



Research note: Chronic Disease Management in Europe

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Abstract

Across Europe and increasingly the rest of the world, the economic costs of chronic illness dwarf the costs of acute illnesses, both for the health care system and for other stakeholders. Employers must contend with substantial productivity losses, while the indirect costs of treatment that patients and families cope with can be debilitating, particularly when insurance coverage is less comprehensive. These economic costs can send ill patients and their families into poverty, creating a poverty cycle that may last for generations. Disparities in the burden of chronic disease exist between western Europe and the central and eastern countries, and current trends indicate that the burden of chronic illness is likely to grow.

The current primary care model is focused more on acute episodes of care than recurrent care for chronic conditions. The implication is that strong doctor-patient relationships are not promoted, training is rarely sufficient for chronic disease management, and there is insufficient continuity and coordination of the patient's journey through the health care system. European countries have taken a variety of approaches to address the growing chronic disease burden. Austria, Belgium, England, Germany, Italy, the Netherlands, and Spain appear to be at the forefront of formal disease management programmes, although Denmark, Finland, France and Poland are also putting these types of chronic disease models into place. Most of the central and eastern European countries are lagging behind in terms of comprehensive models to deal with chronic care, although all have begun to implement some aspects of chronic disease management. Even in countries with the most comprehensive models of chronic disease management, there is still scope for improvement.

More focus should be placed on self-management programmes for patients, formal education programmes for health providers, the use of multi-disciplinary teams and nurses, and electronic information systems that facilitate the easy exchange of information. Primary and secondary care systems need to be redesigned to focus more on chronically ill patients, which implies a substantial overhaul of how we think about health care. Most of the European models of chronic disease management concentrate on specific diseases rather than care as a whole. The increase in co-morbidities implies that the current models may be behind current trends, and more holistic models of primary care should be considered.

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Introduction

The majority of health care costs (around 75%) are comprised of costs related to chronic illnesses, and the economic impact extends well beyond the health care system. The costs of productivity losses for employers may be more than four times medical and pharmacy costs (Loeppke, Taitel et al. 2007). The indirect costs for patients and families can be so high as to send families into poverty cycles that may last for generations.

Chronic illnesses are the primary cause of premature mortality and the overall disease burden within Europe (WHO 2002b), and a growing number of patients are facing multiple chronic conditions (McKee and Nolte 2004). The World Health Organisation (WHO) estimates that globally, chronic illnesses will grow from 57% of all deaths annually to around 65% of deaths by 2030 (WHO 2005c). They impose numerous difficulties on afflicted patients, their families, the health care system, and employers, among other stakeholders, and are a major factor in health disparities between eastern and western Europe (WHO 2002b). Chronic diseases are health conditions that require continuous health care management over a period of years or decades (WHO 2002a) with chance of developing acute illness or episodes associated with the disease. A number of disparate health problems fit under the umbrella of chronic conditions, including persistent communicable (e.g. HIV/AIDS) and noncommunicable (e.g. diabetes, hypertension, coronary heart disease) diseases, long-term mental disorders (e.g. depression and schizophrenia), and continuous physical problems (e.g. arthritis and amputations) (WHO 2002a).

Current trends indicate that the problem is likely to grow, particularly for central and eastern European Union countries. Factors such as ageing populations and the growing obesity epidemic are important contributors to the growing chronic disease problem. While many western European countries have made strides in reducing the burden of disease for major chronic conditions like cerebrovascular disease and chronic respiratory diseases (WHO 2005), other chronic conditions like HIV/AIDS and tuberculosis (TB) that were once thought to be under control are now growing threats (WHO 2005).

The implication is that much can be done to reduce the significant costs that chronic diseases impose on the health care system and the wider economy. European countries have devised a variety of policy responses in an attempt to improve care for chronically ill patients and reduce the economic burden. While prevention policies are widespread, a newer initiative in Europe is chronic care management. The mechanisms to achieve this aim are wide-ranging, from policies that target disease guidelines or patient education to more extensive projects targeting multiple aspects of management. The more formal disease management programmes that were originally developed in the United States (US) are also becoming more pervasive.

Given the severity of the chronic disease problem and the disparate solutions that exist with Europe, this report aims to provide an overview of the topic and what is being done to tackle the problem. The brief starts with a literature review of chronic diseases, beginning with information on the extent of the problem, the economic costs associated with chronic illnesses, and the poverty cycle that it sometimes entails. Then, the inadequacies of the current structure of health care in managing chronic illness are addressed. The next section covers what is being done at the European level to improve chronic care and what is happening at the international level. The report then provides a number of policy recommendations that can be considered at the national and European Union (EU) level.

Literature Review

Morbidity and mortality

The prevalence of chronic conditions is significant and on the rise for certain conditions. The WHO reports that the burden of disease (in terms of disability-adjusted life years, DALYs) from noncommunicable diseases is around 87% in western Europe and 71% in eastern and central Europe (WHO 2002b). Data on morbidity from chronic diseases is patchy, but WHO statistics indicate that morbidity from chronic diseases like ischemic heart disease, cancer, diabetes, cerebrovascular disease, and COPD is increasing (WHO 2007). For diabetes the average prevalence is expected to grow from 8.4% in 2007 to 9.1% in 2025 (BHF 2008). HIV/AIDS was a growing problem in western Europe until the end of the 1990s, although incidence rates have generally been declining since then. The story is different; however, for eastern and central Europe, where incidence is on the rise.

Depression is a major psychiatric disorder that is commonly seen in primary care settings, although less data on its prevalence is available. The WHO indicated that any one point in time, more than 11% of the population in Europe suffers from depression. Depression is also the third largest cause of the burden of disease in Europe, contributing 6.2% of all DALYs (WHO 2005b). Regional variations in depression also exist, with the prevalence of depression ranging from 4.7 percent in Verona, Italy to 16.9 percent in Manchester, UK (Goldberg and Lecrubier 1995).

Chronic diseases are also a major contributor to mortality, with chronic conditions like ischemic heart disease; cardiovascular disease; and trachea, bronchus, and lung cancers being the leading causes of death in Europe (WHO 2001). In 2002 there were 8.1 million deaths from noncommunicable diseases, comprising 85.8% of all deaths, in the WHO European Region (WHO 2005). Table 1 lists more detailed information on mortality rates from some of the major causes of death for the 27 EU countries and Turkey.

Table 1. Standardised death rates per 100,000 population from selected chronic diseases, 2004

Country	Diseases of the circulatory system	Malignant neoplasms	Diabetes mellitus	Diseases of the respiratory system
Austria	248.31	170.84	29.71	34.71
Belgium	N/A	N/A	N/A	N/A
Bulgaria	685.35	156.53	16.78	33.08
Czech Republic	430.53	230.01	10.35	37.31
Denmark ^a	249.67	218.69	17.90	66.16
Estonia	515.38	198.08	15.69	33.47
Finland	248.37	143.81	7.38	36.93
France	145.41	177.07	11.24	29.55
Germany	262.82	169.81	17.00	37.87
Italy ^b	219.91	175.33	16.98	32.93
Lithuania	528.53	194.95	7.17	39.15
Netherlands	197.38	191.21	16.92	54.93
Poland	397.03	213.98	11.60	39.41
Romania	649.44	176.95	8.41	60.58
Slovenia	276.99	198.81	23.09	56.37
Spain	173.54	164.21	13.71	53.25
Sweden	218.79	155.59	12.08	32.64
United Kingdom	223.78	183.07	7.35	77.96
Turkey	N/A	N/A	N/A	N/A

^adata from 2001, ^bdata from 2002

Source: WHO (2007)

Interestingly, there seem to be differences in mortality rates from specific conditions between the earlier EU member states (from before May 2004; EU-A)² and the later accession or candidate states (from after April 2004; EU-B)³. While the mortality from circulatory system diseases is higher in EU-B countries, death rates for malignant neoplasms, diabetes mellitus, and diseases of the respiratory system are relatively close for EU-A and EU-B nations.

Mortality trends over time are also divergent between the original and accession EU member states (Table 2). The EU-A member states appear to have made strides in reducing mortality from the major causes of death; however, the results in the EU-B countries are mixed. Mortality from ischemic heart disease and cerebrovascular disease has decreased, but mortality from cancer and diabetes has increased.

Table 2. Percent changes in death rates (1990 – 2002) for selected chronic diseases^a

Group of countries	Ischemic heart disease	Cerebrovascular disease	Cancer (all types)	Diabetes
EU-A	-29.78	-30.39	-10.58	-2.12
EU-B	-15.97	-8.41	2.21	11.24

^aonly considers the average of countries surveyed in this report; data for Turkey and Belgium unavailable; data for Denmark for 2001

EU-A = EU member states before May 2004; EU-B = EU member states after April 2004 + Turkey

Source: WHO (2007)

Economic costs

The economic costs of chronic illness not only encompass the associated health care treatment costs (direct costs) but also disability, work absence, reduced productivity costs, early retirement, premature mortality, and family carer costs (indirect costs) (Pauwels and Rabe 2004). Numerous studies have characterised the economic costs of chronic diseases (see Appendix Table 1 for literature on this topic); however, the focus is mainly on western European countries, the United States, and Canada. The overall consensus is that chronic diseases entail substantial direct and indirect costs. Lower direct costs because of less advanced health care lead to a squeezed balloon effect of higher indirect costs (Adeyi, Smith et al. 2007). To provide an illustration of the scale of the problem, see Box 1 and Table 3.

² The relevant original member states from this report are Austria, Belgium, Denmark, Finland, France, Germany, Italy, Spain, Sweden, and the United Kingdom.

³ The relevant accession or candidate states from this report are Bulgaria, Czech Republic, Estonia, Lithuania, Poland, Romania, Slovenia, and Turkey.

Box 1. Health system costs of chronic illness

In comparison with acute illnesses, chronic illnesses comprise a major proportion of health expenditures. Few studies have calculated the percent of total health care costs that all chronic diseases comprise, although a number of studies have considered the financial burden of selected chronic illnesses. Data from the United States indicates that chronic illnesses account for 75% of health care expenditures (Wennberg and Fisher 2006), and the percentage is projected to rise in the future. Patients with multiple chronic illnesses may be driving growth in expenditures; virtually all of the growth in US Medicare spending from 1997 to 2002 is accounted for by a twenty percentage-point increase in the proportion of Medicare patients being treated for at least 5 chronic illnesses (Thorpe and Howards 2006). Cardiovascular disease is a major contributor to total health care costs, with the condition accounting for 5% of total health care costs in Denmark to 17% in Poland (Allender, Scarborough et al. 2008). A study of 8 European countries found that the direct costs of type II diabetes ranged from 1.6% of total health care expenditures in the Netherlands to 6.6% in Italy (Jönsson 2002).

Table 3. Economic burden of CVD in Europe, 2006^a

	Total health care costs per capita (€)	Percent of total health care expenditure	Non-health care costs per capita (€)	Ratio of health to non-health care costs
Austria	198	6	162	1.22
Belgium	194	6	157	1.23
Bulgaria	35	14	24	1.46
Czech Republic	107	13	65	1.65
Denmark	183	5	261	0.70
Estonia	77	15	66	1.17
Finland	238	10	255	0.93
France	215	7	158	1.36
Germany	412	14	242	1.70
Italy	235	10	137	1.72
Lithuania	59	13	74	0.79
The Netherlands	271	9	212	1.28
Poland	74	17	60	1.24
Romania	34	15	33	1.02
Slovenia	91	7	84	1.08
Spain	131	7	91	1.44
Sweden	308	10	235	1.31
The United Kingdom	314	12	358	0.88

^adata from Turkey not available

Source: Allender, Scarborough et al. (2008), WHO (2007)

It is not surprising that the EU-A nations spend more per capita for health and non-health related expenditure, but CVD treatment comprises a greater proportion of the health budget in the EU-B countries. Interestingly, the ratios of health to non-health care costs are relatively similar in the EU-A and EU-B countries.

Health costs for chronically ill patients can be multiple times the costs for non-chronically ill patients (Rubin, Altman et al. 1994; Kangas, Aro et al. 1996; Anthonisen, Connnett et al. 2002). Chronic illness expenses are steadily rising, and increasingly, more people are experiencing multiple chronic illnesses simultaneously (Thorpe and Howards 2006; Vogeli, Shields et al. 2007). Even within a disease category, expenditures are generally skewed towards patients in the poorest health (Sullivan, Strassels et al. 1996; Thorpe and Howards 2006).

The wider economy is also affected by the chronic disease burden. While an obvious by-product of chronic illness is absenteeism from work, more commonly, chronically ill patients continue to work at lower productivity levels ('presenteeism'), particularly if they can not afford to take extended leave. There are also concerns regarding the quality of work or customer service provided by chronically ill employees. In the US, studies have estimated that the costs of productivity losses may be as much as or more than four times health care costs for chronically ill patients (World Economic Forum 2008). Productivity losses also differ according to the level of health risk that individuals experience; reductions in productivity can range from 17.1% for low risk individuals to 34.5% for high-risk individuals (World Economic Forum 2008). The main illnesses that drive health care and productivity costs are listed in Table 4.

Table 4. Major contributors to health care and productivity costs

Rank	Health care cost	Productivity cost	Total cost
1	Other cancer	Fatigue	Back/neck pain
2	Back/neck pain	Depression	Depression
3	Coronary heart disease	Back/neck pain	Fatigue
4	Other chronic pain	Sleeping problem	Other chronic pain
5	High cholesterol	Other chronic pain	Sleeping problem
6	Gastroesophageal reflux disease (GERD)	Arthritis	High cholesterol
7	Diabetes	Hypertension	Arthritis
8	Sleeping problem	Obesity	Hypertension
9	Hypertension	High cholesterol	Obesity
10	Arthritis	Anxiety	Anxiety

Source: Loeppke, Taitel et al. (2007), reproduced directly from World Economic Forum (2008)

Importantly, the existing literature likely underestimates the economic costs of chronic illness, and studies may not be able to include other intangibles such as pain and suffering and costs of other services that chronically ill patients use at greater rates (e.g. dental care or dietician care) (Hogan, Dall et al. 2003). Many studies do not measure the value of care provided by family members, and yet there is evidence that caregivers may experience economic, occupational, psychosocial effects, particularly when caring for terminally ill patients (Grunfeld, Coyle et al. 2004).

Chronic illness and poverty

An indirect consequence of chronic illness is the poverty cycle, and the positive correlation between low-income and poor health exacerbates the problem (Macinko, Shi et al. 2003). The need to take time off from work or work fewer hours often instigates the poverty cycle: children in families where one parent cannot work full-time are at greater risk of poor health, and when the children develop chronic conditions, they are unable to participate in the work force and have fewer resources to restore themselves to full health. The indirect burden of chronic illness also pushes families further into poverty (WHO 2002a).

Not surprisingly, studies have found more difficulties with income and employment among the chronically ill population as compared with their healthier counterparts (Dooley, Fielding et al. 1996; Herrin, Cangialose et al. 2000; Van Agt, Stronks et al. 2000; Blanc, Trupin et al. 2001; van Leeuwen, Blyth et al. 2006). The link between chronic conditions and economic difficulties further highlights the need for European countries to better manage chronic care.

Why is chronic care different?

In comparison with care for acute illnesses, two primary reasons that confound the management of chronic care: the nature of chronic illness and the current design of the health care system.

With acute disease, onset tends to be abrupt, of limited duration, with single cause, accurate diagnosis, effective treatment, and possible cure, while chronic diseases are far more complex with gradual and subtle onset, indefinite duration, multiple and changing causes, often uncertain and changing diagnoses, and no cure. Another important distinction is that in the case of acute illness, patients are relatively unaware of the condition and treatments, while for chronic diseases, patients and providers generally have complementary knowledge.

Chronic illnesses entail more interactions with the health care system over different levels of care (primary, specialised, laboratory, etc.), and there is often the confounding factor of comorbidities (Adeyi, Smith et al. 2007). The implication is that continuity, coordination, and comprehensiveness are crucial elements of care. Chronic disease also places a greater management burden on the patient, as the patient needs to manage his risk factors, adhere to treatments over a long period of time, and be mindful of symptoms or changes in health status. The use of pharmaceuticals and other medical technologies within chronic care bring up cost issues, as newer treatments are generally more expensive. Health technology assessment, generic policies, and health care access policies thus becomes important factors related to spending on chronic illnesses.

Given the complexity of chronic disease interventions, one issue is that health care systems were originally designed to address acute health care conditions, for instance, upper respiratory infections or injuries. Diagnosing and treating conditions are hallmarks of the current system, but chronic care requires a more comprehensive model of care.

One problem with the acute care model is that patients rarely develop strong relationships with their health care providers. Strong relationships allow providers to track the patient's conditions over time, and provide a setting in which the patient can ask questions and understand and feel comfortable with self-management of the condition (WHO 2002a). Part of the reason that strong relationships are lacking is that in many cases providers receive insufficient training for chronic disease management. Providers are insufficiently trained in helping patients self-manage conditions, for instance, by helping patients improve adherence using specific tools and techniques (WHO 2002a). There is also a lack of communication regarding information about making appropriate choices in care; it is rare for providers to sufficiently address subjects such as diet changes, smoking cessation, exercising, and work environment changes, among others.

Additionally, the acute care model does not organise care over time or across providers. Given that poorly managed chronic conditions follow an expected course, proactive management and prevention can help the patient avoid more health deterioration than necessary. Providers are often limited in the amount of time they have with patients, while poor coordination between general practitioners, nurses, and specialists can lead to the duplication of tests or the failure to perform necessary tests, for example. Information systems to facilitate the coordination of care are often unavailable or insufficient (WHO 2002a).

What can be gained from better disease management?

According to the WHO (2005c), high-income countries such as Australia, Canada, the UK, and the US have reduced cardiovascular mortality close to 3% per year during the past three decades. Thus, high-income health systems could aim for similar reductions in chronic disease mortality, although such a high reduction target may be less feasible in eastern and central European countries (Adeyi, Smith et al. 2007). Moreover, if the onset of chronic diseases are successfully delayed until old age, the productivity-related costs of illness are reduced.

The productivity losses from chronic diseases have received less attention, although some changes have been implemented at the level of individual companies. Many of these programmes focus on prevention through wellness initiatives (World Economic Forum 2008). There are indications that these prevention programmes are successful at reducing productivity losses for individual firms, implying that large-scale efforts at prevention within health care systems could be beneficial for economies.

Thus, there is significant potential for improvement in chronic care, and many European countries have developed programmes to tackle the problem.

What has been done to address chronic care management?

A number of different models have been employed to address either prevention or both prevention and management of chronic illnesses. Prevention programmes may encompass disease screening (e.g. breast cancer screening), financial incentives for physicians to carry out more prevention activities, population-level programmes that involve the collective action of community organisations, or patient education programmes. The management of chronic care generally takes the form of broad disease management programmes or programmes that target particular health system components or patients at the greatest risk of hospitalisation, for instance, diabetes clinics or nurse case managers that coordinate patients' care.

Disease management programmes

Disease management programmes (DMPs) were originally created in the United States with the twofold purpose of improving chronic care and cutting costs, where disease management is defined as “an approach to patient care that coordinates medical resources for patients across the entire health care delivery system” (Ellrodt, Cook et al. 1997). For each patient a care plan based on knowledge of the full disease process is developed, where the latest evidence-based medicines is meant to be incorporated as it becomes available. Multidisciplinary teams of medical and allied health professionals then work together to manage and deliver the care. Patients are also given a more active role in their own health care, and some programs offer health education and compliance support. The implication is that DMPs emphasise prevention and management of patient risk factors in addition to diagnosis and treatment.

The Chronic Care Model, a more specific guide for chronic disease management for provider organisations, is an offshoot of DMPs (Bodenheimer 2003). The Chronic Care Model entails theory (the model) based on practice and available scientific evidence, where practice drives theory and in turn, theory drives practice. The model identifies six essential factors in chronic illness management, each of which is described in Table 5.

Table 5. Essential factors in chronic care management

Factor	Details
Community resources	Provider organisations need to be linked with community-based resources, e.g. senior centres, patient education classes, and self-help groups.
Health care organisation	The culture, organisations, and mechanisms of the health care and provider organisations must promote safe and high quality care. For instance, provider reimbursement is an important influence on providers' incentives to improve chronic care.
Self-management support	Most patients can be taught to manage chronic illness through diet, exercise, self-measurement of conditions (e.g. glucometers), and proper medication use, and education can help patients routinely assess problems and accomplishments.
Decision support	The daily use of evidence-based guidelines is key, and providers can be supported through physician education and daily reminders.
Delivery system redesign	Delivery systems for chronic care must be separated from acute care by using planned visits and case management of high-risk patients. This redesign also involves creating practice teams with a clear division of labour.
Clinical information systems	Electronic systems provide data for better management of chronic illness through: (i) reminder systems to help primary care teams comply with practice guidelines, (ii) feedback for physicians on performance measures (e.g. lipid levels), and (iii) data registries for planning individual patient care and conducting population-based care.

Source: Bodenheimer, Wagner et al. (2002)

The development of chronic disease management programmes has been accelerating within Europe (Table 6), with many programmes loosely based on the Chronic Care Model. Diabetes, cardiovascular disease, and cancer are the most common conditions chosen for DMPs. The extent to which each disease network models the Chronic Care Model differs, with some programmes in France and Sweden more closely modelling the Chronic Care Model, and the German policy being a more general disease management programme. England has experimented with a number of related initiatives, including ones based on a 'risk pyramid' model developed by Kaiser Permanente in the US and the Chronic Care Model.

Table 6. Disease management programmes in Europe

Country	Examples of disease groups covered	Incentives for providers	Incentives for patients	Collection of data	Evaluations
Austria	diabetes	additional remuneration for enrolling and managing chronic patients and providing group education	training for disease and risk factor management	✓	expected end of 2008
Belgium	diabetes, COPD, HIV, chronic pain	the participating institution receives a lump sum for each covered patient	training for disease and risk factor management	✓	✓
Denmark	diabetes	additional remuneration for participating	training for disease and risk factor management	under collection	✗

Country	Examples of disease groups covered	Incentives for providers	Incentives for patients	Collection of data	Evaluations
England	diabetes, cardiovascular diseases, hypertension, COPD, cancer	national targets for chronic diseases (NSFs), additional payments for performing certain tasks related to chronic illnesses	training for disease and risk factor management	✓	✓
Finland	diabetes	✗	training for disease and risk factor management	under collection	✗
France	diabetes, hypertension, respiratory diseases, neurodegenerative diseases, cancer	additional remuneration for coordinating chronic care; 49 national targets linked to chronic disease outcomes	patients following care protocol exempt from user charges; training for disease and risk factor management; improved access to social support (e.g. disability pension)	under collection	✗
Germany	diabetes, coronary heart disease, COPD, asthma, breast cancer	additional remuneration for documentation and provision of educational programmes; ability to enrol patients for long-term	training for disease and risk factor management; sickness funds can offer financial incentives for patients	✓	✓
Italy	diabetes, cardiovascular disease, heart failure	(regional) additional remuneration for managing chronic patients and meeting some targets; outcomes targets as part of regional agreements	some programs offer disease management training and psychosocial support	✓	✓
The Netherlands	diabetes, cardiovascular disease, COPD	experiments with additional remuneration for quality targets	training for disease and risk factor management	under collection	✗
Poland	diabetes, HIV	capitation fee that funds additional care if it is needed	✗	under collection	✗

Country	Examples of disease groups covered	Incentives for providers	Incentives for patients	Collection of data	Evaluations
Spain	diabetes, diseases of the circulatory system (ischemic heart disease, hypertension, hypercholesterolemia, etc.)	✗ (but higher capitation amount for older patients)	✗	under collection	✗

NSFs = National Service Frameworks

National programmes for chronic disease management exist or are in development in Austria, Denmark, England, Finland, France, Germany, Italy, the Netherlands, and Poland; while regional or private initiatives are also prevalent in England, France, Italy, Spain, and Sweden. Even in Germany, where DMPs are set out in the Social Code book, sickness funds have the choice of whether or not to apply DMPs, although there are financial incentives for implementation (through additional payments from the risk adjustment scheme). Insurance funds in the Netherlands also have discretion over the implementation of DMPs. The implication is that wide variation in the availability of programmes persists within countries, with for instance some German Länders having only 50% of their GPs involved in a DMP and other Länders having more than 80% involvement (Nagel, Bahering et al. 2006). In Italy there is a north-south divide between the availability of regional DMPs.

All of the existing programmes focus on specific diseases, although other more general integrated systems for coordinated care do exist. Depending on the specific plan, care managers for the programmes can be a gate keeping physician (Austria, Denmark, France, Germany, Italy, the Netherlands, Spain), a specialised nurse (Germany, the Netherlands, the UK), a specialist (Poland), and/or a team of providers (Belgium, Finland, Italy, the Netherlands, Spain).

Most countries with existing DMPs plan to extend the programmes to additional diseases. Germany intends to extend its existing programmes to cover depression, heart failure, chronic back pain, diabetic nephropathy and diabetic neuropathy, while Finland has ambitiously stated that it intends to develop an entire system of care for chronic illnesses.

Other chronic disease initiatives

In addition to, as part of, or in place of formal disease management programmes, many initiatives target high-risk patients or particular health system components to improve outcomes for the chronically ill (Table 7).

Table 7. Other chronic disease initiatives

Initiative	Details
Integrated care	Involves collaboration across different health care providers and organisations for the delivery of patient care, entailing additional information exchange beyond routine discharge and referral. Specific examples of integrated care are integrated primary and secondary care, multidisciplinary teams, specialist clinics, use of nurse practitioners, and integrated community outreach.
Evidence-based care pathways	Provide guidelines detailing the patient journey through the health care system and indicate the need for specific services and medications at different points along the journey. The guidelines are based on high quality research evidence.
Case management	For the patients at the highest risk of needing intensive interventions (e.g. hospitalisation), a practitioner is assigned to create a care plan based on an assessment of the patient's needs, arrange and monitor appropriate care, and liaise with the patient's family. For example, the practitioner may be a nurse, and GPs are increasingly being tasked with case management.
Data collection and monitoring	Data collection allows health systems and practitioners to identify patients that are most at risk of hospitalisation or health deterioration
Patient self-care	Includes strategies to involve patients in the management of their conditions. Examples include: involving patients in decision-making, accessible information to make health care choices, self-management education, and self-monitoring referral systems (e.g. individuals monitor their symptoms and decide when to seek medical attention).

Source: Singh (2005)

The increasing decentralisation of health care organisation and delivery in Europe has led to a prevalence of initiatives at the local or individual insurer level. Table 8 indicates that all of the health systems surveyed employ at least one of the chronic care techniques, albeit often on a small scale. In Italy, Spain, and Sweden, for instance, the availability of various chronic disease management techniques varies regionally. Integrated care contracts in Germany are specific to sickness funds, while integrated care is being tested at pilot sites in Turkey.

Table 8. Use of other chronic disease management initiatives within Europe

Country	Integrated care	Evidence-based care pathways	Case management	Data collection and monitoring	Patient self-care
Austria	✓	✓	✓	✓	✓
Belgium	✓	✓	✓	✓	✓
Bulgaria	✗	✓	✗	✓	✓
Czech Republic	✗	✓	✓	✓	✓
Denmark	✓	✓ (being implemented)	✓	✓	✓ (being implemented)
England	✓	✓	✓	✓	✓
Estonia	✓	✗	✓	✓	✓
Finland	✓	✓	✓	✓	✓ (pilot stages)
France	✓	✓	✓	✓ (e-health cards in development)	✓
Germany	✓	✓	✓	✓	✓
Italy	✓	✓	✓	✓	✓
Lithuania	✗	✓	✓	✓	✗
The Netherlands	✓	✓	✓	✓	✓
Poland	✓	✗	✗	✓	✗

Country	Integrated care	Evidence-based care pathways	Case management	Data collection and monitoring	Patient self-care
Romania	x	x	x	✓	x
Slovenia	✓	x	x	✓	x
Spain	✓	✓	✓	✓	✓
Sweden	✓	✓	✓	✓	✓
Turkey	✓	x	x	✓	✓

While disease management programmes encompass many of these listed tools, chronic care programmes that focus on only one initiative (e.g. integrated care) often run in tandem with disease management programmes. In Germany sickness funds receive additional payments from the risk adjustment scheme to set up DMPs, while integrated care contracts entail a separate financial incentive (1% of the sickness fund budget can be deducted for the physician and inpatient resources for these contracts). The integrated care contracts allow sickness funds to selectively contract with a network of preferred providers to secure the care for a condition or group of related conditions in a defined population. Most of the existing contracts have been for specific conditions, and sickness funds and providers have recently begun combining integrated care projects with DMPs (e.g. to treat diabetes) (Greß, Focke et al. 2006).

Outside of Germany, integrated care, mainly in the form of multi-disciplinary treatment teams is also growing in popularity. Even countries where integrated care is not widespread are expressing interest. The Czech Republic, for instance, has formally targeted the improvement of the coordination of health, social, and home-care services for older people in the most recent national programme on ageing. Within multi-disciplinary teams, nurses are enjoying greater involvement, particularly as specialist education for nurses has improved in England, Italy, Slovenia, Spain, Sweden, and Turkey. Nurse-led clinics have been available since 1996 under the Dutch model of transmural care (Temmink, Hutten et al. 2000), and countries such as England, Estonia, Italy, Spain, and the Scandinavian countries also employ this model. In addition, nurses' prescribing rights have evolved in England and Sweden.

Most health systems have developed evidence-based guidelines at the national level or at the level of major organisations like diabetes societies or physicians' associations within the country. In Lithuania reimbursement is even tied to guidelines in some cases; for instance, diabetes treatment must adhere to relevant diabetes guidelines and quality standards for patients to receive it free of charge (Gollmer, Haas et al. 2005).

Case management for chronic disease care is generally under the remit of a nurse or a physician. Two major trends can be observed in case management: the increasing responsibility of nurses and the implementation or strengthening of the gate keeping system. In England a software tool known as PARR (Patients at Risk of Re-hospitalisation) identifies high-risk patients, and each patient is then assigned a nurse as a 'community matron' to coordinate their care. Swedish district nurses play a major role in coordinating services between primary care providers and community support agencies.

In terms of gate keeping, by creating a consistent first point of contact for patients, there is greater scope for the gate keeper to coordinate the patient's journey through the health system. France recently expanded incentives for gate keeping, and gate keeping physicians of chronically ill patients are required to draw up healthcare protocols. Turkey is piloting a system of assigned gate keepers, and patients under DMPs in Germany are managed by a single physician. Some argue that the Dutch GPs are shifting from the role of gate keepers to

care managers for the primary care process, not the least because 10.4% of Dutch GPs in 2002 participated in disease management programmes (Steuten, Vrijhoef et al. 2002). In Estonia there is a financial bonus system for physicians that manage certain chronic conditions, and well-performing physicians receive additional remuneration from the Estonian Health Insurance Fund.

The use of electronic health (ehealth) to track patient information and build databases of clinical information is gaining traction. Information technology can also be employed to improve the coordination of care, for instance, through disease-specific guidelines and electronic communication between health care stakeholders. Denmark has one of the most advanced electronic health systems, followed by Austria, Belgium, England, the Netherlands, and the Scandinavian countries. Despite the varying degrees of penetration, all countries are pursuing ehealth strategies.

In general, health systems in countries like Bulgaria and Turkey seem more focused on prevention programmes for chronic disease than management programmes, although some aspects of disease management are on the national agenda in Bulgaria, and Turkey is running chronic disease pilot programmes for diabetes and hypertension. Recent initiatives in Bulgaria are intended to strengthen outpatient care, for instance, financial incentives for GPs to care for chronically ill patients, while the government envisions developing an integrated electronic health system.

EU level policies

The European Union does not have a comprehensive strategy for chronic diseases as a whole, but there are public health strategies for cancer, cardiovascular diseases, HIV/AIDS, mental health, and some other rare diseases (Health-EU 2008). The EU facilitates information exchange on good practice between Member States, publishes action plans, and funds research activities.

The WHO CINDI (Countrywide Integrated Noncommunicable Diseases Intervention) network comprises 19 of the EU member states, and entails a detailed system for monitoring and assessing chronic disease indicators at the regional and national level. Of the European countries included in this report, Austria, Bulgaria, Czech Republic, Estonia, Finland, Germany, Italy, Lithuania, Poland, Romania, Slovenia, Spain, and the United Kingdom participate in the CINDI programme (WHO 2006).

The WHO CINDI network also informed The European Strategy for the Prevention and Control of Non Communicable Diseases, a WHO Europe initiative that provides a unifying and coherent framework for the EU member states (WHO Europe 2006). The framework encompasses six action areas including better use of individual and societal advocacy; the generation and transfer of knowledge; regulation and financing of health; improved capacity (human resources, infrastructure, and consumables like drugs and medical technologies); community support for individuals; and better health service delivery.

Disease management outside of Europe

Outside of Europe disease management has only become an entrenched part of the US health care system. There is not a national programme for chronic care in the US; instead all programmes are funded via public and private insurers. Virtually all (96%) of the top 150 US commercial health insurers offered some form of disease management in 2005, although nearly all programmes were geared towards diabetes and cardiac conditions, a trend that is

line with European programmes (Matheson, Wilkins et al. 2006). Meanwhile, Medicare, the public health insurance programme mainly for older people, recently concluded the first phase of a three-year pilot programme that outsourced chronic care improvement projects to private companies (Medicare Health Support). The first phase of the programme has not led to cost savings, clinical quality improvements, or better patient satisfaction, although the participating companies argue that Medicare enrolled patients that were already too ill to prevent costly hospital admissions (Abelson 2008). It is unclear whether Medicare will continue with the experiment.

The decentralisation of health care in Canada has similarly led to multiple programmes across provinces and territories and even across provincial regions. Most provinces in Canada have adopted some form of the Chronic Care Model, with British Columbia and Alberta being the forerunners. Interestingly, the British Columbia model is led by the Ministry of Health, while the Alberta network is a regional effort within the province. Each programme is unique, although some provinces developed their programmes based on input from British Columbia and Alberta. In line with disease management in other countries, diabetes and congestive heart failure are the most common illnesses covered under the projects (Health Canada 2007).

In Australia and New Zealand, programmes run simultaneously at the national and regional levels. The Australian Better Health Initiative is another five-year project with a view to managing chronic illnesses and focuses on individuals aged 45 and at risk of chronic illness (Zwar, Harris et al. 2006). Other projects have been developed at the regional level in Australia, some with a heavy focus on the aboriginal population. Meanwhile, the Care Plus programme in New Zealand also focuses on high-risk patients, offering a more structured journey through the health care system and self-management support (Zwar, Harris et al. 2006). While Care Plus is not a formal Chronic Care Model, other regions in New Zealand have developed more formal disease management programmes.

Evidence on chronic disease management

Thousands of studies on single interventions and simultaneous interventions (e.g. the Chronic Care Model) for chronic disease management are available, and numerous literature reviews have been conducted (see Appendix Table 2 for the main literature reviews in the area). A systematic review of DMPs worldwide determined that these programmes improve the quality of care and disease control and in some cases reduce hospital admission rates (Mattke, Seid et al. 2007). However, DMPs do not reduce costs, mainly because enrolled patients are more likely to use outpatient care and prescription drugs. This finding regarding the dynamic between inpatient and ambulatory costs has been verified elsewhere (Wheatley 2002). There was no consistent evidence on long-term health outcomes (Mattke, Seid et al. 2007), mainly because most studies only follow patients for about a year. It is not clear whether the short-term health gains attributed to DMPs would remain over the long term.

Little data on the recent national and regional DMPs in Europe is available, mainly because the larger-scale programmes were not implemented before 2003. Evidence from the German policy confirms what has been found in other literature reviews of DMPs: the German programme appears to have improved the quality of care for diabetes. Some clinical outcomes for diabetic patients also appear to have improved, with reductions in blood pressure and no changes in blood sugar or body mass index (Leinert and Eichenlaub 2007; Willeberg 2007). However, there are regional variations in health outcomes, with the eastern portion of Germany reporting better outcomes for diabetes (Merten 2005).

Numerous exploratory disease management programmes have been carried out in Europe since the late 1990s, and evaluations of these earlier programmes is available. Evidence from a study from the south east of France indicates that diabetes patients in the chronic disease network exhibited better adherence to guidelines, but there was no difference in treatment costs between patients in the treatment and control groups (Boyer, Ohronnd et al. 2007). This was because patients in the treatment group experienced higher average outpatient costs and lower average inpatient costs than the control group. A Dutch study that investigated a disease management program for elderly patients with depression found no difference in treatment costs, effects, or cost-effectiveness between the two treatment groups (Bosmans, de Bruijne et al. 2006).

While it is clear that a multi-pronged approach like the Chronic Care Model improves quality and health outcomes, at least in the short term, it is less clear whether only certain components of the model are necessary (Singh and Ham 2006). A recent study evaluating a large-scale randomised trial of heart failure patients enrolled in a DMP in the Netherlands highlighted this question. The study failed to find any significant differences in re-hospitalisations or mortality between the treatment and control groups (Jaarsma, van der Wal et al. 2008). Given that the control group was required to make regular visits to the cardiologist, it is possible that this requirement was sufficient to improve outcomes for the study sample.

Zwar, Harris et al. (2006) have attempted to address this deficiency in the literature by investigating what components of the Chronic Care Model are the most effective. Many of the studies in their review primarily addressed one and up to two components of the model, so even then, the evidence on which components are sufficient still remains. Nonetheless, Zwar, Harris et al. (2006) determined that certain interventions within the categories of self-management support, delivery system design, and decision support and clinical information systems were more effective than others.

More evidence is clearly needed to conclusively determine which aspects, if all, of disease management programmes are necessary for improved quality and outcomes. In fact, given that disease management programmes are not cost reducing as originally proposed, determining the most important and necessary facets of disease management could improve the cost-effectiveness of these programmes. In the meantime, without evidence on which components of disease management are sufficient for health improvements, we are left with making policy recommendations based on the what has been found to be the most effective within key components of disease management.

The way forward with chronic disease management in Europe

Drawing policy conclusions based on the literature is somewhat difficult in that thousands of variations on disease management exist. The type of patients enrolled, the extent to which health care practitioners are involved, and the quality of self-care education, among numerous other factors will influence the outcomes of the project. The various aspects of disease management that programmes address also makes isolating the effective elements difficult. There is no question; however, that an effective programme needs to focus on different aspects of the care process and combine multiple techniques as few of these interventions will be effective in isolation. Importantly, there appear to be key areas within chronic care management that contribute to better outcomes (Zwar, Harris et al. 2006), and there is scope for improvement in Europe within these key areas.

(1) Develop formal self-management programmes for each targeted disease, and ensure that patients collaborate with the case manager to develop an individual care plan.

There is evidence that the most effective strategies helped the patient improve specific behaviours such as diet changes in relation to diabetes as opposed to broad interventions for chronic disease management in general (Zwar, Harris et al. 2006). Disease-specific support in the form of group education was generally more effective than support in one-on-one settings. Patients also appear to adhere better to their treatment regime when they are able to develop an individual care plan with a medical practitioner (Aged Community and Mental Health 2000).

The implication for European policymakers is that although patient education is a key component of chronic disease management, the method of patient empowerment matters. Most of the countries surveyed carry out some form of patient education, but there is room for improvement. For instance, the Finnish programme focused on diabetes management involves peer-support groups focused on management of certain diabetes risk factors like weight control, while less emphasis is placed on an individual care plan.

(2) Develop a formal education programme for physicians with a multi-intervention approach.

Evidence indicates that supply problems in the health care sector influence the quality of care provided; there is a lack of qualified personnel trained in diabetes management, for example (Gollmer, Haas et al. 2005). Aside from the need for additional supply, health systems need to train providers using a variety of education techniques. It seems that academic detailing in addition to local opinion leaders is relatively successful in improving physician performance and clinical outcomes (in some cases) (Davis, Thomson et al. 1995), although continuing medical education is less effective unless interventions are more interactive and less didactic (Davis, O'Brien et al. 1999). Yet, the most effective strategy appears to be one that combines several education interventions to influence behaviour and outcomes (Bodenheimer 2003).

(3) Employ multidisciplinary teams and increase the role of practice nurses in the management of chronic care.

Within multidisciplinary teams providers collectively manage the care of a defined group of patients, and typically the primary care physician delegates responsibilities to other team members (Wagner 2000). While the addition of nurses, pharmacists, and other team members may improve outcomes simply because the burden of care is spread over more providers, evidence suggests that teams with a collaborative culture function better than non-collaborative teams (Bodenheimer 2003). Practice nurses also appear to hold important roles within the multidisciplinary team (Zwar, Harris et al. 2006).

In some countries the focus has been on strengthening the role of a gate keeping physician rather than using multidisciplinary teams (e.g. Austria, France, Germany). Not surprisingly, physicians in Germany complain of the high work load from administrative requirements in the DMP even though some employ nurses for case management. In Denmark, England, the Netherlands, Sweden, and Finland, nurses have a greater role in health care provision beyond assisting the physician. England now employs nurses as community matrons to manage care for chronically ill patients, and some nurses now have limited prescribing rights. While placing more responsibility in the hands of multidisciplinary teams and nurses is important, there is a need for better training for both managing chronic conditions and working collaboratively in teams.

(4) Implement electronic information systems for health care

Electronic systems within health care offer potential for improvement in coordination, accessibility, and the quality of care. Electronic platforms allow for improved communication between patients and providers (e.g. electronic booking) and between different providers (e.g. electronic referral and feedback). Electronic guidelines provide physicians with the latest available evidence on chronic diseases that can be tailored for their specific patient, while e-health cards that track information such as prescriptions can reduce contraindications and potentially inappropriate prescribing.

Substantial progress toward electronic health cards is being made, but some countries such as Romania can improve considerably. In other areas of health information technology, there is even more variation between countries, with Denmark, England, the Netherlands, and Sweden being technologically advanced in comparison with many eastern European countries. All of the surveyed countries have disease registers, but a European framework for collection and evaluation of data on chronic diseases is missing. A common methodology would allow more robust comparisons of disease incidence and prevalence rates within and between countries and over time.

One consideration related to many of these recommendations is that patients increasingly suffer from multiple chronic diseases simultaneously. The current models of care are mainly built around individual diseases, and there is a move towards more specialisation of health care staff and treatment. While this specialisation appears to improve quality and outcomes, further improvements may be possible if interventions account for the existence of co-morbidities.

Conclusion

Evidence points to a growing and expensive chronic disease problem, and one that is more acute for eastern and central European countries. In addition to the rising burden of disease, mortality has also been rising for some chronic illnesses in eastern and central Europe. Western Europe has made substantial strides in reducing the mortality burden of diseases like cancer, cerebrovascular disease, ischemic heart disease, and diabetes. Nonetheless, chronic diseases are associated with a sometimes crippling economic burden. This is despite the substantial proportion of the health care costs that near-universal health insurance in Europe covers. The indirect costs, which can be even greater than the direct health care costs, are an important factor in Europe, particularly for the low-income population. Productivity losses appear to be a significant drag on the economy. The combination of health-related and economic costs implies the need for models to actively manage chronic illnesses.

From their inception in the US, chronic disease management models have been put forward to reduce mortality and economic costs while improving quality. Although there seems to be little evidence supporting the hypothesis that disease management programmes reduce health care costs, they do seem to improve quality and may improve health outcomes. A number of countries in Europe have recently instituted formal disease management programmes, although the diseases covered, the financial incentives for physicians and patients to participate, and other aspects of the design differed significantly between countries. Aside from disease management programmes, all of the surveyed countries have some policies in place to manage chronic illnesses. Regional disparities in the availability and quality of programmes persist, particularly between western and eastern/central Europe and within countries such as Germany, Italy, Spain, and Sweden. Western Europe generally appears to have more advanced chronic disease management programmes in place.

Despite the growing availability of disease management programmes, there is still considerable scope for improvement in chronic care management. The major problem facing health care systems today is the focus on acute illness episodes. Primary and secondary care needs to be redesigned to address both chronic and acute diseases and should be equipped to deal with co-morbidities. The implication is that more focus should be placed on prevention, both at the secondary and tertiary level. European countries have made considerable strides in secondary prevention, particularly through screening programmes. A model example is the Finnish North Karelia Project, which entails comprehensive prevention of cardiac mortality through community organisations and individual efforts. More recently, Estonia, Lithuania, Romania, and Slovenia have all moved towards more defined and comprehensive screening programmes. Nonetheless, the EU could play a greater role in providing guidelines for screening and prevention programmes and encouraging all member states to offer these types of programmes. European countries could also look to the Finnish project for guidance and implement more comprehensive prevention programmes that involve a variety of actors and methods.

This report has indicated; however, that European countries need to improve tertiary care of chronic illnesses. Only a handful of countries have formal disease management programmes, and the recent introduction of many of these programmes means that little data is available for evaluation. Many of the central and eastern European countries are lagging behind in the use of chronic disease management techniques even though chronic illnesses are on the rise within these countries. Improving disease management implies shifting the way that policymakers and providers think about primary and secondary care. The current models that encourage gate keeping physicians to take on large patient lists are not conducive to disease management as there is little time for physicians to spend with patients. This implies both an increase in the supply of physicians and incentives for smaller patient lists. Other health care providers, such as nurses, could also be substituted for physicians on a number of tasks, for instance developing clinical pathways, guiding patients through the system, working with the patients on self-management, prescribing, and monitoring patients.

The paternalistic models of the doctor-patient relationship are also less relevant to chronic disease management. Care decisions need to be discussed between the patient and the provider, and a care pathway can be decided upon jointly. Providers need to be better trained in communicating with patients and should be given sufficient time during office visits to establish strong relationships with patients. Increasing patient involvement not only increases compliance with therapies, but it can eventually lessen the burden on providers as patients take more responsibility for their own care.

Despite the rise in integrated care models, care coordination is reported as a problem across many countries. Even within countries such as the Netherlands, that have long since introduced models of transmural care to improve coordination, patients complain of coordination problems. Improving coordination requires providers to think differently about the provision of care. Training that focuses on working in multidisciplinary teams helps providers clearly delineate roles and facilitates smoother interactions. Providers also need to be equipped with tools to easily communicate with other providers that the patient sees, including electronic health cards, electronic referrals, and peer-to-peer communication. Feedback mechanisms also help providers pinpoint problem areas and adjust coordination models accordingly.

An important note is that a multi-pronged approach to chronic care is needed, as advocated by the Chronic Care Model (Bodenheimer, Wagner et al. 2002). Few European models

address all relevant aspects of the Chronic Care Model, and countries need to evaluate where they fall short on disease management.

European countries are essentially tinkering with their health care systems rather than considering a complete overhaul of how primary and secondary care is conducted. The rising problem of co-morbidities implies that policies aimed at specific diseases are likely to fall short of comprehensive and continuous care, particularly because multiple sets of provider teams may treat the patient. The patient may feel bombarded by information from multiple sources, information that may potentially be conflicting. Research has also found that if physicians were to apply guideline recommendations for the top ten chronic illnesses, the amount of time spent on these illnesses could range from 3.5 to 10.6 hours per day (Østbye, Yarnall et al. 2005). To successfully treat chronic illnesses, policymakers need to reconsider models of funding for primary and secondary providers, provider supply policies, incentives for single vs. group practice, the involvement of other health practitioners in treatment, communication models, provider training, and multiple other aspects of care.

Appendix

Appendix Table 1. Literature covering direct and indirect costs of selected chronic illnesses

Study	Diagnosis	Time period of costs	Individual or population	Direct costs	Indirect costs
Andersson and Kartman (1995) [SW]	Cardiovascular disease	1 year	individual	SEK 40,052	SEK 38,225
Eisenstein, Shaw et al. (2001) [US]	Cardiovascular disease	10 years	individual	(US) \$44,663 – (US) \$46,423	N/A
Etemad and McCollam (2005) [US]	Cardiovascular disease: acute coronary syndrome	1 year	individual	(US) \$22,503	N/A
Javitz, Ward et al. (2004) [US]	Cardiovascular disease: chronic angina	1 year	population	(US) \$2 billion - (US) \$33 billion	N/A
Russell, Huse et al. (1998) [US]	Cardiovascular disease: coronary artery disease	1 year	individual	(US) \$1,051 - (US) \$17,532	N/A
Sasser, Rousculp et al. (2005) [US]	Cardiovascular disease	1 year	individual	(US) \$12,055	(US) \$4,990
Shaw, Merz et al. (2006) [US]	Cardiovascular disease: coronary artery disease	1 year	individual	(US) \$6,448 - (US) \$10,680	(US) \$1830 - (US) \$2221
Taylor, Scuffham et al. (2007) [FR, GE, IT, SP, UK];	Cardiovascular disease: acute coronary syndrome	1 year	population	€1.9 billion [UK], €1.3 billion [FR], €3.3 billion [DE], €3.1 billion [IT], €1.0 billion [SP]	N/A
Zethraeus, Molin et al. (1999) [SW]	Cardiovascular disease: coronary heart disease	1 year	individual	SEK 40,791 – SEK 95,874	SEK 23,716– SEK 102,292
Bilde, Rud Svenning et al. (2007) [DK]	COPD	1 year	population	DKK 1.9 billion	N/A
Britton (2003) [UK]	COPD	1 year	individual	£819	£820
Chapman, Bourbeau et al. (2003) [CA]	COPD	1 year	individual	(CA) \$1,998	(CA) \$1,198
Dal Negro, Rossi et al. (2003) [IT]	COPD	1 year	individual	(US) €1,261	€47
Detournay, Pribil et al. (2004) [FR]	COPD	1 year	individual	€4,366	N/A
Foster, Miller et al. (2006) [US]	COPD	1 year	individual	(US) \$2,700 - (US) \$5,900	N/A
Foster, Miller et al. (2006) [US]	COPD	1 year	population	(US) \$21.8 billion	(US) \$17 billion
Halpern, Stanford et al. (2003) [US]	COPD	1 year	individual	(US) \$4,119	(US) \$1,527
Izquierdo (2003) [SP]	COPD	1 year	individual	€3,238	€300
Jansson, Andersson et al. (2002) [SW]	COPD	1 year	individual	SEK 5,592	SEK 7,828
Masa, Sobradillo et al. (2004) [SP]	COPD	1 year	population	€239 million	N/A
Miller, Foster et al. (2005) [US]	COPD	1 year	individual	\$2,507	N/A

Study	Diagnosis	Time period of costs	Individual or population	Direct costs	Indirect costs
Miravittles, Murio et al. (2003) [SP]	COPD	1 year	individual	(US) \$1,484 - (US) \$2,911	N/A
Piperno, Huchon et al. (2003) [FR]	COPD	1 year	individual	€530	€1,078
Rutten-van Mólken, Postma et al. (1999) [NE]	COPD	1 year	population	(US) \$346 million	N/A
Sullivan, Ramsey et al. (2000) [US]	COPD	1 year	population	(US) \$14.7 billion	(US) \$9.2 billion
Tynan and Lane (2005) [IR]	COPD	1 year	individual	€4,730	€668
Wouters (2003) [NE]	COPD	1 year	individual	€614	€410
ADA (1998) [US]	Diabetes	1 year	population	(US) \$44 billion	
ADA (2008) [US]	Diabetes	1 year	population	(US) \$116 billion	(US) \$58 billion
Henriksson, Agardh et al. (2000) [SW]	Diabetes	1 year	individual	SEK 25,000	N/A
Henriksson and Jönsson (1998) [SW]	Diabetes	1 year	population	SEK 2 billion	SEK 3 billion
Hogan, Dall et al. (2003) [US]	Diabetes	1 year	population	(US) \$92 billion	(US) \$40 billion
Köster, von Ferber et al. (2006) [DE]	Diabetes	1 year	individual	€5,262	€5,019
Lucioni, Garancini et al. (2003) [IT]	Diabetes	1 year	individual	€2,991	N/A
Lucioni, Garancini et al. (2003) [IT]	Diabetes	1 year	population	€5 billion	N/A
Ng, Jacobs et al. (2001) [US]	Diabetes	1 year	individual	N/A	\$3,700 - \$8,700
Oliva, Lobo et al. (2004) [SP]	Diabetes	1 year	individual	€1,290–€1,476	N/A
Rubin, Altman et al. (1994) [US]	Diabetes	1 year	individual	(US) \$9,493	N/A
Longo, Fitch et al. (2006) [CA]	Cancer	1 year	individual	N/A	(CA) \$7,020
Hensley, Dowell et al. (2005) [US]	Cancer: breast cancer (follow-up)	1 year	individual	(US) \$630	N/A
Lidgren, Wilking et al. (2007a) [SW]	Cancer: breast cancer	1 year	population	SEK 895 million	SEK 2 billion
Lidgren, Wilking et al. (2007b) [SW]	Cancer: breast cancer (follow-up)	1 year	individual	SEK 94,000 - SEK 351,000	N/A
Remák and Brazil (2004) [UK]	Cancer: stage IV breast cancer	lifetime	individual	£12,500	N/A
Sasser, Rousculp et al. (2005) [US]	Cancer: breast cancer	1 year	individual	(US) \$13,925	(US) \$8,236
Will, Berthelot et al. (2000) [CA]	Cancer: breast cancer	lifetime	individual	(CA) \$23,275 - (CA) \$36,340	N/A
Braud, Lévy-Piedbois et al. (2003) [FR]	Cancer: lung cancer	1 year	individual	€7369 - €13,969	N/A
Cakir Edis and Karlikaya (2007) [TR]	Cancer: lung cancer	1 year	individual	(US) \$5,480	N/A
Dedes, Szucs et al. (2004) [CH]	Cancer: lung cancer	1 year	individual	€19,212 - €20,992	N/A
Evans, Will et al. (1995a) [CA]	Cancer: lung cancer	5 years	individual	(CA) \$16,500 - (CA) \$29,860	N/A

Study	Diagnosis	Time period of costs	Individual or population	Direct costs	Indirect costs
Hillner, McDonald et al. (1998) [US]	Cancer: non-small cell lung cancer	2 years	individual	(US) \$37,514 – (US) \$52,797	N/A

CA = Canada; CH = Switzerland; DE = Germany; DK = Denmark; FR = France; IR = Ireland; IT = Italy; NE = The Netherlands; SP = Spain; SW = Sweden; TR = Turkey; UK = United Kingdom; US = United States

Appendix Table 2. Literature reviews covering chronic disease management

Diagnosis	Study	Cost reductions	Quality of care improvements	Health improvements
Integrated care or DMPs as a whole				
multiple diagnoses considered	Bodenheimer, Wagner et al. (2002)	✓ but insufficient evidence	N/A	✓
	Krause (2005)	✓	N/A	N/A
	MacAdam (2008)	✓	✓	✓
	Ouwens, Wollersheim et al. (2005)	✓ but insufficient evidence	✓	✓ but insufficient evidence
asthma	Mattke, Seid et al. (2007)	inconclusive evidence	inconclusive evidence	✗
COPD	Mattke, Seid et al. (2007)	insufficient evidence	insufficient evidence	insufficient evidence
depression	Badamgarav, Weingarten et al. (2003)	✗	✓	✓
depression	Mattke, Seid et al. (2007)	✗	✓	N/A
diabetes	Mattke, Seid et al. (2007)	inconclusive evidence	✓	✗
heart disease	McAlister, Lawson et al. (2001)	inconclusive evidence	✓	✓
	Mattke, Seid et al. (2007)	inconclusive evidence	✓	inconclusive evidence
Self-management support				
arthritis	Warsi, LaValley et al. (2003)	N/A	N/A	✓
COPD	Turnock, Walters et al. (2005)	N/A	✗	inconclusive evidence
	Deakin, McShane et al. (2005)	N/A	N/A	✓
diabetes	Faas, Schellevis et al. (1997)	N/A	N/A	insufficient evidence
	Loveman, Cave et al. (2003)	insufficient evidence	insufficient evidence	✓
	Norris, Engelgau et al. (2001)	inconclusive evidence	insufficient evidence	inconclusive evidence
	Norris, Nichols et al. (2002b)	insufficient evidence	insufficient evidence	✓
	van Dam, van der Horst et al. (2003)	N/A	N/A	✓
hypertension	Boulware, Daumit et al. (2001)	N/A	N/A	✓
	Fahey, Schroeder et al. (2003)	N/A	N/A	inconclusive evidence
Delivery system design				
multiple diagnoses considered	Smith, Allwright et al. (2007)	N/A	✗	✗
asthma	Ram, Jones et al. (2002)	N/A	insufficient evidence	insufficient evidence
COPD	Taylor, Candy et al. (2005)	N/A	insufficient evidence	✗

Diagnosis	Study	Cost reductions	Quality of care improvements	Health improvements
diabetes	Griffin and Greenhalgh (1998)	insufficient evidence	N/A	✓
	Loveman, Royle et al. (2003)	N/A	✘	✘
	Norris, Nichols et al. (2002a)	N/A	N/A	✓
heart disease	Page, Lockwood et al. (2005)	insufficient evidence	insufficient evidence	✓
Decision support				
asthma	Barton, Sulaiman et al. (2003)	N/A	N/A	inconclusive evidence
diabetes	Renders, Valk et al. (2000)	N/A	N/A	insufficient evidence
hypertension	Fahey, Schroeder et al. (2003)	N/A	N/A	✓
Clinical information systems				
multiple diagnoses considered	Garg, Adhikari et al. (2005)	N/A	inconclusive evidence	inconclusive evidence

Country experts

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