition, it contains the date of birth of the insuree, date of death (if applicable), gender, and 4-digit postcode of the insured's residence. For each insuree year combination, information on the costs of five different types of care is available: care by GP, hospital care, pharmaceutical care, paramedic care (like physical therapy), and care covered by supplementary insurance.

### *General practitioners and patients*

The dataset also contains the names and addresses of the general practitioners who have patients who are insured by Agis, which allows us to distinguish between CON GPs and CAM GPs. We defined a general practitioner as anthroposophic CAM GP if his or her name appears in the list of general practitioners with additional training in anthroposophic medicine (AM) as provided by their professional association [14]. CAM GPs with homeopathy (HOM) [15] and CAM GPs with acupuncture [16] are defined similarly.

Patients were regarded CON patients and CAM patients if they were patient of respectively a CON GP or a CAM GP during all of the years they appear in the dataset. Patients that transferred from a CON GP to a CAM GP or vice versa, were regarded to be a member of a third group called 'Switchers'.

### *Statistical analyses*

Significance of coefficients is tested using Student's t tests, with clustering of standard errors at the level of the insured. Given the large sample sizes available here, asymptotic t-testing for differences in means is appropriate by virtue of the central limit theorem. Calculations were made using StataSE 10.0. Means with 95% confidence intervals and p-values ( $< 0.1$ ,  $< 0.05$ , and  $< 0.01$ ) are presented.

### *Ethical approval*

Since the study involved no experimental treatment, patients were not recruited. Since patient data were anonymized, no ethical approval was necessary.

## **Results**

### *GP practices and patients*

The dataset contained 9,126 GP practices: 9,016 CON practices and 110 CAM practices. Due to the systematics of the insurance company, one individual GP can appear as different practices, so the actual number of GPs is lower than the number of GP practices. Contrarily, each patient is never counted more than once. The majority of the CAM GPs are anthroposophic GPs (70 AM practices (64%)). Other CAM GPs were specialized in acupuncture (15%) and homeopathy (25%). Since some GPs were specialized in more than one CAM modality the total percentage of CAM GPs is larger than 100%. Exact numbers and percentages of CAM GPs vary a little over the years.

### *Healthcare costs*

#### **The dataset**

The dataset contains information of more than 1.5 million insurees during the years 2006-2011 (Table 1). Nearly 19,000 insurees (1.2%) had throughout this whole period a CAM GP. More than 10,000 other insurees had in some years a CON GP and in other years a CAM GP ('Switchers'). On average, the Switchers group had three years a CON GP and three years a CAM GP. The insurees had a mean age of 41.0 (SD=23.5). 53% are women. These patients live in 4,014 different 4-digit postal codes.

Without controlling for relevant differences between the groups, the comparison demonstrates: higher percentages of females in in the CAM GP and Switchers groups; higher percentages of insurees living in the 'Vogelaarwijk' in the CON and Switchers group; 183 Euros lower and 168 Euros higher total compulsory costs in respectively the CAM and the Switchers group; and 40 Euros and 25 Euros higher supplementary costs in costs in respectively the CAM and the Switchers group. The percentages of patients with a



supplementary insurance were almost the same (CON GPs: 92.7%; CAM GPs: 93.4% and Switchers: 92.1%).

Since the aim of the study was to compare the costs of patients with a CON GP and a CAM GP, the data of the Switchers group were left out of the main regression analyses on annual total compulsory and supplementary costs. The results of the analyses on the Switchers group are separately presented in Appendix 1.

	CON GP	CAM GP	Switchers
Insured (n)	1,521,773	18,862	10,769
Age (year)	41.0	41.6	40.1
Female (percentage)	52.9%	55.2%	56.4%
'Vogelaarwijk' (percentage)	15.7%	9.3%	17.1%
Supplementary insured (percentage)	92.7%	93.4%	92.1%
Compulsory insurance costs (Euros)			
<i>Total costs</i>	1,821	1,638	1,989
<i>GP costs</i>	133	128	140
<i>Pharmaceutical costs</i>	402	357	474
<i>Hospital costs</i>	1,242	1,104	1,328
<i>Paramedical costs</i>	44	48	47
Supplementary insurance costs (Euros)	75	115	100

#### Annual total compulsory and supplementary insurance costs

The mean annual total costs of patients treated in CON practices covered by the compulsory insurance were 1,821 Euros (95% CI: 1,813 – 1,828) (Table 1). After correction for observed differences between the groups by means of linear regression analyses, the mean annual total compulsory insurance costs of patients of CAM GP practices are 225 Euros (95% CI: 169 –

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3 281;  $p < 0.001$ ) (12.4%) lower. These lower costs are mainly due to lower hospital costs (165  
4 Euros; 95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros; 95%  
5 CI: 41 – 75;  $p < 0.001$ ).  
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9 The mean annual total supplementary costs for patients treated in CON practices were  
10 75.3 Euros (95% CI: 75.1 – 75.5) (the mean is calculated over all patients, including those  
11 (less than 8%) without supplementary insurance). For patients treated in CAM practices these  
12 costs are 33 Euros (95% CI: 31 – 37;  $p < 0.001$ ) (44%) higher and were highest in the third  
13 age group (50 – 74 years) (52 Euros (95% CI: 31 – 37;  $p < 0.001$ )). Taken together, the mean  
14 total annual compulsory and supplementary insurance costs are 192 Euros (10.1%) lower for  
15 the CAM group of patients.  
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21 The log linear analyses of the mean total annual compulsory and supplementary  
22 insurance costs (Appendix 2) provide the same lower costs for the CAM group of patients as  
23 found in the linear analyses (Table 2). In addition, higher paramedic costs are found for the  
24 CAM group of patients.  
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### 30 31 **Costs per age category and insurance category**

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33 Lower total compulsory costs were found in all age categories (Table 2): 80 Euro (95% CI:  
34 21 – 140;  $p < 0.01$ ) in the first group (0-24 years); 137 Euros (95% CI: 54 – 219;  $p < 0.01$ ) in  
35 the second group (25 – 49 years); 356 Euros (95% CI: 227 – 485;  $p < 0.001$ ) in the third  
36 group (50 – 74 years), and 236 Euros (95% CI: -9 – 481;  $p < 0.1$ ) in the last group (75+  
37 years). Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50  
38 Euros; 95% CI: 23 – 77;  $p < 0.001$ ) and the third age group (50 – 74 years) (126 Euros; 95%  
39 CI: 88 – 164;  $p < 0.001$ ). Lower hospital costs were found in all age groups, with the largest  
40 differences in the third age group (50 – 74 years) (232 Euros; 95% CI: 124 – 341;  $p < 0.001$ )  
41 and the last age group (75+ years) (219 Euros; 95% CI: 7 – 431;  $p < 0.05$ ). In addition, the  
42 largest difference in total compulsory costs was found in the last year of life (1,161 Euros;  
43 95% CI: -138 – 2,461;  $p < 0.1$ ), which is completely the result of lower hospital costs (1,250  
44 Euros; 95% CI: 19 – 2,481;  $p < 0.05$ ).  
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54 The log linear analyses of the mean total annual compulsory and supplementary  
55 insurance costs (Appendix 2) provide the same lower costs for the separate age groups of  
56 CAM patients as found in the linear analyses (Table 2). In addition, now there are also  
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significant lower costs for the CAM group of patients with regard to GP costs in the third age group (50 – 74), lower pharmaceutical costs in the first (0 – 24) and the last age group (75+); and higher paramedic costs in the second (25 – 49) and third (50 – 74) age group.

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-225***	-3***	-58***	-165***	1	33***
0-24	-80***	-3***	-2	-74***	-2	11***
25-49	-137***	-2**	-50***	-85**	1	32***
50-74	-356***	-1	-126***	-232***	3	52***
75+	-236*	11***	-38	-219**	10	24***
Last year of life	-1,161*	5	67	-1,250**	27	3

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

### *Mortality rates*

In the present dataset, the only information available on health outcomes is mortality. During the period 2006 – 2011 80,543 patients died in the CON group (5.26%) and 973 in the CAM group (5.14%). After controlling for all relevant variables (age, postal codes, etcetera), we find that patients with a CAM GP have significantly lower mortality rates in all LMP analyses (Table 3). However, the differences are very small: total group: 0.004 (95% CI: 0.001 – 0.007;  $p < 0.05$ ); men: 0.004 (95% CI: 0.001 – 0.008;  $p < 0.1$ ); women: 0.007 (95% CI: 0.003 – 0.011;  $p < 0.05$ ). The Logit analyses resulted in a significantly higher mortality rate for the total group at the 10% level (but not at the 5% level) (0.066; 95% CI: -0.143 – 0.011;  $p < 0.1$ ), but no significant differences for men and women separately. The Cox proportional hazard analyses resulted in significant higher mortality rates at the 10% level (but not at the 5% level), both for the total group: 1.059 (95% CI: 0.994 – 1.129;  $p < 0.1$ ), and

the group of women: 1.072 (95% CI: 0.987 – 1.165;  $p < 0.1$ ), but no significant difference for men was found.

Based on all results, taking into account the small differences in the LPM analyses, the high p-values ( $p < 0.1$ ) in the Logit and Cox proportional hazard analyses and the contradictory outcomes between the LPM analyses on the one hand and the Logit and Cox proportional hazard analyses on the other hand, we conclude that there is no difference in mortality rates between the CON and CAM group of patients.

Table 3. Differences in mortality rates: CAM patients compared to CON patients

	Total	Men	Women
LPM with fixed effects	-0.004**	-0.004*	-0.007**
Logit with fixed effects	0.066*	0.081	0.049
Cox proportional hazard	1.059*	1.043	1.072*

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

### Conclusions

The comparison of the healthcare costs of insurees of CON GPs and CAM GPs in a database with data of 1,540,635 patients from the Dutch insurance company Agis during the period 2006-2011 demonstrates:

1. On average annual total compulsory and supplementary healthcare costs of patients treated by a CAM GP are 192 Euros (10.1%) lower than the costs of patients treated by conventional GPs as a result of 225 Euros (12.4%) lower compulsory costs and 33 Euros (44%) higher supplementary costs.
2. The lower mean annual total compulsory healthcare costs are mainly due to lower hospital care costs (165 Euros) and lower pharmaceutical care costs (58 Euros).
3. Lower mean annual total compulsory healthcare costs are demonstrated in all age categories, but the differences are largest in the third age group (50 – 74 years) (total costs: 356 Euros; hospital care: 232 Euros; pharmaceutical care: 126 Euros) and in the last year of life (total costs: 1,093 Euros; hospital care: 1,223 Euros).

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3 4. Patients with a CAM GP do not have significantly lower or higher mortality rates than  
4 patients with a CON GP.  
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## 9 Discussion

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11 In this study the mean annual total compulsory costs, supplementary costs, costs during the  
12 last year of life and mortality rates of patients with a conventional (CON) GP (n = 1.52  
13 million; 98.8%) and patients with GPs that know complementary and alternative medicine  
14 (CAM) (n = 18,862; 1.2%) were compared in a dataset from the Dutch insurance company  
15 Agis over a six year period (2006 – 2011) by means of regression analyses. The mean annual  
16 compulsory healthcare costs of patients treated by a conventional GP are 1,821 Euros (95%  
17 CI: 1,813 – 1,828). On average annual total compulsory healthcare costs of patients treated  
18 by a CAM GP are 225 Euros (95% CI: 169 – 281; p < 0.001) (12.4%) lower than patients  
19 treated by conventional GPs. Lower total compulsory costs were found in all age categories.  
20 Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50 Euros;  
21 95% CI: 23 – 77; p < 0.001) and the third age group (50 – 74 years) (126 Euros; 95% CI: 88  
22 – 164; p < 0.001). Lower hospital costs were found in all age groups. The largest difference  
23 in total compulsory costs was found in the last year of life (1,161 Euros; 95% CI: -138 –  
24 2461; p < 0.1), which is completely the result of lower hospital costs (1,250 Euros; 95% CI:  
25 19 – 2481; p < 0.05). The mean annual supplementary insurance costs of patients treated by a  
26 conventional GP are 75.3 Euros (95% CI: 75.1 – 75.5). On average annual supplementary  
27 healthcare costs of patients treated by a CAM GP are 33 Euros (95% CI: 31 – 37; p < 0.001)  
28 (44%) higher. The absolute lower compulsory costs for all patients for the six years period  
29 (2006 – 2011) for the CAM group is 25,463,700 Euros (or on average 4,243,950 Euros per  
30 year) compared to the CON group. The extrapolation of the lower costs in the CAM group of  
31 patients to the Dutch population (16.8 million inhabitants), if applicable, would result in 3.78  
32 billion Euros lower annual compulsory costs. The absolute lower compulsory and  
33 supplementary costs for all patients for the six years period (2006 -2011) for the CAM group  
34 is 21,729,024 Euros (or on average 3,621,504 Euros per year) compared to the CON group.  
35 The extrapolation of the lower costs in the CAM group of patients to the Dutch population  
36 (16.8 million inhabitants), if applicable, would result in 3.23 billion Euros lower annual  
37 compulsory and supplementary costs. Patients with a CAM GP do not have significantly  
38 lower or higher mortality rates than patients with a conventional GP.  
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3 The first strength of the study is the large sample size of patients and practices.  
4 Approximately 9.2% of the Dutch population (1.54/ 16.8 million), and 29.7% of the insurees  
5 of Achmea (1.54/ 5.18 million) were included in the study. Compared to the first pilot study  
6 [11] there were 10 times more patients from a CON GP (151,952 versus 1,521,773), three  
7 times more patients from a CAM GP (5,922 versus 18,862), 4,5 times more CON GP  
8 practices (1,913 versus 9,016) and about 1,5 times more CAM practices (79 versus 110). This  
9 large sample size allows a more precise estimate of costs and mortality rate differences and  
10 increases the representativeness of the sample and the generalizability of the results [13]. The  
11 second strength is that the results are based on a relatively long period of six years, also  
12 contributing to more precise estimations, and better representativeness and generalizability of  
13 the results. Thirdly, this study, unlike the first pilot study [11], distinguishes between  
14 compulsory and supplementary costs providing a more complete picture of healthcare costs  
15 expenditure related to CAM. The first limitation of the study is that it did not compare two  
16 treatments (CON versus CAM) for a specific indication, in a controlled setting with other  
17 health related outcome parameters than mortality, reducing the ability to detect causal  
18 relationships between interventions and (cost)effects. Missing information includes costs of  
19 out-of pocket expenses, morbidity, work absence, objective disease related outcome  
20 measures, subjective health and patient satisfaction. A second limitation is, contrary to the  
21 first pilot study [11], that we were not able to analyse at the level of the 6-digit postcode but  
22 only at the level of the 4-digit postcode. As a result, the results might not be optimally  
23 controlled for socio-economic status of the patients. However, a reanalysis of the data of the  
24 first pilot study [11] demonstrated very small differences in results between the analyses with  
25 the 6-digit postcode and the analyses with the 4-digit postcode. Another limitation of the  
26 study concerns the limited dataset, since the dataset is from only one insurer and the data  
27 reflect the behaviour of only a small number of CAM modalities (most GP practices (64%)  
28 were anthroposophic). These facts challenge the generalizability of the results.  
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47 The current results with regard to differences in healthcare costs confirm the results of  
48 our first smaller pilot study [11] with only 153,000 insurees and observations during a four-  
49 year period. In addition, the current study with 10 times as many patients and a two-year  
50 longer period of observations, enabled to estimate the cost differences more precisely.  
51 Whereas in this first study estimation of mean annual total compulsory costs of CAM patients  
52 were in the range of 0 – 30% lower than these of patients of CON GPs, the mean cost  
53 differences are now estimated to be 12.4% lower (range: 9.3 – 15.4%) for the CAM group.  
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3 Like in the first study, the lower total compulsory costs are mainly the result from lower  
4 hospital and pharmaceutical costs. Lower costs for CAM in this study are also in line with the  
5 results of the recent review of Herman et al. [10] on economic evaluation of CAM and CIM,  
6 demonstrating that 29% of comparisons made in the 56 higher-quality studies showed a  
7 health improvement with cost savings for the CIM therapy versus usual (conventional) care.  
8 Since most CAM patients in the current study were treated in an anthroposophic practice,  
9 comparison with other economic studies on anthroposophic medicine (AM) is justified.  
10 Kienle et al. [13,15] reviewed the few economic investigations on AM, demonstrating less or  
11 equal costs in AM compared to CON treatment, due to reduced hospital admissions and less  
12 prescriptions of medications. Hamre et al. [15] found that in patients starting anthroposophic  
13 therapies for chronic disease, total healthcare costs did not increase in the first year, and were  
14 significantly reduced in the second year by 416 Euros (95% CI: 264 – 960) compared to the  
15 pre-study year. This reduction was largely explained by a decrease of inpatient  
16 hospitalisation. With regard to differences in mortality rates between CON and CAM  
17 patients, the results do not confirm the (weak) evidence of lower mortality rates that were  
18 found in the first study [11]. The conclusion is now that CAM patients do not have lower or  
19 higher mortality rates than CON patients.  
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32 With regard to the healthcare costs differences reported in the Results section, we can  
33 hypothesize four types of explanations. First, the differences could be due to selection on  
34 unobservables in patients' GP choice. For example, patients who are healthier and more  
35 health-conscious or patients with a strong preference to minimize exposure to medical  
36 interventions might be more likely to choose a CAM GP. In both cases, costs will be lower  
37 due to lower demand for healthcare. A standard approach to control for selection on  
38 unobservables in a non-experimental setting is to use Instrumental Variables (IV). A potential  
39 instrumental variable in this case is the distance between a patient's home and the various  
40 GPs, c.q. a change in distance as a result of a move of a patient or practice. We intend to  
41 explore this approach in future work. With respect to selection, several studies that compare  
42 the health status of patients treated in CAM and in conventional medicine in primary care  
43 settings find that patients treated in CAM practices suffer more often from severe and chronic  
44 illnesses (e.g., [16, 17]). This suggests that if we could control for severity and chronicity of  
45 illnesses (with additional data), the estimated compulsory cost differences might be larger.  
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47 Second, the results could be due to undertreatment by CAM GPs. In the present dataset, we  
48 were only able to analyse mortality and found that patients with a CAM GP tend to have  
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3 equal mortality rates. However, a number of studies have reported that patients seeking CAM  
4 or anthroposophic care have longer lasting and more severe health problems than patients in  
5 conventional care. At the same time, these patients report fewer adverse side effects of  
6 treatments and higher patient satisfaction (e.g., [16-18]). These findings combined with the  
7 results in this study provide some indication that undertreatment by CAM GPs is unlikely.  
8 Firmer conclusions require more detailed data on outcomes. Thirdly, the results could be due  
9 to better practices of CAM due to a stronger focus on preventive and curative health  
10 promotion, less overtreatment and better communication and professional relationships. For  
11 example, a CAM GP might try a low-cost CAM treatment first. As mentioned, the primary  
12 professional orientation of CAM doctors is to strengthen the self-healing capacity of the body  
13 and the self-management of the patient. This approach is associated with prescribing fewer  
14 conventional pharmaceuticals, tests and operations. Nissen et al. [19, p. 14], based on a  
15 review of the literature on citizens' attitudes and needs concerning CAM in Europe,  
16 concluded that 'many citizens in Europe value the practice of CAM, particularly the CAM  
17 provider-patient relationship, and the patient-centred and holistic approach aspired to by  
18 many CAM providers.' Van Dulmen [20] concluded in a Dutch study comparing patients  
19 visiting conventional general practitioners (GPs) and three types of CAM GPs (homeopathy,  
20 acupuncture and naturopathy), that, contrary to expectations, patients do not consult a CAM  
21 physician because they are disappointed with mainstream GP care. CAM patients primarily  
22 appear to be seeking a physician who takes the time to talk with them and who will treat their  
23 complaints from a holistic viewpoint. Ernst and Hung [21] described the published evidence  
24 on the expectations of CAM users (in order of prevalence): hope to influence the natural  
25 history of the disease; disease prevention and health/ general well-being promotion; fewer  
26 side effects; being in control over one's health; symptom relief; boosting the immune system;  
27 emotional support; holistic care; improving quality of life; relief of side effects of  
28 conventional medicine; positive therapeutic relationship; obtaining information; coping better  
29 with illness; supporting the natural healing process; and the availability of treatment. In  
30 addition CAM GPs might focus more on the relationship and communication. For example  
31 Esch et al. [16] found that AM patients appreciated that their physicians listened to them  
32 (80.0% vs. 67.1%,  $p < 0.001$ ), spent more time (76.5% vs. 61.7%,  $p < 0.001$ ), had more  
33 interest in their personal situation (74.6% vs. 60.3%,  $p < 0.001$ ), involved them more in  
34 decisions about their medical care (67.8% vs. 58.4%,  $p = 0.022$ ), and made it easy to tell the  
35 physician about their problems (71.6% vs. 62.9%,  $p = 0.023$ ). AM patients gave significantly  
36 better rating as to information and support (in 3 of 4 items,  $p < 0.05$ ) and for thoroughness  
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3 (70.4% vs. 56.5%,  $p < 0.001$ ). AM patients showed significantly higher treatment satisfaction  
4 in all of the five items than CON patients. These results are consistent with other studies  
5 demonstrating high patient satisfaction with AM [13,14]. For instance, in a Dutch survey  
6 (Consumer Quality Index, a national standard to measure healthcare quality from the  
7 perspective of healthcare users), 2,099 patients reported very high satisfaction with  
8 anthroposophic GP practices (8.4 on a scale: 0-10, 10 indicating the best possible score) [18].  
9 These results are consistent with AM theory, which emphasizes relationship and  
10 communication, as well as shared decision-making [14]. More AM patients expressed a  
11 general treatment satisfaction (56.1% vs. 43.4%,  $p < 0.001$ ) and saw their expectations  
12 completely fulfilled at follow-up (38.7% vs. 32.6%,  $p < 0.001$ ). AM patients reported  
13 significantly fewer adverse side effects (9.3% vs. 15.4%,  $p = 0.003$ ), and more other positive  
14 effects from treatment (31.7% vs. 17.1%,  $p < 0.001$ ). Fourthly, the lower costs could be  
15 related to the fact that patients interested in CAM might have higher out-of-pocket expenses  
16 since not all CAM treatments are covered by supplementary insurance. Clarifying the role of  
17 out-of-pocket expenses is an empirical issue that requires additional data.  
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29 The major implication of this study and other economic evaluations of CAM is that  
30 there is sufficient evidence now to justify more professional interest in CAM from  
31 conventional healthcare professionals and policymakers. We can also conclude that there is  
32 sufficient good evidence that CAM can be cost-effective compared to conventional medicine,  
33 that the contribution of CAM might result in substantial diminishing of healthcare costs and  
34 therefore can provide a contribution to national healthcare policies aiming at controlling and  
35 diminishing healthcare expenditures. Therefore more investment in the study of the cost-  
36 effectiveness of CAM modalities with their additional health promotion medicines and  
37 therapies is indicated. The main unanswered questions in the current study are: where do the  
38 cost differences come from (to which indications and which therapies do they pertain to?) and  
39 what are the health-related effects of CAM treatment (objective parameters (e.g., lowering of  
40 blood pressure), quality of life, patient-reported outcomes, sick-leave, etcetera)? Future  
41 research should therefore focus on (1) exploring to what extent selection on unobservables  
42 and causal effects explain the lower costs of patients with a CAM GP; (2) exploring in more  
43 depth the costs differences between patients of CON GPs and CAM GPs in order to develop  
44 adequate, testable hypothesis of cost-effectiveness of specific CAM treatments for specific  
45 indications, and to transfer the cost differences related knowledge from CAM to CON GP  
46 practices in order to diminish healthcare expenditures in CON practices; (3) designing and  
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3 executing highly controlled, comparative effectiveness research projects [22] with more  
4 health related outcome parameters than mortality rate only; and (4) replication studies based  
5 on similar, large datasets with other CAM modalities (acupuncture, TCM herbal treatment,  
6 etcetera) and with other insurance companies to explore and confirm the present results.  
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For peer review only

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## Contributors

PK was the project lead for the statistical analyses. EB and PK wrote the manuscript. All authors reviewed the manuscript and contributed to manuscript revisions. EB is the guarantor for this study.

## Competing interests

We have read and understood the BMJ Group policy on declaration of interests and declare the following interests:

- Dr. Erik W. Baars receives a part of his salary from the Professorship Anthroposophic Healthcare of the University of Applied Sciences Leiden, The Netherlands. The professorship works closely with those in the AH professional field and works on practical problems using applied research which focuses on three main categories: (1) investigating efficacy and safety, (2) developing and delivering optimal quality, and (3) improving communication about AH.

## Data sharing

- No additional data available

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### 10 11 12 13 **Transparency declaration**

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15 The lead author affirms that this manuscript is an honest, accurate, and transparent account of  
16 the study being reported; that no important aspects of the study have been omitted; and that  
17 any discrepancies from the study as planned (and, if relevant, registered) have been  
18 explained.  
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### 20 21 22 **Role of the study sponsors**

23  
24 Not applicable.  
25

### 26 27 28 **Statement of independence of researchers from funders**

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30 Funders played no part in article selection, analysis, interpretation, or decision to publish.  
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### 33 34 35 **Previous publication**

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37 A part of the content of our study results was published in February 2014 as a Dutch article in  
38 the Dutch journal Economisch Statistische Berichten for economists in The Netherlands [23].  
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7 A six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch  
8 patients from conventional and CAM GPs  
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**Abstract**

**Objectives** To compare healthcare costs and mortality rates of Dutch patients with a conventional (CON) general practitioner (GP) and patients with a GP who has additionally completed training in complementary and alternative medicine (CAM).

**Design** Comparative economic evaluation.

**Setting** Database from the Dutch insurance company Agis.

**Participants** 1,521,773 patients (98.8%) from a CON practice and 18,862 patients (1.2%) from a CAM practice.

**Main outcome measures** Annual information on five types of healthcare costs for the years 2006 – 2011: care by GP, hospital care, pharmaceutical care, paramedic care and care covered by supplementary insurance. Healthcare costs in the last year of life. Mortality rates.

**Results** The mean annual compulsory and supplementary healthcare costs of CON patients are respectively 1,821 Euros (95% CI: 1,813 – 1,828) and 75.3 Euros (95% CI: 75.1 – 75.5). Compulsory healthcare costs of CAM patients are 225 Euros (95% CI: 169 – 281;  $p < 0.001$ ) (12,4%) lower and result mainly from lower hospital care costs (165 Euros) (95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros) (95% CI: 41 – 75;  $p < 0.001$ ), especially in the age categories 25 – 49 years and 50 – 74 years. The costs in the last year of life of patients with CAM GPs are 1,161 euro (95% CI: -138 – 2,461;  $p < 0.1$ ) lower. This difference is entirely due to lower hospital costs (1,250 Euros) (95% CI: 19 – 2,481;  $p < 0.05$ ). The mean annual supplementary costs of CAM patients are 33 Euros (95% CI: 30 – 37;  $p < 0.001$ ) (44%) higher. CAM patients do not have lower or higher mortality rates than CON patients.

**Conclusions** Dutch patients whose GP additionally completed training in CAM on average have 192 Euros (10.1%) lower annual total compulsory and supplementary healthcare costs and do not live longer or shorter than CON patients.



### Strengths and limitations of this study

- The study is based on a large sample size of patients and practices and a relatively long period of six years contributing to more precise estimations, and better representativeness and generalizability of the results.
- The study distinguishes between compulsory and supplementary costs providing a more complete picture of healthcare costs expenditure related to CAM.
- The study did not compare two treatments (conventional versus CAM) for a specific indication, in a controlled setting with other health related outcome parameters than mortality, reducing the ability to detect causal relationships between interventions and (cost)effects.
- Since the analyses were at the level of the 4-digit postcode and not at the level of the 6-digit postcode, the results might not be optimally controlled for socio-economic status of the patients.
- The study concerns a limited dataset, since the dataset is from only one insurer and the data reflect the behaviour of only a small number of CAM modalities (most GP practices (64%) were anthroposophic). These facts challenge the generalizability of the results.

## Introduction

In most countries of the European Union the annual healthcare costs are rising faster than the economy [1]. Therefore, national healthcare policies are increasingly aiming at controlling and diminishing healthcare expenditures. This also applies to the situation in The Netherlands [2]. In 1972 8% of the Dutch national income (GDP) was used to finance public healthcare. In 2010 already 13% of GDP was used and The Netherlands were worldwide in second place of healthcare expenditures of countries. Without drastic measures, the estimated costs will be over 30% in 2040 [3]. Public spending on healthcare will rise from 61 billion Euros in 2012 to an estimated nearly 80 billion Euros in 2017 [4]. Dutch health economists and policy makers have largely ignored the possible contribution of Complementary and Alternative Medicine (CAM) and Integrative Medicine (IM) to the reduction of healthcare costs as an area of research and interest. The here presented economic study, a six-year comparative economic evaluation of healthcare costs and mortality rates of Dutch patients from conventional and CAM general practitioners (GPs), contributes to the development of an evidence-based Dutch policy with regard to the role of CAM and IM in the reduction of healthcare expenditure growth.

### *The Dutch financing system*

The Dutch financing system contains two basic compulsory health insurances, that are for 80% paid for through income taxes: for curative care (Zorgverzekeringswet (ZvW)) and for long-term care (Algemene Wet Bijzondere Ziektekosten (AWBZ)). The compulsory health insurances cover costs of most of GP, pharmaceutical and hospital care and some paramedic care. In addition, people in The Netherlands can buy supplementary insurance. Supplementary insurance covers costs not covered by basic insurance (for example specific or additional paramedic treatment, complementary therapies) (e.g., costs of CAM treatment is paid for up to 500 Euros/ year) [5]. Many supplementary insurances cover costs of CAM treatments like anthroposophic medicine, acupuncture and homeopathy. Supplementary insurance can also cover costs of improvements over the standard level of care paid for by compulsory insurance (e.g., extra costs for a better room and service in case of hospitalisation).

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7 *Policies to reduce healthcare expenditure growth*

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9 The vast majority of expenditure growth is due to innovations in healthcare. The Cultureel  
10 Planbureau (CPB) anticipates that the total costs of curative care will rise from 36 billion  
11 Euros this year to 49 billion Euros in 2017. The rising costs of curative care, according to the  
12 CPB is largely due to the ‘creeping expansion’ of the compulsory health insurance; ‘Year  
13 after year, new medical techniques and drugs appear on the market that are often better, but  
14 also more expensive’, especially, since more patients will be treated with the new techniques  
15 [3]. Of the total growth of public healthcare expenditure, about a quarter is the result of  
16 aging. In 2040 more than 22% of the Dutch population will be older than 65, whereas  
17 currently this is 16%. As people grow older, on average the costs of healthcare will increase  
18 (on the level of the whole older population).  
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24 Which policies can be deployed to control the risk of rising costs? The measures  
25 aimed at reducing healthcare expenditures are, without being complete: more efficiency and  
26 higher productivity in healthcare (including reducing management layers), more competition  
27 between healthcare institutions, fewer hospitals (specialization and concentration), more  
28 ‘neighbourhood care’ by general practitioners (GPs), more remote care (e-health), preventing  
29 overtreatment/ less (extra) care, more responsible behaviour of consumers (more self-care),  
30 more emphasis on healthy living (prevention), higher co-payments, higher deductibles and  
31 already saving for higher healthcare expenditure in the old days (precautionary savings) [3].  
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36 In July 2013 the Dutch healthcare minister Schippers reached an agreement with  
37 hospitals, medical specialists, mental healthcare providers, general practitioners, health  
38 insurers and patients’ organizations to reduce the growth rate of healthcare spending: to 1.5%  
39 in 2014 and 1% per year from 2015 to 2017. This reduction represents a total additional  
40 savings of approximately 1 billion Euros. To achieve the reduced expenditure growth, extra  
41 measures will be taken that increase the efficiency and improve the quality of care: more care  
42 of medical specialists goes to the GP and from the GP to self-care; concentration of complex  
43 care; tighter application of medical guidelines and care standards; treatments are given  
44 according to the standards of the medical profession itself; access to the claims of the  
45 compulsory health insurances is tightened; and more transparency about quality and cost of  
46 care [6].  
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### *The contribution of Complementary and Alternative Medicine*

According to the National Center for Complementary and Alternative Medicine (NCCAM), CAM is a group of diverse medical and healthcare systems, practices, and products that are not generally considered part of conventional medicine [7]. The Cochrane Collaboration definition of complementary medicine is that it includes all such practices and ideas that are outside the domain of conventional medicine in several countries and defined by its users as preventing or treating illness, or promoting health and well-being. These practices complement mainstream medicine by satisfying a demand not met by conventional practices and diversifying the conceptual framework of medicine [8]. “Integrative Medicine is the practice of medicine that reaffirms the importance of the relationship between practitioner and patient, focuses on the whole person, is informed by evidence, and makes use of all appropriate therapeutic approaches, healthcare professionals and disciplines to achieve optimal health and healing.” [9] In addition, IM emphasizes the active role of the patient in prevention (lifestyle), well-being and therapy and healing processes, and the use of healing environments [9].

Herman et al. [10] performed a systematic review of economic evaluations on complementary and integrative medicine (CIM). This study identified 338 economic evaluations of CIM, including 114 full evaluations, published between 2001 and 2010. All recent (and likely most cost-relevant) full economic evaluations published from 2001 to 2010 were subjected to several measures of quality. Detailed results of higher-quality studies were reported. The cost-utility analyses found were of similar or better quality to those published across all medicine. Of the 56 comparisons made in the higher-quality studies, 16 (29%) show a health improvement with cost savings for the CIM therapy versus usual (conventional) care. Study quality of the cost-utility analyses (CUAs) of CIM was generally comparable to that seen in CUAs across all medicine according to several measures, and the quality of the cost-saving studies was slightly, but not significantly, lower than those showing cost increases (85% vs 88%,  $p = 0.460$ ).

In The Netherlands, a few percent of the GPs have followed an additional training in CAM. In 2010, we performed an initial economic evaluation, comparing the healthcare costs of patients from Dutch conventional (CON) GPs and CAM GPs [11]. A dataset from a Dutch health insurer Azivo was used containing quarterly information on healthcare costs (GP care, hospital care, pharmaceutical care, and paramedic care), dates of birth and death (if

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7 applicable), gender and 6-digit postcode of all approximately 150,000 insurees, for the years  
8 2006–2009. Data from 1,913 conventional GPs were compared with data from 79 GPs with  
9 additional CAM training in acupuncture (n=25), homeopathy (n=28), and anthroposophic  
10 medicine (n=26). Results were that patients whose GP has additionally completed training in  
11 CAM training had 0–30% lower healthcare costs and mortality rates, depending on age  
12 groups and type of CAM. The lower costs resulted from fewer hospital stays and fewer  
13 prescription drugs. It was concluded that more controlled studies (replication studies,  
14 research based on more comprehensive data, cost-effectiveness studies on CAM for specific  
15 diagnostic categories) were indicated.  
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### 20 21 22 *This study*

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24 Given the current need to diminish healthcare expenditures in The Netherlands and based on  
25 the positive results from both the review of Herman et al. [10] and our own study [11], we  
26 decided to perform a replication study comparing the healthcare costs of patients from  
27 conventional (CON) GPs and CAM GPs with a larger dataset from a Dutch health insurer, to  
28 analyse the robustness of the results of the first study. The research questions of the study  
29 were:  
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- 33 1. Is there a statistically significant difference in healthcare costs (care by GP, hospital  
34 care, pharmaceutical care, paramedic care, care covered by supplementary insurance,  
35 and healthcare costs in the last year of life) of patients from CON GPs and CAM  
36 GPs?  
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- 39 2. Is there a statistically significant difference in mortality rates of patients from CON  
40 GPs and CAM GPs?  
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### 45 **Methods**

#### 46 *Comparative economic evaluation*

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48 Full economic evaluations compare the costs (resource use) associated with one or more  
49 alternative interventions (e.g., intervention X versus comparator Y) with their consequences  
50 (outcomes, effects). In this study we were able to measure five types of costs in two  
51 categories: (1) care covered by compulsory insurance: care by GP, hospital care,  
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7 pharmaceutical care, paramedic care, and (2) costs covered by supplementary insurance.  
8 Alternative interventions were: conventional GP care compared to care from GPs that know  
9 CAM. Outcomes were: differences in healthcare costs and annual mortality rates.  
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### 11 12 13 *Model overview*

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15 Costs were analysed at the patient level using linear and loglinear regression analysis. The  
16 cost analysis has been performed for the total sample, as well as separately for the age groups  
17 0–24, 25–49, 50–74, and  $\geq 75$ , given the large average differences in health and healthcare  
18 needs across age groups. Effects on mortality rates are analysed using a linear probability  
19 model (LPM), a Logit model, and a Cox proportional hazard model (CPH). In all models, the  
20 explanatory variables are gender, age (linear, within each age category), dummies for CAM  
21 and ‘Vogelaarwijk’ (city areas with known lower socio-economic status of inhabitants), year  
22 dummies, and postal code fixed effects. In the cost regressions and the LPM model, fixed  
23 effects at the 4-digit insuree postcode level were controlled for. In the Logit and CPH model  
24 2-digit postcode level fixed effects were included, as estimation with more detailed fixed  
25 effects appeared to be numerically infeasible.  
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29 The regression approach is standard practice in health economics and yields results similar to  
30 those of matching procedures (both are unable to correct for unobserved differences between  
31 groups of patients). Given the large sample sizes Student’s  $t$  tests are asymptotically valid by  
32 virtue of the central limit theorem, independent of whether the underlying distributions are  
33 normal or non-normal. Standard errors are clustered at the level of the insured to control for  
34 the statistical dependence of observations pertaining to a given insured person (i.e.  
35 observations are independent ‘between’ individuals but dependent ‘within’ individuals).  
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39 With regard to the six years of data the data set was used as a panel. This means that if an  
40 insured person is observed for all six years, six observations of annual costs of this person are  
41 used in the analysis (taking into account the ‘within’-person correlation by clustering  
42 standard errors at the level of the individual). The reported differences can be interpreted as  
43 the average of cost differences across years. Any trends are controlled for by the year dummy  
44 variables.  
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### *Dataset on healthcare costs and demographics*

A dataset was analyzed from health insurer Agis, a subsidiary company of Achmea. Achmea has a share in the market of 31% (5.18 million insured) of the Dutch population in 2013; while the share of Agis is 9,2% (1.54 million insured). The dataset contains quarterly information on the healthcare costs of all Agis insurees, which was aggregated to annual information for the years 2006 up to 2011. In addition, it contains the date of birth of the insuree, date of death (if applicable), gender, and 4-digit postcode of the insured's residence. For each insuree year combination, information on the costs of five different types of care is available: care by GP, hospital care, pharmaceutical care, paramedic care (like physical therapy), and care covered by supplementary insurance.

### *General practitioners and patients*

The dataset also contains the names and addresses of the general practitioners who have patients who are insured by Agis, which allows us to distinguish between CON GPs and CAM GPs. We defined a general practitioner as anthroposophic CAM GP if his or her name appears in the list of general practitioners with additional training in anthroposophic medicine (AM) as provided by their professional association [14]. CAM GPs with homeopathy (HOM) [15] and CAM GPs with acupuncture [16] are defined similarly.

Patients were regarded CON patients and CAM patients if they were patient of respectively a CON GP or a CAM GP during all of the years they appear in the dataset. Patients that transferred from a CON GP to a CAM GP or vice versa, were regarded to be a member of a third group called 'Switchers' ~~and were excluded from all analyses.~~

### *Statistical analyses*

Significance of coefficients is tested using Student's t tests, with clustering of standard errors at the level of the insured. Given the large sample sizes available here, asymptotic t-testing for differences in means is appropriate by virtue of the central limit theorem. Calculations were made using StataSE 10.0. Means with 95% confidence intervals and p-values ( $< 0.1$ ,  $< 0.05$ , and  $< 0.01$ ) are presented.

### *Ethical approval*

Since the study involved no experimental treatment, patients were not recruited. Since patient data were anonymized, no ethical approval was necessary.

## **Results**

### *GP practices and patients*

The dataset contained 9,126 GP practices: 9,016 CON practices and 110 CAM practices. Due to the systematics of the insurance company, one individual GP can appear as different practices, so the actual number of GPs is lower than the number of GP practices. Contrarily, each patient is never counted more than once. The majority of the CAM GPs are anthroposophic GPs (70 AM practices (64%)). Other CAM GPs were specialized in acupuncture (15%) and homeopathy (25%). Since some GPs were specialized in more than one CAM modality the total percentage of CAM GPs is larger than 100%. Exact numbers and percentages of CAM GPs vary a little over the years.

### *Healthcare costs*

#### **The dataset**

The dataset contains information of more than 1.5 million insurees during the years 2006-2011 (Table 1). Nearly 19,000 insurees (1.2%) had throughout this whole period a CAM GP. More than 10,000 other insurees had in some years a CON GP and in other years a CAM GP ('Switchers'). On average, the Switchers group had three years a CON GP and three years a CAM GP. The insurees had a mean age of 41.0 (SD=23.5). 53% are women. These patients live in 4,014 different 4-digit postal codes.

Without controlling for relevant differences between the groups, the comparison demonstrates: higher percentages of females in in the CAM GP and Switchers groups; higher percentages of insurees living in the 'Vogelaarwijk' in the CON and Switchers group; 183 Euros lower and 168 Euros higher total compulsory costs in respectively the CAM and the Switchers group; and 40 Euros and 25 Euros higher supplementary costs in costs in respectively the CAM and the Switchers group. The percentages of patients with a



supplementary insurance were almost the same (CON GPs: 92.7%; CAM GPs: 93.4% and Switchers: 92.1%).

Since the aim of the study was to compare the costs of patients with a CON GP and a CAM GP, the data of the Switchers group were left out of the ~~further-main~~ regression analyses on annual total compulsory and supplementary costs. The results of the analyses on the Switchers group are separately presented (in Appendix 1).

Table 1. Descriptive statistics of the dataset

	CON GP	CAM GP	Switchers
Insured (n)	1,521,773	18,862	10,769
Age (year)	41.0	41.6	40.1
Female (percentage)	52.9%	55.2%	56.4%
'Vogelaarwijk' (percentage)	15.7%	9.3%	17.1%
Supplementary insured (percentage)	92.7%	93.4%	92.1%
Compulsory insurance costs (Euros)			
<i>Total costs</i>	1,821	1,638	1,989
<i>GP costs</i>	133	128	140
<i>Pharmaceutical costs</i>	402	357	474
<i>Hospital costs</i>	1,242	1,104	1,328
<i>Paramedical costs</i>	44	48	47
Supplementary insurance costs (Euros)	75	115	100

#### Annual total compulsory and supplementary insurance costs

The mean annual total costs of patients treated in CON practices covered by the compulsory insurance were 1,821 Euros (95% CI: 1,813 – 1,828) (Table 1). After correction for observed differences between the groups by means of linear regression analyses, the mean annual total compulsory insurance costs of patients of CAM GP practices are 225 Euros (95% CI: 169 –

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7 281;  $p < 0.001$ ) (12.4%) lower. These lower costs are mainly due to lower hospital costs (165  
8 Euros; 95% CI: 118 – 212;  $p < 0.001$ ) and lower pharmaceutical care costs (58 Euros; 95%  
9 CI: 41 – 75;  $p < 0.001$ ).  
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11 The mean annual total supplementary costs for patients treated in CON practices were  
12 75.3 Euros (95% CI: 75.1 – 75.5); (The mean is calculated over all patients, including those  
13 (less than 8%) without supplementary insurance). For patients treated in CAM practices  
14 these costs are 33 Euros (95% CI: 31 – 37;  $p < 0.001$ ) (44%) higher and were highest in the  
15 third age group (50 – 74 years) (52 Euros (95% CI: 31 – 37;  $p < 0.001$ )). Taken together, the  
16 mean total annual compulsory and supplementary insurance costs are 192 Euros (10.1%)  
17 lower for the CAM group of patients.  
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22 The log linear analyses of the mean total annual compulsory and supplementary  
23 insurance costs (Appendix Table 3 2) provide the same lower costs for the CAM group of  
24 patients as found in the linear analyses (Table 2). In addition, higher paramedic costs are  
25 found for the CAM group of patients.  
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### 30 **Costs per age category and insurance category**

31 Lower total compulsory costs were found in all age categories (Table 2): 80 Euro (95% CI:  
32 21 – 140;  $p < 0.01$ ) in the first group (0-24 years); 137 Euros (95% CI: 54 – 219;  $p < 0.01$ ) in  
33 the second group (25 – 49 years); 356 Euros (95% CI: 227 – 485;  $p < 0.001$ ) in the third  
34 group (50 – 74 years), and 236 Euros (95% CI: -9 – 481;  $p < 0.1$ ) in the last group (75+  
35 years). Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50  
36 Euros; 95% CI: 23 – 77;  $p < 0.001$ ) and the third age group (50 – 74 years) (126 Euros; 95%  
37 CI: 88 – 164;  $p < 0.001$ ). Lower hospital costs were found in all age groups, with the largest  
38 differences in the third age group (50 – 74 years) (232 Euros; 95% CI: 124 – 341;  $p < 0.001$ )  
39 and the last age group (75+ years) (219 Euros; 95% CI: 7 – 431;  $p < 0.05$ ). In addition, the  
40 largest difference in total compulsory costs was found in the last year of life (1,161 Euros;  
41 95% CI: -138 – 2,461;  $p < 0.1$ ), which is completely the result of lower hospital costs (1,250  
42 Euros; 95% CI: 19 – 2,481;  $p < 0.05$ ).  
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50 The log linear analyses of the mean total annual compulsory and supplementary  
51 insurance costs (Appendix 2-Table 4) provide the same lower costs for the separate age  
52 groups of CAM patients as found in the linear analyses (Table 2). In addition, now there are  
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also significant lower costs for the CAM group of patients with regard to GP costs in the third age group (50 – 74), lower pharmaceutical costs in the first (0 – 24) and the last age group (75+); and higher paramedic costs in the second (25 – 49) and third (50 – 74) age group.

Table 2. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (linear regression model)

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-225***	-3***	-58***	-165***	1	33***
0-24	-80***	-3***	-2	-74***	-2	11***
25-49	-137***	-2**	-50***	-85**	1	32***
50-74	-356***	-1	-126***	-232***	3	52***
75+	-236*	11***	-38	-219**	10	24***
Last year of life	-1,161*	5	67	-1,250**	27	3

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01

### Mortality rates

In the present dataset, the only information available on health outcomes is mortality. During the period 2006–2011 80,543 patients died in the CON group (5.26%) and 973 in the CAM group (5.14%). After controlling for all relevant variables (age, postal codes, etcetera), we find that patients with a CAM GP have significantly lower mortality rates in all LMP analyses (Table 3). However, the differences are very small: total group: 0.004 (95% CI: 0.001 – 0.007;  $p < 0.05$ ); men: 0.004 (95% CI: 0.001 – 0.008;  $p < 0.1$ ); women: 0.007 (95% CI: 0.003 – 0.011;  $p < 0.05$ ). The Logit analyses resulted in a significantly higher mortality rate for the total group at the 10% level (but not at the 5% level) (0.066; 95% CI: -0.143 – 0.011;  $p < 0.1$ ), but no significant differences for men and women separately. The Cox proportional hazard analyses resulted in significant higher mortality rates at the 10% level (but not at the 5% level), both for the total group: 1.059 (95% CI: 0.994 – 1.129;  $p < 0.1$ ), and

the group of women: 1.072 (95% CI: 0.987 – 1.165;  $p < 0.1$ ), but no significant difference for men ~~wasere~~ found.

Based on all results, taking into account the small differences in the LPM analyses, the high p-values ( $p < 0.1$ ) in the Logit and Cox proportional hazard analyses and the contradictory outcomes between the LPM analyses on the one hand and the Logit and Cox proportional hazard analyses on the other hand, we conclude that there is no difference in mortality rates between the CON and CAM group of patients.

	Total	Men	Women
LPM with fixed effects	-0.004**	-0.004*	-0.007**
Logit with fixed effects	0.066*	0.081	0.049
Cox proportional hazard	1.059*	1.043	1.072*
*: p-value < 0.1; **: p-value < 0.05; ***: p-value < 0.01			

### Conclusions

The comparison of the healthcare costs of insurees of CON GPs and CAM GPs in a database with data of 1,540,635 patients from the Dutch insurance company Agis during the period 2006-2011 demonstrates:

1. On average annual total compulsory and supplementary healthcare costs of patients treated by a CAM GP are 192 Euros (10.1%) lower than the costs of patients treated by conventional GPs as a result of 225 Euros (12.4%) lower compulsory costs and 33 Euros (44%) higher supplementary costs.
2. The lower mean annual total compulsory healthcare costs are mainly due to lower hospital care costs (165 Euros) and lower pharmaceutical care costs (58 Euros).
3. Lower mean annual total compulsory healthcare costs are demonstrated in all age categories, but the differences are largest in the third age group (50 – 74 years) (total costs: 356 Euros; hospital care: 232 Euros; pharmaceutical care: 126 Euros) and in the last year of life (total costs: 1,093 Euros; hospital care: 1,223 Euros).

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7 4. Patients with a CAM GP do not have significantly lower or higher mortality rates than  
8 patients with a CON GP.  
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## 12 Discussion

14 In this study the mean annual total compulsory costs, supplementary costs, costs during the  
15 last year of life and mortality rates of patients with a conventional (CON) GP (n = 1.52  
16 million; 98.8%) and patients with GPs that know complementary and alternative medicine  
17 (CAM) (n = 18,862; 1.2%) were compared in a dataset from the Dutch insurance company  
18 Agis over a six year period (2006 – 2011) by means of regression analyses. The mean annual  
19 compulsory healthcare costs of patients treated by a conventional GP are 1,821 Euros (95%  
20 CI: 1,813 – 1,828). On average annual total compulsory healthcare costs of patients treated  
21 by a CAM GP are 225 Euros (95% CI: 169 – 281; p < 0.001) (12.4%) lower than patients  
22 treated by conventional GPs. Lower total compulsory costs were found in all age categories.  
23 Lower pharmaceutical costs were found in the second age group (25 – 49 years) (50 Euros;  
24 95% CI: 23 – 77; p < 0.001) and the third age group (50 – 74 years) (126 Euros; 95% CI: 88  
25 – 164; p < 0.001). Lower hospital costs were found in all age groups. The largest difference  
26 in total compulsory costs was found in the last year of life (1,161 Euros; 95% CI: -138 –  
27 2461; p < 0.1), which is completely the result of lower hospital costs (1,250 Euros; 95% CI:  
28 19 – 2481; p < 0.05). The mean annual supplementary insurance costs of patients treated by a  
29 conventional GP are 75.3 Euros (95% CI: 75.1 – 75.5). On average annual supplementary  
30 healthcare costs of patients treated by a CAM GP are 33 Euros (95% CI: 31 – 37; p < 0.001)  
31 (44%) higher. The absolute lower compulsory costs for all patients for the six years period  
32 (2006 – 2011) for the CAM group is 25,463,700 Euros (or on average 4,243,950 Euros per  
33 year) compared to the CON group. The extrapolation of the lower costs in the CAM group of  
34 patients to the Dutch population (16.8 million inhabitants), if applicable, would result in 3.78  
35 billion Euros lower annual compulsory costs. The absolute lower compulsory and  
36 supplementary costs for all patients for the six years period (2006 -2011) for the CAM group  
37 is 21,729,024 Euros (or on average 3,621,504 Euros per year) compared to the CON group.  
38 The extrapolation of the lower costs in the CAM group of patients to the Dutch population  
39 (16.8 million inhabitants), if applicable, would result in 3.23 billion Euros lower annual  
40 compulsory and supplementary costs. Patients with a CAM GP do not have significantly  
41 lower or higher mortality rates than patients with a conventional GP.  
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7 The first strength of the study is the large sample size of patients and practices.  
8 Approximately 9.2% of the Dutch population (1.54/ 16.8 million), and 29.7% of the insurees  
9 of Achmea (1.54/ 5.18 million) were included in the study. Compared to the first pilot study  
10 [11] there were 10 times more patients from a CON GP (151,952 versus 1,521,773), three  
11 times more patients from a CAM GP (5,922 versus 18,862), 4,5 times more CON GP  
12 practices (1,913 versus 9,016) and about 1,5 times more CAM practices (79 versus 110). This  
13 large sample size allows a more precise estimate of costs and mortality rate differences and  
14 increases the representativeness of the sample and the generalizability of the results [13]. The  
15 second strength is that the results are based on a relatively long period of six years, also  
16 contributing to more precise estimations, and better representativeness and generalizability of  
17 the results. Thirdly, this study, unlike the first pilot study [11], distinguishes between  
18 compulsory and supplementary costs providing a more complete picture of healthcare costs  
19 expenditure related to CAM. The first limitation of the study is that it did not compare two  
20 treatments (CON versus CAM) for a specific indication, in a controlled setting with other  
21 health related outcome parameters than mortality, reducing the ability to detect causal  
22 relationships between interventions and (cost)effects. Missing information includes costs of  
23 out-of pocket expenses, morbidity, work absence, objective disease related outcome  
24 measures, subjective health and patient satisfaction. A second limitation is, contrary to the  
25 first pilot study [11], that we were not able to analyse at the level of the 6-digit postcode but  
26 only at the level of the 4-digit postcode. As a result, the results might not be optimally  
27 controlled for socio-economic status of the patients. However, a reanalysis of the data of the  
28 first pilot study [11] demonstrated very small differences in results between the analyses with  
29 the 6-digit postcode and the analyses with the 4-digit postcode. Another limitation of the  
30 study concerns the limited dataset, since the dataset is from only one insurer and the data  
31 reflect the behaviour of only a small number of CAM modalities (most GP practices (64%)  
32 were anthroposophic). These facts challenge the generalizability of the results.  
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45 The current results with regard to differences in healthcare costs confirm the results of  
46 our first smaller pilot study [11] with only 153,000 insurees and observations during a four-  
47 year period. In addition, the current study with 10 times as many patients and a two-year  
48 longer period of observations, enabled to estimate the cost differences more precisely.  
49 Whereas in this first study estimation of mean annual total compulsory costs of CAM patients  
50 were in the range of 0 – 30% lower than these of patients of CON GPs, the mean cost  
51 differences are now estimated to be 12.4% lower (range: 9.3 – 15.4%) for the CAM group.  
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7 Like in the first study, the lower total compulsory costs are mainly the result from lower  
8 hospital and pharmaceutical costs. Lower costs for CAM in this study are also in line with the  
9 results of the recent review of Herman et al. [10] on economic evaluation of CAM and CIM,  
10 demonstrating that 29% of comparisons made in the 56 higher-quality studies showed a  
11 health improvement with cost savings for the CIM therapy versus usual (conventional) care.  
12 Since most CAM patients in the current study were treated in an anthroposophic practice,  
13 comparison with other economic studies on anthroposophic medicine (AM) is justified.  
14 Kienle et al. [13,15] reviewed the few economic investigations on AM, demonstrating less or  
15 equal costs in AM compared to CON treatment, due to reduced hospital admissions and less  
16 prescriptions of medications. Hamre et al. [15] found that in patients starting anthroposophic  
17 therapies for chronic disease, total healthcare costs did not increase in the first year, and were  
18 significantly reduced in the second year by 416 Euros (95% CI: 264 – 960) compared to the  
19 pre-study year. This reduction was largely explained by a decrease of inpatient  
20 hospitalisation. With regard to differences in mortality rates between CON and CAM  
21 patients, the results do not confirm the (weak) evidence of lower mortality rates that were  
22 found in the first study [11]. The conclusion is now that CAM patients do not have lower or  
23 higher mortality rates than CON patients.  
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32 With regard to the healthcare costs differences reported in the Results section, we can  
33 hypothesize four types of explanations. First, the differences could be due to selection on  
34 unobservables in patients' GP choice. For example, patients who are healthier and more  
35 health-conscious or patients with a strong preference to minimize exposure to medical  
36 interventions might be more likely to choose a CAM GP. In both cases, costs will be lower  
37 due to lower demand for healthcare. A standard approach to control for selection on  
38 unobservables in a non-experimental setting is to use Instrumental Variables (IV). A potential  
39 instrumental variable in this case is the distance between a patient's home and the various  
40 GPs, cq. a change in distance as a result of a move of a patient or practice. We intend to  
41 explore this approach in future work. With respect to selection, several studies that compare  
42 the health status of patients treated in CAM and in conventional medicine in primary care  
43 settings find that patients treated in CAM practices suffer more often from severe and chronic  
44 illnesses (e.g., [16, 17]). This suggests that if we could control for severity and chronicity of  
45 illnesses (with additional data), the estimated compulsory cost differences might be larger.  
46 Second, the results could be due to undertreatment by CAM GPs. In the present dataset, we  
47 were only able to analyse mortality and found that patients with a CAM GP tend to have  
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7 equal mortality rates. However, a number of studies have reported that patients seeking CAM  
8 or anthroposophic care have longer lasting and more severe health problems than patients in  
9 conventional care. At the same time, these patients report fewer adverse side effects of  
10 treatments and higher patient satisfaction (e.g., [16-18]). These findings combined with the  
11 results in this study provide some indication that undertreatment by CAM GPs is unlikely.  
12 Firmer conclusions require more detailed data on outcomes. Thirdly, the results could be due  
13 to better practices of CAM due to a stronger focus on preventive and curative health  
14 promotion, less overtreatment and better communication and professional relationships. For  
15 example, a CAM GP might try a low-cost CAM treatment first. As mentioned, the primary  
16 professional orientation of CAM doctors is to strengthen the self-healing capacity of the body  
17 and the self-management of the patient. This approach is associated with prescribing fewer  
18 conventional pharmaceuticals, tests and operations. Nissen et al. [19, p. 14], based on a  
19 review of the literature on citizens' attitudes and needs concerning CAM in Europe,  
20 concluded that 'many citizens in Europe value the practice of CAM, particularly the CAM  
21 provider-patient relationship, and the patient-centred and holistic approach aspired to by  
22 many CAM providers.' Van Dulmen [20] concluded in a Dutch study comparing patients  
23 visiting conventional general practitioners (GPs) and three types of CAM GPs (homeopathy,  
24 acupuncture and naturopathy), that, contrary to expectations, patients do not consult a CAM  
25 physician because they are disappointed with mainstream GP care. CAM patients primarily  
26 appear to be seeking a physician who takes the time to talk with them and who will treat their  
27 complaints from a holistic viewpoint. Ernst and Hung [21] described the published evidence  
28 on the expectations of CAM users (in order of prevalence): hope to influence the natural  
29 history of the disease; disease prevention and health/ general well-being promotion; fewer  
30 side effects; being in control over one's health; symptom relief; boosting the immune system;  
31 emotional support; holistic care; improving quality of life; relief of side effects of  
32 conventional medicine; positive therapeutic relationship; obtaining information; coping better  
33 with illness; supporting the natural healing process; and the availability of treatment. In  
34 addition CAM GPs might focus more on the relationship and communication. For example  
35 Esch et al. [16] found that AM patients appreciated that their physicians listened to them  
36 (80.0% vs. 67.1%,  $p < 0.001$ ), spent more time (76.5% vs. 61.7%,  $p < 0.001$ ), had more  
37 interest in their personal situation (74.6% vs. 60.3%,  $p < 0.001$ ), involved them more in  
38 decisions about their medical care (67.8% vs. 58.4%,  $p = 0.022$ ), and made it easy to tell the  
39 physician about their problems (71.6% vs. 62.9%,  $p = 0.023$ ). AM patients gave significantly  
40 better rating as to information and support (in 3 of 4 items,  $p < 0.05$ ) and for thoroughness  
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7 (70.4% vs. 56.5%,  $p < 0.001$ ). AM patients showed significantly higher treatment satisfaction  
8 in all of the five items than CON patients. These results are consistent with other studies  
9 demonstrating high patient satisfaction with AM [13,14]. For instance, in a Dutch survey  
10 (Consumer Quality Index, a national standard to measure healthcare quality from the  
11 perspective of healthcare users), 2,099 patients reported very high satisfaction with  
12 anthroposophic GP practices (8.4 ~~and 8.3~~ on a scale: 0-10, 10 indicating the best possible  
13 score) [18]. These results are consistent with AM theory, which emphasizes relationship and  
14 communication, as well as shared decision-making [14]. More AM patients expressed a  
15 general treatment satisfaction (56.1% vs. 43.4%,  $p < 0.001$ ) and saw their expectations  
16 completely fulfilled at follow-up (38.7% vs. 32.6%,  $p < 0.001$ ). AM patients reported  
17 significantly fewer adverse side effects (9.3% vs. 15.4%,  $p = 0.003$ ), and more other positive  
18 effects from treatment (31.7% vs. 17.1%,  $p < 0.001$ ). Fourthly, the lower costs could be  
19 related to the fact that patients interested in CAM might have higher out-of-pocket expenses  
20 since not all CAM treatments are covered by supplementary insurance. Clarifying the role of  
21 out-of-pocket expenses is an empirical issue that requires additional data.  
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29 The major implication of this study and other economic evaluations of CAM is that  
30 there is sufficient evidence now to justify more professional interest in CAM from  
31 conventional healthcare professionals and policymakers. We can also conclude that there is  
32 sufficient good evidence that CAM can be cost-effective compared to conventional medicine,  
33 that the contribution of CAM might result in substantial diminishing of healthcare costs and  
34 therefore can provide a contribution to national healthcare policies aiming at controlling and  
35 diminishing healthcare expenditures. Therefore more investment in the study of the cost-  
36 effectiveness of CAM modalities with their additional health promotion medicines and  
37 therapies is indicated. The main unanswered questions in the current study are: where do the  
38 cost differences come from (to which indications and which therapies do they pertain to?) and  
39 what are the health-related effects of CAM treatment (objective parameters (e.g. lowering of  
40 blood pressure), quality of life, patient-reported outcomes, sick-leave, etcetera)? Future  
41 research should therefore focus on ~~and~~ (1) exploring to what extent selection on  
42 unobservables and causal effects explain the lower costs of patients with a CAM GP; (2)  
43 exploring in more depth the costs differences between patients of CON GPs and CAM GPs in  
44 order to develop adequate, testable hypothesis of cost-effectiveness of specific CAM  
45 treatments for specific indications, and to transfer the cost differences related knowledge  
46 from CAM to CON GP practices in order to diminish healthcare expenditures in CON  
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7 practices; (3) designing and executing highly controlled, comparative effectiveness research  
8 projects [22] with more health related outcome parameters than mortality rate only; and (4)  
9 replication studies based on similar, large datasets with other CAM modalities (acupuncture,  
10 TCM herbal treatment, etcetera-) and with other insurance companies to explore and confirm  
11 the present results;.

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17  
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19 for providing the dataset for the study.

### 22 **Competing interests**

23  
24 We have read and understood the BMJ Group policy on declaration of interests and declare  
25 the following interests:  
26

- 27 - Dr. Erik W. Baars receives a part of his salary from the Professorship Anthroposophic  
28 Healthcare of the University of Applied Sciences Leiden, The Netherlands. The  
29 professorship works closely with those in the AH professional field and works on  
30 practical problems using applied research which focuses on three main categories: (1)  
31 investigating efficacy and safety, (2) developing and delivering optimal quality, and  
32 (3) improving communication about AH.  
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**Transparency declaration**

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

**Contributors**

PK was the project lead for the statistical analyses. EB and PK wrote the manuscript. All authors reviewed the manuscript and contributed to manuscript revisions. EB is the guarantor for this study.

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**Role of the study sponsors**

Not applicable.

**Statement of independence of researchers from funders**

Funders played no part in article selection, analysis, interpretation, or decision to publish.

**Data sharing**

Details of how to obtain additional data from the study can be obtained from EB ([baars.e@hsleiden.nl](mailto:baars.e@hsleiden.nl)).

**Previous publication**

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7 A part of the content of our study results was published in February 2014 as a Dutch article in  
8 the Dutch journal Economisch Statistische Berichten for economists in The Netherlands [23].  
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For peer review only

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## Appendix 1

**The Switcher group**

From the total group of 10,769 Switchers, during the period 2006–2011, 6,224 patients switched one time; 2,992 patients switched two times (= back to their first type of GP); 1,282 patients switched three times; 241 patients switched four times and 30 patients switched five times. From the Switchers group that started with a CAM GP, 69.3% ends up with a CON GP. From the Switchers group that started with a CON GP, 70.5% ends up with a CAM GP. As a result the total percentages of CAM patients and CON patients hardly change.

When we analyze the changes in compulsory costs after switching in the subgroup that switched only one time, the total compulsory costs after switching are higher, independent of the direction of the switch. Switching from a CON to a CAM GP results in 337 Euros higher costs ( $p < 0.001$ ), switching from a CAM to a CON GP results in 372 Euros higher costs ( $p < 0.001$ ). After correction for observed differences between the groups by means of linear regression analyses, switching from a CON to a CAM GP results in 34 Euros lower costs (not significant:  $p = 0.83$ ) and switching from a CAM to a CON GP results in 360 Euros higher costs ( $p < 0.079$ ).

When we analyze the changes in supplementary costs after switching in the subgroup that switched only one time, we see that switching from a CON to a CAM GP results in 23 Euros higher costs ( $p < 0.001$ ), and that switching from a CAM to a CON GP results in 1 Euro lower costs (not significant:  $p = 0.78$ ). After correction for observed differences between the groups by means of linear regression analyses, switching from a CON to a CAM GP results in 1 Euro higher costs (not significant:  $p = 0.816$ ) and switching from a CAM to a CON GP results in 2 Euros higher costs (not significant:  $p = 0.803$ ).

~~Since we are mainly interested in the differences in costs between patients that have a CAM GP and patient that have a CON GP for the whole period of six years (2006–2011), the Switcher group is left out of the following analyses.~~

## Appendix 2

Table 4. Estimated differences in mean annual total compulsory and supplementary insurance costs: CAM patients compared to CON patients (loglinear regression model)

	Compulsory insurance costs					Supplementary insurance costs
	Total	GP	Pharmaceutical	Hospital	Paramedic	
All ages	-.114***	-.121***	-.281***	-.185***	.028**	.496***
0-24	-.071***	-.018**	-.169***	-.152***	.017	.344***
25-49	-.088***	-0.14**	-.267***	-.153***	.021*	.433***
50-74	-.173***	-.025***	-.418***	-.220***	.036*	.653***
75+	-.072**	.026*	-.176***	-.124**	.055	.355***
Last year of life	-.146**	.026	-.143	-.287**	.178	.134

\*: p-value < 0.1; \*\*: p-value < 0.05; \*\*\*: p-value < 0.01



## Appendix 1

**The Switcher group**

From the total group of 10,769 Switchers, during the period 2006 – 2011, 6,224 patients switched one time; 2,992 patients switched two times (= back to their first type of GP); 1,282 patients switched three times; 241 patients switched four times and 30 patients switched five times. From the Switchers group that started with a CAM GP, 69.3% ends up with a CON GP. From the Switchers group that started with a CON GP, 70.5% ends up with a CAM GP. As a result the total percentages of CAM patients and CON patients hardly change.

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When we analyze the changes in supplementary costs after switching in the subgroup that switched only one time, we see that switching from a CON to a CAM GP results in 23 Euros higher costs ( $p < 0.001$ ), and that switching from a CAM to a CON GP results in 1 Euro lower costs (not significant:  $p = 0.78$ ). After correction for observed differences between the groups by means of linear regression analyses, switching from a CON to a CAM GP results in 1 Euro higher costs (not significant:  $p = 0.816$ ) and switching from a CAM to a CON GP results in 2 Euros higher costs (not significant:  $p = 0.803$ ).

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**Additional file 1**

EVEREST Statement: Checklist for health economics paper

	<b>Study section</b>	<b>Additional remarks</b>
<b>Study design</b>		
(1) The research question is stated	Introduction	
(2) The economic importance of the research question is stated	Introduction	
(3) The viewpoint(s) of the analysis are clearly stated and justified	Methods; Discussion	
(4) The rationale for choosing the alternative programmes or interventions compared is stated	Methods	
(5) The alternatives being compared are clearly described	Introduction; Methods	
(6) The form of economic evaluation used is stated	Introduction; Methods	
(7) The choice of form of economic evaluation is justified in relation to the questions addressed	Introduction; Methods; Discussion	
<b>Data collection</b>		
(8) The source(s) of effectiveness estimates used are stated	Methods	
(9) Details of the design and results of effectiveness study are given (if based on single study)	N/A	
(10) Details of the method of synthesis or meta-analysis of estimates are given (if based on an overview of a number of effectiveness studies)	N/A	
(11) The primary outcome measure(s) for the economic evaluation are clearly stated	Methods	
(12) Methods to value health states and other benefits are stated	Introduction; Methods	
(13) Details of the subjects from whom valuations were obtained are given	Methods	
(14) Productivity changes (if included) are reported separately	N/A	
(15) The relevance of productivity changes to the study question is discussed	N/A	
(16) Quantities of resources are reported separately from their unit costs	Methods; Tables 2-4	
(17) Methods for the estimation of quantities and unit costs are described	Methods; Tables 2-4	
(18) Currency and price data are recorded	Methods; Tables 2-4	
(19) Details of currency of price adjustments for	NA	

inflation or currency conversion are given		
(20) Details of any model used are given	Methods-Model overview	
(21) The choice of model used and the key parameters on which it is based are justified	Methods	
<b>Analysis and interpretation of results</b>		
(22) Time horizon of costs and benefits is stated	Methods; Discussion	
(23) The discount rate(s) is stated	N/A	
(24) The choice of rate(s) is justified	N/A	
(25) An explanation is given if costs or benefits are not discounted	N/A	
(26) Details of statistical tests and confidence intervals are given for stochastic data	N/A	
(27) The approach to sensitivity analysis is given	N/A	
(28) The choice of variables for sensitivity analysis is justified	Methods; Tables 2-4	Confidence intervals are given
(29) The ranges over which the variables are varied are stated	Tables 2-4	
(30) Relevant alternatives are compared	Introduction; Methods	
(31) Incremental analysis is reported	Discussion	We describe the extrapolation from the lower costs in the CAM group of patients to the Dutch population
(32) Major outcomes are presented in a disaggregated as well as aggregated form	Tables 2-4	
(33) The answer to the study question is given	Discussion; Conclusion	
(34) Conclusions follow from the data reported	Conclusion	
(35) Conclusions are accompanied by the appropriate caveats	Discussion; Conclusion	