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Are disease management programmes (DMPs) effective in improving quality of care for people with chronic conditions?

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EVIDENCE FOR DECISION-MAKERS

ABSTRACT

Health Evidence Network (HEN) synthesis report on Disease Management Programmes

Chronic diseases account for most of the burden of disease in the European Region. Although there are effective interventions for the management of various chronic conditions, there are also wide practice variations in the delivery of care. DMPs are one of the measures intended to address this situation. DMPs organize care in multidisciplinary, multicomponent programmes, in a proactive approach focusing on the whole course of a chronic disease, using evidence-based standards of care.

This report is HEN's response to a question from a decision-maker. It provides a synthesis of the best available evidence, including a summary of the main findings and policy options related to the issue.

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Summary

The issue

Chronic diseases account for most of the burden of disease in the European Region. Although there are effective interventions for the management of various chronic conditions, there are also wide practice variations in the delivery of care. DMPs are one of the measures intended to address this situation. DMPs organize care in multidisciplinary, multicomponent programmes, in a proactive approach focusing on the whole course of a chronic disease, using evidence-based standards of care.

Findings

Most of the evaluated DMPs for chronic conditions have been shown to improve the management and control of the disease. There is a wide body of evidence on this for diabetes, depression, chronic heart failure and cardiovascular diseases.

There is evidence that DMPs improve providers' adherence to evidence-based standards of care.

There is no evidence about which components of a DMP are most important for improving quality of care.

There is no evidence of a direct link between DMPs and significant reductions in mortality or of improvements in quality of life.

There is no evidence on DMPs' cost-effectiveness.

Policy considerations

There is a need to improve the quality of care for people with chronic diseases. DMPs will achieve this goal for chronic conditions such as diabetes, depression, chronic heart failure and cardiovascular diseases. Although there is a clear link between improved management of chronic conditions and better health outcomes, there is no scientific evidence that specific DMPs improve the survival rate or quality of life. However, the absence of evidence does not mean absence of effect; it means it has not been studied.

Investments in DMPs may be costly. Therefore it is important to study the cost-effectiveness of any DMP before it is introduced on a large-scale.

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Introduction

Health care systems across the world are concerned with continuity of care, avoidance of medical errors, patient safety, effective delivery of services, and avoiding excessive variations in practice (*1*). Many countries in the World Health Organization European Region have implemented national quality strategies, such as accreditation systems, hospital quality management (for example by Total Quality Management, European Foundation for Quality Management) or external assessments such as league tables or audits (*2,3*).

Quality of care can be defined as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (*4*). This definition underlines a very important aspect of quality: its relationship to scientific knowledge about effective interventions. High quality care can be achieved only when interventions that work are applied to the right patients at the right time. Improving quality of care is thus a matter of defining and promoting best clinical practice, namely developing evidence-based clinical practice guidelines, or recommendations, and performing health technology assessments. Quality of health care can be improved by translating evidence from research into practice. This approach may reduce practice variations, and promote appropriate medical procedures.

Quality of health care delivery is not, however, only a matter of using evidence in practice. Organizational and structural aspects of delivery also have important implications for quality of care. For example, medical errors are often more attributable to structural problems and system design, than to individual professionals (*5*). Fragmentation of the health care system is also an important threat to

the quality of care. Both patients and professionals are concerned about the problems which may arise in the interfaces between outpatient and inpatient care, and among groups of professionals, organizational units or teams of care (*6*). A lack of continuity of care may delay appropriate measures, duplicate services, and lead to uncoordinated interventions. The quality of care of people with chronic conditions may be threatened by both insufficient transfer of evidence to practice and organizational problems. It has been maintained that the management of asthma, for example, does not satisfactorily correspond to the recommendations from evidence-based guidelines in Europe (*7*). There is room for improvement in applying evidence to everyday practice for patients with diabetes as well (*8*). It is common for a wide range of professionals and specialties to be involved in the care of patients with chronic conditions and therefore there is a need for improved coordination among providers to assure continuity and avoid duplication.

Several approaches have been proposed to transferring scientific evidence into practice. Disease management programmes (DMPs) have been introduced to implement evidence-based clinical practice (through guidelines, care protocols, and formulary lists of effective drugs), improve coordination among providers and assure comprehensiveness of care (*9*). There is no single definition of disease management programmes, however, they have three main features: a knowledge base, a delivery system with coordinated care components, and a continuous improvement process (*10*). The key elements of disease management are presented in Box 1.

Box 1. Disease Management: Key elements

- comprehensive care: multiprofessional, multidisciplinary, acute care, prevention and health promotion
- integrated care, care continuum, coordination of the different components
- population orientation (defined by a specific condition)
- active client-patient management tools (health education, empowerment, self-care)
- evidence-based guidelines, protocols, care pathways
- information technology, system solutions
- continuous quality improvement

Source: adapted from (9)

In sum, disease management is a means to coordinate care, focusing on the whole clinical course of a disease. Care is organized and delivered according to scientific evidence and patients are actively involved in order to achieve better health outcomes.

The purpose of this synthesis is to summarize available evidence about disease management programs and, if possible, to identify the key elements for their success, as compared to "standard" or "usual" care.

Sources for this review

We have undertaken a literature search to identify systematic reviews, technology assessment reports and meta-analyses assessing the effectiveness of DMPs (see appendices 1 and 2).

Findings

Evidence from Systematic Reviews[1]

Most of the disease management programmes that have been evaluated in appropriately designed studies have been shown to be effective - compared to "standard" or "usual" care - in improving the quality of care of patients with chronic conditions. In these studies quality has been measured by

[1] For further details see Tables 1 and 2 in the Annex.

providers' compliance with standards of care and by patients' ability to monitor their disease. The standards used are based on evidence from research and control of disease has been measured with validated surrogate outcomes (for example for diabetes by glycemic levels, and for asthma by forced expiratory volume). It has been shown that the risk of being hospitalized was reduced among chronic heart failure and coronary heart disease patients in DMPs, indicating a better control of the underlying condition. DMPs targeting coronary heart disease led to higher rates of prescription of beta-blockers, antiplatelet agents or lipid-lowering drugs. Programmes targeting congestive heart failure enhanced the rate of prescription of ACE-inhibitors. These drugs improve survival or symptom relief and are recommended in widely recognized clinical practice guidelines.

DMPs for patients with diabetes where more likely to lead to adequate control of glycated haemoglobin concentrations and they were more often screened for retinal, neurological, foot or renal complications. The improved rates of performance suggest that DMPs succeed in shifting care from a reactive approach (reacting to manifest complications) to a proactive one (anticipating potential complications).

The programmes evaluated in the systematic reviews included in this synthesis used different implementation strategies, and targeted a wide range of different interventions, providers and patients. The results suggest that DMPs enhance the adherence of providers to evidence-based standards, enhance continuity of care and improve patients' knowledge of their illness.

Gaps in evidence and conflicting results

Most of the evidence supporting the effectiveness of DMPs is based on evaluations of programmes for diabetes, depression,[2] coronary heart disease and chronic heart failure. For other chronic conditions, results are inconclusive. For example, DMPs targeting providers (with the exception of those for rheumatic symptoms) failed to improve adherence to evidence-based standards of care and to improve control of disease in persons with hyperlipidemia and/or hypertension. However, DMPs including interventions targeting patients led to improvements of disease control (with the exception rheumatoid arthritis and osteoarthritis). These findings are based on evaluations of a small number of programmes, and available evidence does not allow identifying the most successful implementation strategies for disease management. The ideal mix of interventions seems to differ with the target conditions.

Disease management is a very broad concept, including different content, forms of care and organization. Nearly each trial implemented a unique programme consisting of various components. This illustrates the heterogeneity of the concept of disease management. This is further demonstrated by the fact that no overlap of included studies was found between the review of McAlister et al. (*11*) and that of Weingarten et al. (*12*). The studies included in these two reviews all met the definition of disease management, however, they differed in their implementation to such an extent that no study was considered in both reviews. There is an obvious need to develop a more rigorous concept of disease management to allow for more reliable synthesis and conclusions.

Another important limitation is the heterogeneity of comparators. The studies in the reviews included here compared DMPs with "standard" or "usual" care. However, the organization and provision of care differs across and within health care systems.

None of the trials included in the systematic reviews compared incremental benefits of single components, and therefore it is not possible to draw conclusions about an ideal combination of DMP components. The descriptions of the programmes are too imprecise to reproduce these for other groups. The most effective mix of components of a disease management programme will most likely depend on the target condition and on the underlying health care delivery situation.

Although the DMPs which have been evaluated are effective in improving the quality of health care, as measured by an improved provider adherence to evidence-based standards and by disease control,

[2] We excluded psychiatric disorders from this synthesis, however a comprehensive review by Weingarten et al. (12) identified 25 programmes for depression.

no program has demonstrated statistically significant benefits on mortality or morbidity. In most assessments of DMPs these end-outcomes were not measured. The Weingarten review (ibid.), addressing programmes for 12 target conditions, did not include assessment of mortality. The protocol of the Norris et al. review (*13*), focusing on diabetes, included all-cause mortality, but the reviewers did not find any adequate trial reporting on it. The effect of disease management on mortality was evaluated by McAlister et al. in their two reviews (on coronary heart disease and chronic heart failure). They found no statistical significant difference in patient mortality between DMPs and other provisions of care.

Since DMPs contribute to improved control of chronic diseases, one might expect that survival would also improve. There are two possible explanations for the lack of a measurable effect on mortality: First, the design of the trials may have been inadequate to measure a significant impact on mortality. For example the studies' follow-up time was relatively short (a median of 12 months). Second, whereas the care for a programme's target conditions improves, other accompanying diseases might be neglected or become undertreated. This would dilute any positive survival effect of the programme. The strong focus on a particular disease, risk factor or symptom has also been claimed to be one of the possible negative effects of DMPs, however there is no evidence for this. The long-term impact of DMPs on health and health care systems still needs to be evaluated. The impact of DMPs on patients' quality of life and on patients' and providers' satisfaction also remains to be assessed, as does evaluation of their cost-effectiveness.

Strength of the evidence
The evidence summarized in this synthesis report is based on published systematic reviews, both randomized controlled trials - claimed to represent the highest level of evidence (*14*) - and non-randomized controlled trials or controlled before/after studies, which have been judged acceptable in evaluation of organizational interventions (*15*).

The strongest evidence available relates to programmes targeting diabetes, coronary heart disease and cardiac heart failure. On the basis of the findings of the review by Norris et al., the United States Task Force on Community and Preventive Services has strongly recommended disease management as effective interventions for improving the care of diabetes (*16*). The evidence was qualified as strong, because several studies of adequate design and good management found consistent results (*17*). Nevertheless, this recommendation is based only on improvements of validated surrogate outcomes, since evidence of effectiveness in reducing mortality or morbidity was insufficient.

Other aspects

Conditions for successful implementation of DMPs
The included systematic reviews do not warrant conclusions about the relative effectiveness of the single components of a programme. The programmes were too heterogeneous and the descriptions of the interventions and implementation strategies not detailed enough.

The following assumption can be made about factors in the success of a disease management programme: A DMP seems to be suitable for conditions for which there are wide practice variations and poor outcomes, due to problems in continuity of care and finding evidence of interventions' effectiveness. The existence of evidence may be viewed as the essential condition for successful implementation of DMPs. This ensures credibility and acceptance of a programme (*10*) as well as the possibility of assessing its impact.

Disease management requires behavioural changes, in both providers and patients (*9*). Different education and training strategies, feedback and reminder systems, targeting patients and/or providers are some of the strategies to achieve this. No evidence is available for any recommendation about the ideal mix of interventions. The choice will depend on the condition and on the determinants of poor or

good outcomes. For example, if patient compliance is crucial in achieving good outcomes, the focus of the programme should be on patient behaviour. The motivation of the different stakeholders is another key determinant for achieving behavioural changes. It has been suggested that the motivation for providers to support a programme may be threatened if its focus is mainly on cost containment (*10*). In defining the goals of the programme it therefore seems important to achieve a balance between quality of care, satisfaction of providers and patients, and cost. The use of financial incentives could be a method to enhance DMP adherence. It should, however, be limited to activities for which there is strong evidence of effectiveness, and needs to be designed carefully in order to avoid unintended negative effects (*18*).

Continuous quality improvement has also been suggested as a key feature for the success of DMPs. A system of indicators of performance and outcomes should be considered an essential component of disease management (*10*).

The disease management approach needs to have a long-term perspective (*10*). Some of the outcomes, like provider adherence to evidence-based standards of care or improvements in some surrogate parameters, may be measurable in the short and medium terms, but programmes should include strategies to assure sustainability of these results in the long term.

Box 2. Critical Factors in the Design of successful Disease Management Programmes

- suitable target condition
- evidence base
- consideration of barriers to implementation
- strategies to change attitudes of stakeholders
- balance of economic and quality of care goals
- strategies for continuous quality improvement
- strategies for evaluation of cost-effectiveness

Cost and cost-effectiveness
When DMPs were introduced for the first time in the United States, their primary goal was to achieve cost savings (*19*). The implementation of DMPs requires substantial investments. The costs of developing and establishing a programme, including training and information technologies (especially hardware and software), need to be considered in evaluations of disease management (*9*). The available evidence about reduced episodes of hospitalization and reduced rates of complications from chronic disease have been claimed to be potentially cost-saving. However, there is no evidence to conclude that DMPs are more cost-effective than standard care. Another important gap relates to the ideal allocation of resources to the different components of a programme.

Potential social implications
Concerns have been raised about the ethical and social implications of DMPs (*9*). Patient autonomy might be threatened by the reduction of freedom of choice resulting from standardization. It is also necessary to make clear which of the providers should play the coordinating role in DMPs, and on the implications this may have for the responsibilities of others towards the individual patient (*9*).

Many DMPs have been developed with the assistance of commercial interests, notably the pharmaceutical industry. Concerns have been expressed that this could lead to unintended consequences for the health care system, or that DMPs might be used as a marketing tool for certain drugs or medical devices (*20, 21*).

Ongoing Projects and Present trends
The following projects are examples of ongoing DMPs in Europe:

Maastricht Project (*22*): In January 2000 a DMP for patients with diabetes was implemented in the Maastricht region in The Netherlands. The explicit aim is to improve the quality of care for patients with diabetes. The programme's elements are: a core team of general practitioners, nurse specialists and endocrinologists; cooperation with other caregivers (e.g. ophthalmologists, dieticians); protocols stating routes of care, responsibilities and tasks; provision of care according to clinical practice guidelines; and systematic collection of data about patient contacts in order to monitor each patient and assess practice variations among providers. By January 2001, 42 general practitioners with 2100 patients were enrolled in the project. The intervention is being evaluated.

National Service Frameworks: The United Kingdom's 1997 Government White Paper *The New NHS* set out the plan for the modernization of the British NHS. As a result, National Service Frameworks (NSFs) have been established by the NHS to enhance the quality and efficiency of the system. Strictly speaking, the NSFs are not DMPs; however, they represent a systematic effort to improve care for particular conditions or groups of patients, and share some elements of disease management. They approach the whole course of a condition and the state's comprehensive strategies to organize care with the aim of improving outcomes. The NSFs set national evidence-based standards of care ─ including organizational interventions ─ formulate service delivery strategies and establish performance measures to evaluate progress. At present, NSFs cover cancer, paediatric intensive care, mental health, coronary heart disease, gerontology and diabetes. There are NSFs in preparation for renal services, children's services and long-term neurological conditions (*23*).

German Disease Management Programmes: A health care reform act passed in 2001 provided the basis for the implementation of DMPs in Germany. The programmes are offered by the health funds must be accredited by the Federal Insurance Office, a governmental agency charged with the supervision of social insurances. Implementation of DMPs is linked to financial incentives for the health funds, as enrolled patients are calculated separately in the inter-sickness fund risk compensation mechanism. Evidence-based minimum standards and criteria for enrollment are proposed by the Coordinating Committee (a self-governing body including sickness funds and providers representatives) and subsequently passed by the Ministry of Health and Social Security. As of now, standards have been set for diabetes type II, breast cancer and coronary heart disease. In 2003 standards will be provided for programmes in diabetes type I, asthma, and chronic obstructive pulmonary disease. The first programme was accredited in April, 2003, for breast cancer in the region of North-Rhine. A contract between all the regional health funds the regional physicians' association provides care for women with breast cancer in the context of structured disease management. About 950 gynaecologists and 20 hospitals will participate in the programme (*24*).

Conclusions

- The organization of care in multidisciplinary, multicomponent programmes, with a proactive approach focusing on the whole course of a chronic disease, applying the ideas of evidence-based medicine for the formulation of standards of care, can be considered the core of DMPs.
- The heterogeneity of DMPs, and their dependence on context, complicate the transferability of findings to other settings other than those of their evaluation. There is no single DM model to be applied everywhere.
- DMPs improve the quality of care of people with chronic diseases, as measured by performance indicators. However, there is no evidence available on DMPs' impact on survival, quality of life or on their relative cost effectiveness.
- It is not possible to identify an ideal mix of components for a DMP to be effective.
- There is a need to evaluate the economic, social and ethical implications of disease management programmes.

Policy considerations

There is no evidence available about long-term health outcomes, impact on quality of life or relative cost-effectiveness of DMPs. Therefore, in considering DMPs as a strategy to improve quality of care and to tackle unacceptable variations in practice, such programmes should be introduced only in controlled settings where it is possible to evaluate their costs and benefits.

Aside from whether DMPs are introduced or not, the question of providing care according to evidence-based standards should be at the centre of any initiative aiming at improving quality of care and in strategies to reduce unacceptable variations in health care delivery.

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Annex 1: Synthesis Methods

This synthesis report is based on a literature search for evidence from systematic reviews, health technology assessment reports and meta-analyses concerning the effectiveness of disease management programmes for chronic illnesses. The following databases were searched: Cochrane Library, INAHTA Database, Medline, EMBASE, Sociological Abstracts, SCI, SSCI, the Database of the Campbell Collaboration and Educational Resources Information Centre (ERIC) database. We used combinations of the following keywords: "disease management program*[3]", "comprehensive multidisciplinary program*", "case management program*", "chronic disease", "chronic illness*". For the Medline-search we used a validated search filter from the York Centre for Reviews and Dissemination (available at http://www.york.ac.uk/inst/crd/search.htm). The database searches were completed with an internet-based manual search for reports of INAHTA members. Only systematic reviews, meta-analyses and health technology assessment reports were included; reports from primary studies were excluded, as were studies of interventions for psychiatric conditions and interventions solely targeting children or adolescents. To be included, the reviews had to clearly state their definition of disease management or at least state the components of their disease management programmes.

Of a total of twelve potentially eligible systematic reviews, eight were excluded. The reasons for exclusion are listed in table 3 of Annex 2. Four systematic reviews were taken into account in this synthesis report. One dealt with disease management programmes for different conditions (*12*), one focused on heart failure (*25*), one focused on coronary heart disease (*11*) and one on diabetes (*13*).

[3] *Indicates the use of wildcard.

Annex 2: A review of included and excluded studies in this synthesis report

Table 1. Characteristics of the Included Reviews

Reference	PY	Working definition of Disease Management	Conditions	Databases and Period searched	Selection criteria	Studies included and Synthesis Method	Outcomes
Weingarten et al.	2002	"an intervention defined to manage or prevent a chronic condition using a systematic approach and potentially employing multiple treatment modalities" whereby systematic approach to care was defined as "systematically developed statements to assist practitioner and patient decisions about appropriate health care for a specific clinical circumstance."	Asthma Back Pain Coronary Artery Disease Chronic pain Chronic obstructive pulmonary disease Depression* Diabetes End-stage renal disease Hyperlipidemia Hypertension Rheumatoid arthritis	Medline Cochrane Library HealthStar January 1987- June 2001	Inclusion English language Design: randomized controlled trial, controlled clinical trial, controlled before and after study, interrupted time series study. *Exclusion* Interventions aiming only at improving drug compliance Programmes targeting only children Evaluations of single treatments	Identified: 16 917 Selected: 102 studies, reporting 118 programmes Results were pooled in meta-analysis (random effects empirical Bayesian method) to obtain estimates of effect size.	Provider adherence to guidelines (depending on condition e.g. beta-blocker prescribing rate, ACE-inhibitors prescribing rate, screening for retinal complications, etc.) Disease Control (depending on condition e.g. re-infarction, systolic blood pressure, LDL cholesterol blood concentration)

McAlister et al.	2001a	No explicit working definition of disease management reported; however, programme components of the selected studies are compatible with the elements of disease management as stated in Box 2.	Heart failure	Medline (1966-1999) Embase (1980-1998) Cinahl (1982-1999) Sigle (1980-1998) Cochrane Library (period not stated)	Inclusion Design: randomized controlled trials Outpatient interventions Exclusion Inpatient interventions Design not randomized	Identified: 416 Selected: 11 trials reporting programmes: 10 Results pooled in meta-analysis (fixed effects model), to obtain risk ratios. Sensitivity analysis was made, heterogeneity was tested.	**All-cause mortality** **Hospitalization rate** At least one admission during follow-up
McAlister et al.	2001b	No explicit working definition of disease management reported, however programme components of the selected studies are compatible with the elements of disease management as stated in Box 2.	Coronary heart disease	Medline (1966-1999) Embase (1980-1998) Cinahl (1982-1999) Sigle (1980-1998) Cochrane Library (period not stated)	Inclusion Secondary prevention of CHD Design: randomized controlled trials Exclusion Design not randomized Evaluated single interventions Enrolled no more than 50 patients Primary prevention of CHD	Identified: 1562 Selected: 12 trials reporting programmes: 12 Results pooled in meta-analysis (fixed effects model), to obtain risk ratios or effect size estimates. Sensitivity analysis was made, heterogeneity was tested.	**All-cause mortality** Re-infarction rate Hospitalization rate At least one admission during follow-up Provider adherence to guidelines (prescription of antiplatelet agents, beta-blockers or lipid lowering drugs) Disease Control (cholesterol concentration, blood pressure, smoking cessation)

Norris et al.	2002	"an organized, proactive, multi-component approach to healthcare delivery that involves all members of a population with a specific disease entity such as diabetes. Care is focused on and integrated across the entire spectrum of the disease and its complications, the prevention of comorbid conditions and the relevant aspects of the delivery system."	Diabetes	Medline (1966-2000) ERIC (1966-2000) CINAHL (1982-2000) HealthStar (1975-2000)	Inclusion Primary studies of disease management Conducted in Established Market Economies (as defined by the World Bank) Contain information on at least one of the outcomes of interest Meet pre-defined minimum-quality standard	Identified: 622 Selected: 27 Structured qualitative synthesis, using descriptive statistics and classifying results by "Strength of Evidence" following pre-set rules No formal meta-analysis was done.	**Provider adherence to guidelines** (monitoring of glycated haemoglobin(GHb), lipid concentration control, foot exams, control of proteinuria, screening for retinal complications) <u>Disease Control</u> (GHb concentration, weight, body mass index, blood pressure, lipid concentrations, quality of life) <u>Health care utilization</u> (hospitalization rate, no. of visits) <u>Other</u> (patient knowledge on condition, self-monitoring, etc.)

* We did not considered the data on depression, as we excluded psychiatric conditions form our synthesis.

Table 2. Results from the Included Reviews

Reference	**Components of disease management programmes**	**Summary of Results**
Weingarten et al. 2002	Provider education: Instruction and/or materials stating appropriate care for the condition targeted by the programme Provider feedback: Information concerning results of care or experiences from patients Provider reminders: Prompts to perform specific actions Provider financial incentives: Payments for achieving specific performance goals Patient education: Instruction and/or materials providing information on the condition and its management Patient reminders: Prompts to perform specific actions Patient financial incentives: Payments for achieving specific treatment goals	**Components included in programmes** 78% of the programmes included patient education 40% of the programmes included provider education 27% of the programmes included provider feedback 24% of the programmes included patient reminders 16% of the programmes included provider reminders 5% of the programmes included patient financial incentives None of the programmes included provider financial incentives 59% of the programmes used 2 or more components Provider adherence to guidelines was improved by programmes including: Provider feedback, provider reminders, provider education Disease Control was improved by programmes including: Provider education, provider feedback, provider reminders, patient education, patient reminders, patient financial incentives

McAlister et al. 2001a	Provider education: Instruction and/or materials stating appropriate care for the condition targeted by the programme Provider feedback: Information concerning results of care or experiences from patients Multidisciplinary follow-up: Multidisciplinary team providing specialized and intense follow-up (i.e. home visits) Patient education: Instruction and/or materials providing information on the condition and its management Patient reminders: Prompts to perform specific actions	All programmes included more than two components All cause mortality The programmes did not reduce the risk of death with statistical significance (RR 0.94; 95%CI: 0.75-1.19) Hospitalization rate The programmes reduced the risk of being hospitalized (RR 0.87; 95%CI: 0.79-0.96) Provider adherence to guidelines Data were not pooled, 2 of three trials reporting this outcome found significant improvement within the programmes

McAlister et al. 2001b	Provider education: Instruction and/or materials stating appropriate care for the condition targeted by the programme Multidisciplinary follow-up: Multidisciplinary team providing specialized and intense follow-up (i.e. home visits) Patient education Instruction and/or materials providing information on the condition and its management. Patient reminders: Prompts to perform specific actions	**All programmes included more than two components** **All-cause mortality** The programmes did not reduce the risk of death with statistical significance **(RR 0.91; 95%CI: 0.79-1.04)** **Re-infarction rate** The programmes did not reduce the risk of re-infarction with statistical significance (RR 0.94; 95%CI: 0.80-1.10) **Hospitalization rate** The programmes reduced the risk of being hospitalized (RR 0.84; 95%CI: 0.76-0.94) Provider adherence to guidelines Antiplatelet agents were more likely to be prescribed to the patients in the programmes (RR 1.07; 95%CI: 1.03-1.11). Beta-blockers were more likely to be prescribed to the patients in the programmes (RR 1.19; 95%CI: 1.07-1.32). Lipid lowering agents were more likely to be prescribed to the patients in the programmes (RR 2.14; 95%CI: 1.92-2.38). **Disease Control** Data were not pooled, but 5 of 8 trials reporting this outcome found significant improvement within the programmes.

Norris et al. 2002	**Identification of population** **Guidelines of performance standards** Management of identified people Information systems for tracking and monitoring Additional interventions (patient education, patient reminders, provider education, provider reminders)	**Provider adherence to guidelines** *Strong evidence* of effectiveness of disease management to improve provider adherence to guidelines in monitoring of GHb and retinal complications screening *Sufficient evidence* of effectiveness of disease management to improve provider adherence to guidelines in screening for foot lesions or peripheral neuropathy, monitoring of lipid concentrations, and proteinuria. **Disease Control** Strong evidence for the effectiveness of disease management to improve the concentration of GHb. For all other outcomes evidence was deemed *insufficient.* The evidence was interpreted to be applicable for adults with diabetes in USA and Europe being treated in managed care organizations and community clinics.

Table 3. Excluded Papers with Reasons

Reference	Reason for exclusion
Ferguson JA, Weinberger M. Case management in primary care. *J Gen Intern Med* 1998, 13:123-126.	Focused mainly on *case-management*. The disease management studies included in this review were considered also in the more comprehensive reviews included in this synthesis.
Gillespie J. The value of disease management –Part 1: Balancing cost and quality in the treatment of congestive heart failure: A review of disease management services for the treatment of congestive heart failure. *Dis Manage* 2001, 4:41-51.	This paper included studies of inadequate design.
Gillespie JL. The value of disease management –Part 2: Balancing cost and quality in the treatment of diabetes mellitus. An annotated bibliography of studies on benefits of disease management for the treatment of diabetes mellitus. *Dis Manage* 2002, 5:37-50.	This paper was judged to be an unsystematic review.
Lee TA, Weiss KB. An update on health economics of asthma and allergy. *Curr Op Allergy Clin Immunol* 2002, 2:195-200.	No clear selection criteria, no definition of the intervention. This paper was judged to be an unsystematic review.
Philbin EF. Comprehensive multidisciplinary programmes for the management of patients with congestive heart failure. *J Gen Int Med* 1999, 14:130-135.	This systematic review was based mainly on studies of inadequate design to assess effectiveness (validity threatened).
Renders CM, Valk GD, Griffin S, Wagner EH, Eijk JTM, Assendelft WJJ. Interventions to improve the management of diabetes mellitus in primary care, outpatient and community settings (Cochrane Review). In: *The Cochrane Library*, Issue 1, 2003. Oxford: Update Software.	This review was of wide scope and did not especially focus on disease management. Many of the interventions evaluated in this review may be part of disease management programmes, but were not analyzed as such. The relevant studies concerning disease management were also included in the other reviews considered in our synthesis.
Rich MW. Heart failure disease management: a critical review. *J Card Fail* 1999, 5:64-75.	Neither sources, nor search strategy, nor selection criteria were stated. This paper was judged to be an unsystematic review.
VATAP (2000). Impacts of case management programmes. Brief assessment of health care technology. Number 4. (http://www.va.gov/resdev/prt/ta_short_7_00.pdf, retrieved 2003-05-08).	This rapid technology assessment was dealing with another intervention (case-management).

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