

# Service improvement tools for the prevention, diagnosis and management of chronic diseases

## Final report

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# Executive Summary

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## Objectives

This systematic literature review was commissioned by the National Health Priority Action Council to address three principle objectives. The first objective was to identify tools aimed at improving the delivery of health care services in the National Health Priority Areas (NHPA) of arthritis and musculoskeletal conditions, asthma, cancer, diabetes mellitus, cardiovascular disease and stroke. This also included tools that are universally applicable and are used at the jurisdictional, national, and international level. The second objective was to evaluate the effectiveness of these tools, and third, to identify the critical success factors that enable these tools to improve the quality of health care.

## Approach to assessment

A systematic and comprehensive search of the medical and health literature was conducted to identify relevant studies and reviews of organisational approaches for the improvement of health service delivery, including tools that were specific to each NHPA and those that had a more universal application. From an initial set of over 19,000 citations, 910 were collected for closer scrutiny. Health service improvement tools were identified in 455 studies. Brief descriptions of these tools are provided. Those studies (78) that satisfied the inclusion criteria delineated in a review protocol were appraised for methodological quality and assessed as to the effectiveness of the tool. The evidence presented in the included studies was classified according to the strength of the evidence, size of the effect, and relevance of the evidence. Data were extracted and critical success factors were ascertained, where possible.

## Results

The health service improvement tools identified in this review have been categorised, for comparative purposes, into 13 groups:

- **Clinical Practice Guidelines** - systematically developed statements (either consensus or evidence-based) to assist practitioner decisions about appropriate health care for specific clinical circumstances.
- **Continuous Quality Improvement** - an iterative process of problem-solving and group decision-making that centres on the analysis of organisational systems and work processes, and is designed to deliver improvements in health outcomes.
- **Educational tools** - any replicable educational activity or program intended to improve the performance of health care providers and the health status of patients through increased knowledge. This includes, for example, educational materials, continuing medical education, educational outreach (academic detailing), and opinion leaders.

- **Decision support** – computerised or written protocols that are aimed at assisting the patient or health care provider make health care decisions.
- **Prompts and reminders** - any intervention (computerised or written) that prompts the health care provider or patient to perform a clinical action, particularly in the promotion of well-established and effective clinical practices.
- **Feedback** - involves evaluating the performance and consequences of health care decisions or actions after they have been made. This includes audit and feedback which summarises clinical performance over a specified period, and according to specified benchmarks, with or without recommendations for clinical action.
- **Financial incentives** - involve some form of payment system, whereby individual health care providers receive remuneration that directly affects their personal disposable income.
- **Record systems** – any system developed for the storage and exchange of information. Record systems vary considerably and include manual or computerised versions, centrally-held or patient-held records, and structured or unstructured systems.
- **Telemedicine** - involves the use of telecommunications as a medium to deliver medical services to sites distant from the health care provider. It utilises conventional telephone services, computer modems, satellites, and other equipment or software to transmit and receive data.
- **Patient-centred approach** - involves shared decision-making between patients and health care providers concerning interventions or management of patients' illnesses, as well as an holistic approach to treatment with the focus on the patient as a person, rather than the illness.
- **Alternative care approaches** – use an alternative setting for health care or a different health care provider than that traditionally utilised.
- **Interdisciplinary approaches** – involve representatives of different health disciplines working collaboratively to tailor treatment and management options and strategies to a particular patient.
- **Multi-faceted interventions** - employ two or more tools (such as those described above) to address several aspects of health care from a variety of perspectives.

Almost all of these categories of tools have been applied in the areas of diabetes, cancer, and cardiovascular diseases, whereas relatively fewer categories were used in studies involving asthma and arthritis patients. Universally applicable tools and those used to improve cancer services were found to apply across the continuum of care, excepting rehabilitation. Similarly, tools used to improve service in the area of cardiovascular disease and stroke were applied at all levels of care, excepting palliation. In contrast, the service improvement tools identified in the area of diabetes care were used exclusively

for the management of the disease. Arthritis and asthma tools were similar in that they focussed predominantly on diagnosis, treatment and management of the disease.

In general, the universally applicable tools that were most effective at improving the *process* of service delivery were interactive educational tools, including academic detailing, as well as prompts and reminders, and multi-faceted interventions. The most effective tools for improving the process of health service delivery in the area of arthritis and musculoskeletal conditions were interactive educational tools and decision support, whereas asthma services benefited from interactive educational tools and feedback. Cancer service delivery benefited most through the use of decision support and prompts and reminders. There was a wider range of tools found to be effective at improving service delivery to cardiovascular disease and stroke patients (i.e. continuous quality improvement, academic detailing, decision support, prompts and reminders, alternative care approaches, and multi-faceted interventions). In contrast, only the multi-faceted interventions appeared to improve the delivery of diabetes services.

In studies where patient health was also an outcome that was assessed, service improvement tools appeared to have limited impact. Interactive educational tools were found to impact slightly on the health of asthma patients, and patients with cardiovascular disease appeared to receive marginal benefit from alternative care approaches and some multi-faceted interventions. There are several possibilities as to why service improvement tools appeared to have little impact on patient health: (1) chronic disease management is multi-factorial, with considerable responsibility (e.g. compliance, lifestyle modification) resting with the patient as opposed to the health provider, (2) impact (patient-relevant) outcome measures are often not measured or are measured inadequately (e.g. unvalidated tools) or (3) follow-up is of insufficient duration to capture a change in health status.

Among the better quality studies that were evaluated, there was considerable heterogeneity, particularly in the intensity, complexity, and duration of interventions, and in the settings, levels of care, and targeted behaviours. However, several common features of the more effective tools have become apparent.

- Clear and focussed objectives;
- Simple interventions – concise, convenient and accessible interventions, requiring relatively little input and easily integrated into existing procedures;
- Credible/ trustworthy information sources;
- Repetition and reinforcement of messages;
- Relevance to the targeted health provider or patient – including the disease or problem, patient characteristics and setting;
- Interaction and personalised contact – requiring active participation rather than the passive dissemination/receipt of information;
- Use of pre-disposing strategies – consultation with health care professionals to enhance motivation to comply; tailoring strategies on the basis of needs-based assessments;

- Use of enabling strategies – removal of barriers to change, such as procedural or equipment limitations and perceived threats to providers’ autonomy or competence; and
- Combining effective strategies – addressing a focussed issue using a variety of well-chosen tools that are appropriate for the specific objective.

## Conclusions

Although some tools appear to be more effective than others in bringing about changes in health providers’ performance, most notably the interactive educational tools - no single tool is always effective. The targeted behaviour, context, culture, setting, and available support influence the extent to which improvements are likely to occur. There are, however, certain critical success factors that appear to facilitate the impact of a health service improvement tool.

Few studies have shown changes that provide significant benefit to patients’ health – either because the impact of the tool on the patient was not measured, or because it had no effect. In the cases where the impact was measured, only three tools - an interactive continuing medical education program for asthma, and an alternative care or multi-faceted approach for cardiovascular disease - appeared to have some effect on the patient, although this was negligible. Appropriate study design, longer follow-up and constant reinforcement may be necessary to detect sustainable improvements at the level of the patient.

# Background

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## Rationale for Assessment

The National Health Priority Action Council (NHPAC) is seeking to improve health services across the continuum of care in the National Health Priority Areas (NHPA) of arthritis and musculoskeletal conditions, asthma, cancer, diabetes mellitus, cardiovascular disease and stroke.

This project focuses on identifying and appraising available service improvement tools (international, national and jurisdictional) dedicated to the delivery of high-quality health care for patients suffering chronic illness in the National Health Priority Areas (NHPA). It examines tools designed to improve clinical service across all levels of care – prevention, detection, treatment, management, rehabilitation and palliation. In addition, the project seeks to identify the critical success factors that enable these tools to improve the quality of health care.

Health care quality has been 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”* (Rubin et al. 2001). Over 30 years ago, Donabedian proposed that health care quality be measured by observing its structure, processes and outcomes (Donabedian 1966). Although assessing the quality of health care is important, it is part of a dynamic process that includes finding effective and reliable approaches to improving health outcomes for patients and assisting health care professionals in keeping up with advances in health care knowledge and technology. Among the variety of approaches that have been applied in a range of health care settings, the challenge is to determine those that achieve beneficial outcomes and identify the critical elements that may be reproduced in other health areas.

# Objective

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## Assessment Objective

The principle objective of this review was to identify the tools aimed at improving clinical service in the National Health Priority Areas (NHPA) across all levels of care and to evaluate their success in terms of health care improvement.

Health service improvement tools were defined as: Any organised proactive approach committed to improving health care delivery - a strategy, model or system that involves health care professionals working together as a team.

## Research Questions

The three main research questions that this report was commissioned to investigate were:

1. What tools (international, national and jurisdictional) have been used to improve health service delivery in the NHPA?
2. How have these tools been implemented across the continuum of care – prevention, detection, treatment, management (primary and acute settings), rehabilitation and palliation?
3. Have these tools been successful in improving health care? If so, what factors have contributed to their success?

These questions have been applied to each NHPA and each area will be addressed separately.

# Approach to Assessment

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*“Systematic reviews provide information about the effectiveness of interventions by identifying, appraising, and summarising the results of otherwise unmanageable quantities of research”* (Khan et al. 2001).

The primary focus of systematic reviews in medicine is to integrate empirical research for the purpose of creating generalisations and thus to provide a rational basis for health care decision-making (Cooper & Hedges 1994; Mulrow et al. 1997).

The key components of a systematic review include: (1) the development of a specific research question or hypothesis; (2) a transparent methodical process defined *a priori* (i.e. a review protocol); (3) an exhaustive search for relevant primary research on the topic; (4) the critical appraisal of this research; (5) an attempt to answer the research question and to resolve conflicts in the literature; and (6) the identification of issues central to future research on the topic (Cooper & Hedges 1994; Mulrow et al. 1997; Clarke & Oxman 2000).

The following is an outline of the review protocol that was followed in undertaking this systematic literature review.

## Inclusion Criteria

Studies were included as part of this systematic review if they provided relevant information addressing the research questions. The inclusion criteria for including studies are given in Box 1.

## Box 1. Study selection criteria

<b>Research questions</b>	
<ol style="list-style-type: none"><li>1. What tools (international, national and jurisdictional) have been used to improve health service delivery in the National Health Priority Areas?</li><li>2. How have these tools been implemented across the continuum of care – prevention, detection, treatment, management, rehabilitation and palliation?</li><li>3. Have these tools been successful in improving health care? If so, what factors have contributed to their success?</li></ol>	
<b>Selection criteria</b>	<b>Inclusion criteria</b>
<b>Participants</b>	Health care organisations that implement strategies or programs aimed at improving health outcomes in patients with asthma, arthritis and musculoskeletal conditions, diabetes mellitus, cancer, cardiovascular disease and/or stroke. These health care organisations include hospitals, hospices, nursing homes and residential centres, rehabilitation centres, domiciliary services, and community clinics or groups of health care staff who work together as a team.
<b>Intervention</b>	Tools (strategies or programs) aimed at improving the service of a health care organisation and, ultimately, the health outcomes of patients. Tools cover all levels of health care, including prevention, detection, treatment, management, rehabilitation and palliation. Information is provided on the process of implementation, the target group enacting the new strategy, the tools that were used as part of the intervention, and the group targeted for improved health outcomes. Individualised interventions are excluded.
<b>Comparator</b>	"Standard or usual care" – established institutionalised care programs (not using health service improvement tools), or individualised approaches to treatment and management of patients, as determined by the attending health professionals.
<b>Outcomes</b>	<i>Process measures</i> – assessment of participation (behavioural change and compliance by staff), assessment of participant satisfaction, assessment of productivity (change in efficiency of health care organisation) and <i>Impact measures</i> – patient functional ability or health status, number of readmissions or duration of hospital stay, number of complications, patient ability to manage their disease (eg medication compliance), patient quality of life, patient satisfaction with clinical service improvement strategy, and sustainability of service improvement tool.
<b>Study design</b>	Randomised controlled trials (including cluster randomised controlled trials), concurrently controlled trials, controlled before-and-after studies, and interrupted time series*.
<b>Study duration</b>	Health service improvement tools were implemented for at least three months.
<b>Language</b>	Studies other than English language were translated and included only if they represented a higher level of evidence than that available in the English language evidence base.
<b>Baseline performance</b>	Baseline measurements or control group performance were delineated when determining the effectiveness of the service improvement tool so that the possibility of a "ceiling effect" <sup>#</sup> could be explored.

\* Study designs recommended by the Cochrane Effective Practice and Organisation of Care (EPOC) Review Group (Bero et al. 2002);  
# Ceiling effect = both control and intervention groups performance is close to 'best', meaning comparisons are not meaningful.

## Search Strategy

The medical and health literature was searched to identify relevant studies and reviews on organisational approaches to improvement in health service delivery, including tools that were specific to each NHPA and those that had a more universal application. The search period was from 1966 to September 2003. Table 1 describes the electronic databases that

were used for this search. Table 2 describes other potentially relevant sources of literature that were canvassed, including grey literature.

**Table 1. Electronic databases used for literature search**

Electronic Database	Time Period
AustHealth	1997-9/2003
Australian Medical Index	1996-9/2003
Australian Public Affairs Information Service (APAIS) - Health	1990-9/2003
Cinahl	1977-9/2003
Cochrane Library – including, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, the Cochrane Central Register of Controlled Trials (CENTRAL), the Health Technology Assessment Database, the NHS Economic Evaluation Database	1966-9/2003
Current Contents	1993-9/2003
Embase	1974-9/2003
Cochrane Effective Practice and Organisation of Care (EPOC) register	1995-9/2003
Pre-Medline and Medline	1966-9/2003
ProceedingsFirst	1993-9/2003
PsycInfo	1983-9/2003
Web of Science – Science Citation Index Expanded	1995-9/2003

Table 2 Other sources of evidence (1966 – 9/2003)

Source	Location
<i>Internet</i>	
NHMRC- National Health and Medical Research Council (Australia)	<a href="http://www.health.gov.au/nhmrc/">http://www.health.gov.au/nhmrc/</a>
Australian Department of Health and Ageing	<a href="http://www.health.gov.au/">http://www.health.gov.au/</a>
US Department of Health and Human Services (reports and publications)	<a href="http://www.os.dhhs.gov/">http://www.os.dhhs.gov/</a>
New York Academy of Medicine Grey Literature Report	<a href="http://www.nyam.org/library/greylit/index.shtml">http://www.nyam.org/library/greylit/index.shtml</a>
Scirus – for Scientific Information Only	<a href="http://www.scirus.com">http://www.scirus.com</a>
Trip database	<a href="http://www.tripdatabase.com">http://www.tripdatabase.com</a>
Current Controlled Trials metaRegister	<a href="http://controlled-trials.com/">http://controlled-trials.com/</a>
Health Technology Assessment International (HTAi)	<a href="http://www.htai.org/">http://www.htai.org/</a>
International Network for Agencies for Health Technology Assessment	<a href="http://www.inahta.org/">http://www.inahta.org/</a>
National Library of Medicine Health Services/Technology Assessment Text	<a href="http://text.nlm.nih.gov/">http://text.nlm.nih.gov/</a>
National Library of Medicine Locator Plus database	<a href="http://locatorplus.gov">http://locatorplus.gov</a>
U.K. National Research Register	<a href="http://www.update-software.com/National/">http://www.update-software.com/National/</a>
Websites of Health Technology Agencies	See Appendix A
Websites of Specialty Health Service Improvement Organisations	See Appendix B
<b><i>Hand Searching (Journals from 2002-9/2003)</i></b>	
<i>Quality in Health Care</i>	Library or electronic access
<i>Quality and Safety in Health Care</i>	Library or electronic access
<i>Quality Management in Health Care</i>	Library or electronic access
<i>Health Services Research</i>	Library or electronic access
<i>Preventive Medicine</i>	Library or electronic access
<i>Lancet</i>	Library or electronic access
<i>Medical Care</i>	Library or electronic access
<i>Medical Journal of Australia</i>	Library or electronic access
<i>New England Journal of Medicine</i>	Library or electronic access
<i>British Medical Journal</i>	Library or electronic access
<i>International Journal for Quality in Health Care</i>	Library or electronic access
<i>Joint Commission Journal on Quality Improvement</i>	Library or electronic access
<b><i>Specialty Journals in NHPA (2002 – 9/2003)</i></b>	
<i>American Journal of Cardiology</i>	Library or electronic access
<i>American Journal of Hypertension</i>	Library or electronic access
<i>Arthritis and Rheumatism</i>	Library or electronic access
<i>Cancer</i>	Library or electronic access
<i>Cancer Detection and Prevention</i>	Library or electronic access
<i>Chest</i>	Library or electronic access
<i>Diabetes Care</i>	Library or electronic access
<i>Diabetic Medicine</i>	Library or electronic access
<i>European Journal of Cancer</i>	Library or electronic access
<i>Journal of Rheumatology</i>	Library or electronic access
<i>Journal of Asthma</i>	Library or electronic access
<i>Journal of Cardiovascular Nursing</i>	Library or electronic access
<i>Journal of Clinical Oncology</i>	Library or electronic access
<i>Heart and Lung</i>	Library or electronic access

Table 2 (cont) Other sources of evidence (1966 – 9/2003)

Source	Location
<i>Specialty Journals in NHPA (2002 – 9/2003) Cont.</i>	
<i>Stroke</i>	Library or electronic access
<i>Expert Clinicians</i>	
Studies other than those found in regular searches	Expert sources
<i>Pearling</i>	
All included articles had their reference lists searched for additional relevant source material	

## Search Terms

The search terms that were used to search the electronic bibliographic databases are listed in Table 3. The full search strategy (based on a PubMed platform) is provided in Appendix C.

Table 3. Search terms used to identify service improvement tools

Search Terms
<p><b>MeSH</b> Quality-of-health-care, diabetes-mellitus, asthma, arthritis, neoplasms, cardiovascular-diseases</p>
<p><b>Text words</b> (root cause analysis), (continuous quality improvement), (quality improvement), (change management), (total quality management), (patient care management), (clinical governance), (clinical process management), (decision making), (decision support), (diagnostic tool*), clinical, quality, improvement</p>
<p><b>Limits</b> Studies were restricted to those concerning humans. Studies reported in languages other than English were only translated if the study design represented a higher level of evidence than that available in the English language evidence-base.</p>

Appendix E provides a description of all the studies that met the inclusion criteria for assessing the effectiveness of service improvement tools in each of the NHPAs, as well as those that were universally applicable. Studies that appeared to meet the inclusion criteria but on closer examination were found to lack (or duplicate) data critical for the assessment of effectiveness, are listed in Appendix F.

Many sources reported service improvement tools that failed to meet the inclusion criteria. These tools could not, therefore, be assessed or evaluated with respect to effectiveness. They are, however, included in the description of identified tools in each of the results sections of this report and are appropriately referenced.

# Critical Appraisal

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The evidence presented in the selected studies was assessed and classified using the dimensions of evidence defined by the National Health and Medical Research Council (National Health and Medical Research Council 2000).

These dimensions (Table 4) include: the strength of the evidence, size of the effect and relevance of the evidence. This approach to assessment of study quality incorporates appraisal of study methodology, as well as clinical import or relevance.

Table 4. Evidence dimensions

Type of evidence	Definition
Strength of the evidence	
Level	The study design used, as an indicator of the degree to which bias has been eliminated by design.*
Quality	The methods used by investigators to minimise bias within a study design.
Statistical precision	The p-value or, alternatively, the precision of the estimate of the effect. It reflects the degree of certainty about the existence of a true effect.
Size of effect	The distance of the study estimate from the "null" value and the inclusion of only clinically important effects in the confidence interval.
Relevance of evidence	The usefulness of the evidence in clinical practice, particularly the appropriateness of the outcome measures used.

\*See Table 5

Three sub-domains (level, quality and statistical precision) are collectively a measure of the methodological strength of the evidence. These were assessed during critical appraisal of each of the included studies. The designations of the levels of evidence are shown in Table 5.

Table 5. Designations of levels of evidence\*

Level of evidence	Study design
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly-designed randomised controlled trial
III-1	Evidence obtained from well-designed quasi-randomised controlled trials (alternate allocation or some other method)
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case-control studies, or interrupted time series with a control group
III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group
IV	Evidence obtained from case series, either post-test or pre-test/post-test

\*Modified from (NHMRC 1999)

Study quality was assessed using the "Assessment of Methodological Quality" checklist developed by the Cochrane Effective Practice and Organisation of Care Group (see Appendix D). This checklist uses seven standard criteria to assess the quality of randomised and concurrently controlled trials, controlled before-and-after studies and interrupted time series. Information on specific methodological components shown empirically to impact on treatment effect sizes are included in this checklist – specifically,

concealment of allocation, blinding, and completeness of data (Juni et al. 2001; Moher et al. 1998; Schulz et al. 1995).

Statistical precision was determined using standard statistical principles. The clinically important benefit of the effect size associated with impact (patient-relevant) outcomes in the included studies was assessed qualitatively in the report, where possible. The clinical relevance of the evidence (e.g. whether the outcome measures were surrogate or patient-relevant) was also assessed.

# Data Extraction and Analysis

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The process of study selection went through six phases (see Figure 1).

Figure 1. Study selection process

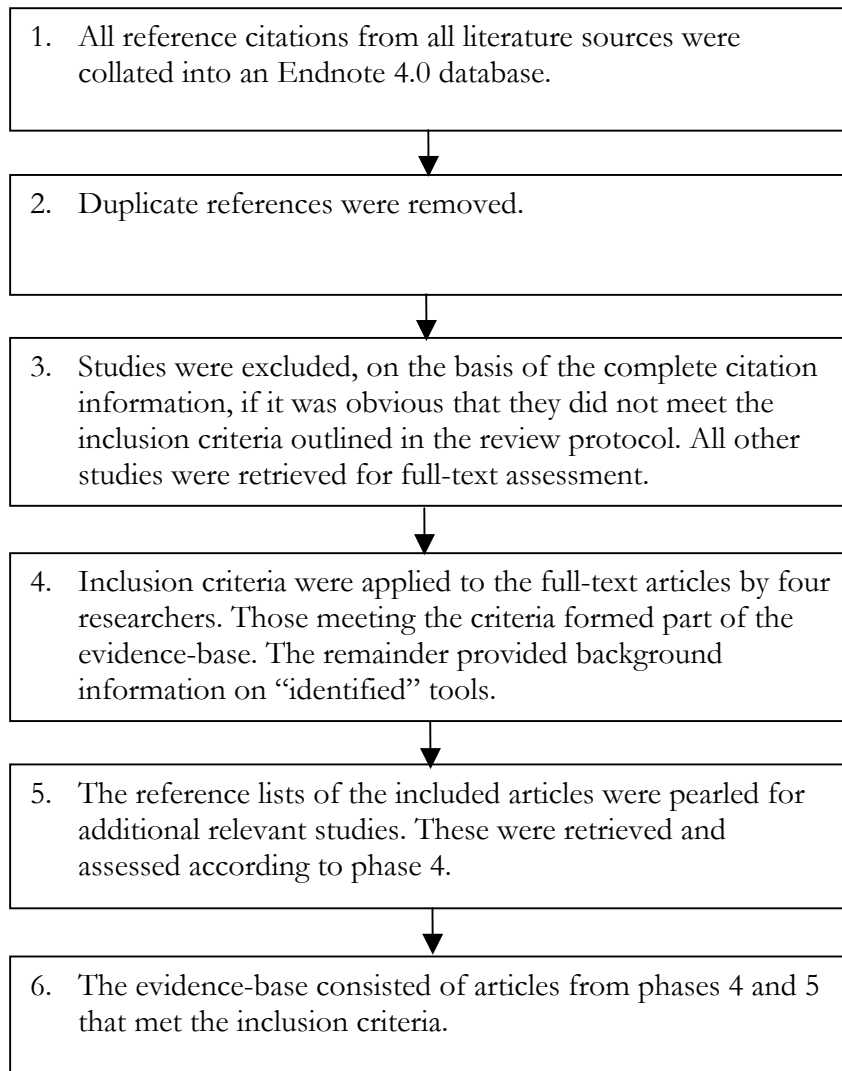


Table 6 provides a breakdown of the study selection process in terms of the number of literature citations or articles retrieved and retained from the search. Any doubt concerning inclusions at Phase 4 was resolved by group consensus.

Table 6. Number of citations initially retrieved and then retained at each phase

Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6 (Total Included)
19,346	15,404	910	62	16	78

Data were extracted from the included studies by a single researcher using tables developed *a priori* and outcome definitions provided in the review protocol. All data extraction was checked by another researcher for face validity.

A profile was developed for each study – specifically outlining the level of evidence and study design, methodological quality, study authors and publication year, study setting, target/study population characteristics, type of intervention and comparator intervention, outcomes assessed and the follow-up period.

Information on each of the relevant outcomes was extracted, tabulated and summarised in the body of the report – including numerator and denominator information, means and standard deviations, and summary measures of effect, where appropriate. All studies were assessed for unit of analysis errors. Unit of analysis errors occur when healthcare organisations or providers are randomly (or non-randomly) allocated to the intervention or control group but statistical analyses are conducted on individual patient data as if there were no clustering by organisation or provider. This type of error results in spuriously low *p*-values or artificially narrow confidence intervals due to the inflated power of the study. The point estimate is not affected by a unit of analysis error, so it is therefore possible to consider the size of an effect reported from such studies, although not its statistical significance (Grimshaw et al. 2003).

It is important when assessing the effectiveness of organisational interventions, to ensure that baseline differences between intervention and control groups are either minimal or are minimised/controlled through statistical adjustment. This ensures that the final “post-intervention” result is reflecting a “real” change, rather than simply differences between the two groups that were already present at baseline. Similarly, the baseline measurement in the intervention or control group may indicate that there is little scope for the tool to improve a service, as the usual approaches to health care delivery may already be adequate (“ceiling effect”). Studies that did not collect baseline data were excluded (Appendix F).

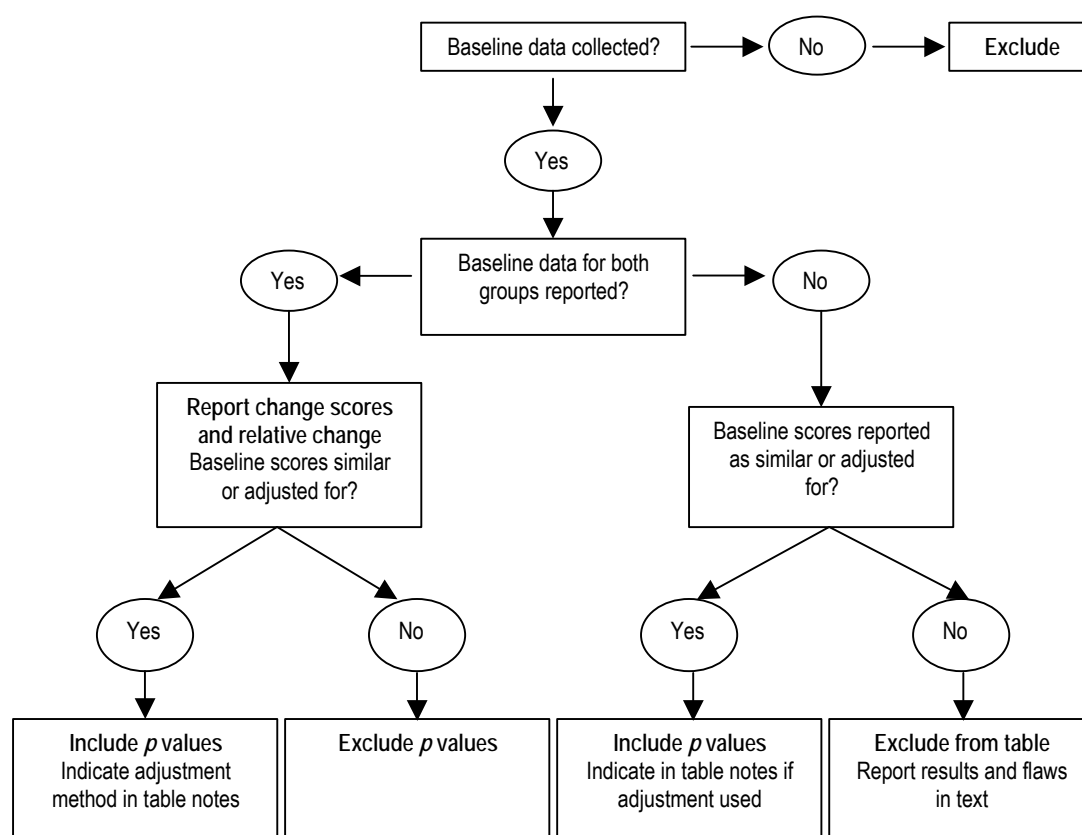
Figure 2 outlines the decision guide that was used by the researchers when extracting data from the included studies. In instances where both baseline and follow-up data were provided on an outcome for the intervention and control groups, a within-groups change score\* and between-groups relative change† was calculated. Where the baseline data were given, but differences between the groups were not adjusted for, *p*-values have not been stated as results may be a consequence of regression to the mean. However, if an analysis of covariance (ANCOVA) or other appropriate statistical test was conducted, this result was reported as it effectively adjusts individual follow-up scores for the associated baseline score (Vickers & Altman 2001). If baseline data were not given, but were reported as similar, or differences were adjusted for using appropriate statistical methods, *p* values were stated. In cases where the baseline data were not provided and were not reported as equivalent (or there was no statistical adjustment for baseline differences), results were reported in the text alone and indicated as flawed. A statistically significant difference was assumed at  $p < 0.05$ .

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\* Change score in each group = follow-up score – baseline score

† Relative change = change score for the intervention group/ change score for the control group

Figure 2. Decision tree for dealing with baseline data



Where two (or more) papers reported on different aspects of the same study, such as the methodology in one and the findings in the other, they were treated as one study. Similarly, if the same data were duplicated in multiple articles, results from the most comprehensive, or most recent article only were included. Consultants and contacts in National Health Priority Area Council Expert Advisory Groups (EAGs) and relevant jurisdictional departments were contacted to request information on additional published or unpublished reports that had not been identified in the literature searches. Time constraints precluded contacting authors for missing data or clarification of methodology.

All of the studies evaluated for effectiveness were given a quality rating (good, average, poor) in accordance with their efforts to minimise bias by the following criteria, which are detailed more extensively in the EPOC Checklist (Appendix D): concealment of allocation; protection against contamination; adequate follow-up of health care professionals and patients; blinding or objective assessment of primary outcomes; reliability and validity of primary outcomes; and adequate reporting and assessment of baseline characteristics and measures. To maintain consistency between reviewers, studies were assigned ratings of good protection against bias if 61-100% of criteria were satisfied, average if 31-60% were met, and poor if less than 30% were done.

Since the randomised controlled trials (RCTs) available for this review differed in numerous aspects, including clinical problem, health care provider, patients, method of intervention, length of follow-up, and measure of outcomes, no common measure of

effect was considered justified for meta-analysis of trial results. Therefore, process and impact outcomes were characterised for each study according to reported statistically significant effects and a qualitative synthesis of the data was undertaken.

# Results

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This review examined the effectiveness of a range of tools to improve the delivery of preventive, diagnostic, treatment, management, rehabilitative, and palliative health care services. Health care delivery is changing rapidly, with increasing financial pressure to improve efficiency and patient turnover. Frequently there are gaps between knowledge and practice – particularly evidence-based practice – and a lag between the advances in clinical research and the dissemination of information that could provide improvements in health care. Health care programs can be costly to develop and implement. Therefore, evaluation of health service improvement tools is warranted to ensure that there is a real improvement in the *process* of service delivery, as well as a positive *impact* on patient health. The process and impact outcomes that were used to assess the effectiveness of these tools in this review are outlined in Box 1 (page 8).

Although the ultimate goal of implementing health service improvement tools is to achieve better outcomes in patients' health, there are numerous pathways to attaining this goal. Examples include maximising opportunities for disease-specific screening programs, minimising the proportion of adverse drug events or iatrogenic injuries, improving the skills (communication, knowledge, attitudes) of health care providers, and enhancing the efficiency and accuracy of administrative or system-oriented processes. This systematic review attempts to identify these varied service improvement tools and assess their effectiveness (where possible).

Database searches generated 19,346 citations published between 1966 and September 2003. After duplicates were removed, 15,404 citations were screened initially by one reviewer who excluded articles that were clearly not relevant to this review. Articles that were excluded immediately by screening the titles and abstracts included narrative reviews, letters, editorials, comments and opinions, uncontrolled studies, and articles that dealt with individualised interventions – or therapies – as opposed to service improvement tools.

Full reports (910) of all articles that were deemed potentially relevant were retrieved for further screening and allocated by NHPA to four researchers, who judged the eligibility for inclusion of all retrieved studies according to the criteria developed in the review protocol. Studies that were not clearly included or excluded were resolved by group discussion. Of those articles screened, most failed to meet the inclusion criteria for the following reasons:

- Articles provided narrative or descriptive information only
- Studies investigated the effectiveness of individualised interventions in health care settings, but did not focus on the service delivery of these interventions (i.e. data on impact outcomes only, no information on relevant process outcomes)
- Study designs were inappropriate - uncontrolled or non-concurrent controls
- Studies did not have an appropriate comparator (i.e. usual or standard care)

- Studies were implemented for less than three months
- Studies did not measure or report baseline performance for intervention and control groups

455 studies presented information on health service improvement tools. Of these, 62 studies were initially included to assess effectiveness. A further 16 articles were included after the reference lists of the included articles were searched. Therefore, the total evidence-base comprised of 78 studies and systematic reviews.

The identified health service improvement tools were categorised into broadly similar groups for comparative purposes. The health service improvement tools that were implemented in settings comprising more than one NHPA (e.g. diabetes and asthma patients), or in general areas of medicine, have been presented in the first results section titled - *Universally applicable tools*. Subsequent chapters deal with health service improvement tools that are specific to the NHPAs and/or were implemented in a particular NHPA target population. For example, tools targeting health professionals working with cancer patients are discussed in the section on Cancer.

In each section, there is a tabulated list of all identified health service improvement tools and a brief definition and description of the tool in the text. Studies that examined the *effectiveness* of the identified tools and satisfied the inclusion criteria have had their data extracted and presented in separate tables for process and impact outcomes. An evaluation of the effectiveness of the tools is provided and results from the highest level and best quality evidence, are given the most credibility.

# Universally Applicable Tools

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In general, health service improvement tools are physician-, patient- or system-oriented. Physician-oriented tools indirectly influence patient outcomes by changing the knowledge, attitudes, behaviour or performance of health professionals, patient-oriented tools focus more directly on changing patient behaviour, and system-oriented tools are designed to influence the efficiency and productivity of the health care organisation.

Examples of health service improvement tools, within these categories, are given in Table 7.

Table 7. Categories of tools used in the delivery of health service improvement

<b>Physician-oriented</b> Clinical Practice Guidelines; Continuous Quality Improvement; Continuing Medical Education; academic detailing; local opinion leaders; decision support; prompts and reminders; audit and feedback; financial incentives; interdisciplinary approaches; patient-centred care
<b>Patient-oriented</b> Educational materials; decision support; reminders; self-management programs; telemedicine
<b>System-oriented</b> Record systems; computerised support systems

In several cases, systematic reviews have evaluated the effectiveness of health service improvement tools that could fit into a number of different categories, such as educational tools, reminders, feedback, and decision support. The results of these reviews and studies are presented in the section that most closely relates to the stated aim of the paper.

## Clinical Practice Guidelines

Clinical practice guidelines (CPGs) are “systematically developed statements to assist practitioner decisions about appropriate health care for specific clinical circumstances” (Institute of Medicine, 1990). Development and implementation of CPGs entails a series of steps: 1) a local or national body identifies the need for guidelines in a particular clinical area; 2) data from research or existing guidelines are synthesised and the strength of evidence is evaluated; 3) recommendations about strategies for investigation and management are based on the evidence from these data; 4) the sponsoring organisation and other relevant organisations endorse the guidelines; 5) CPGs are disseminated, usually by mailouts or publication in recognised clinical journals; 6) health care practitioners endeavour to actively implement guidelines; 7) CPGs are re-appraised periodically and the process is reiterated (Davis & Taylor-Vaisey 1997). While the development of disease-specific CPGs is well-established, strategies for disseminating the information and implementing change in health care practice have been applied inconsistently.

CPGs are a well-established tool for improving the quality of health services. Many health care services/agencies (e.g. National Health and Medical Research Council)

develop and widely disseminate CPGs for specific disorders, conditions, and procedures. Despite this, studies indicate that the extent to which physicians incorporate CPGs into their clinical practice is often disappointing (Karuza et al. 1995). CPGs typically require physicians to change their professional behaviour and this may be difficult to accomplish. Information is a necessary but not sufficient motivation to change behaviour. Therefore, several tools have been developed to overcome the problem of CPG distribution, implementation, and compliance. Table 8 identifies those tools utilised to promote the uptake or compliance with CPGs, and therefore, that are aimed at improving health service delivery. In studies where additional tools, such as reminders or feedback, have been used to enhance compliance with CPGs, the effectiveness of the additional tool is evaluated in the appropriate subsequent sections.

**Table 8. Clinical Practice Guidelines (CPGs)**

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Computer-based CPGs: computerised implementation strategies for CPGs	All levels	(Shiffman et al. 1999) (Jousimaa et al. 2002)*	1. Physician participation: <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> <li>• Change in documentation</li> </ul> 2. Participant satisfaction	1. Patient ability to manage disease: <ul style="list-style-type: none"> <li>• Blood pressure, cholesterol, triglycerides</li> </ul> 2. Number of admissions: <ul style="list-style-type: none"> <li>• Hospitalisations and emergency room visits</li> </ul>
Review criteria: prioritised criteria of CPGs presented in concise format with emphasis on key recommendations for majority of patients. 10 criteria for asthma and 14 criteria for angina  Review criteria plus feedback: prioritised review criteria plus feedback on actual practice performance compared to other practices	Management	(Baker et al. 2003a)	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> </ul>	1. Patient health status 2. Patient satisfaction
Local adaptation of CPGs: CPGs on Stroke Prevention and management of Lower Urinary Tract Symptoms in Men	All levels	(Silagy et al. 2002)	1. Physician participation: <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> <li>• Change in physicians' knowledge and practice</li> </ul>	n/a
Clinical practice guidelines: access to evidence based guidelines through Queensland Health's intranet	All levels	QH*	N/E	N/E
Standardised health management protocols: for rural, remote & indigenous health practitioners	Treatment and management	QH*	N/E	N/E

n/a = not available; QH = Queensland Health; N/E = not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of clinical practice guidelines

The highest level of evidence available that assessed the effectiveness of clinical practice guideline (CPG) distribution and implementation strategies, was provided by one systematic review and two recent randomised controlled trials.

One average quality systematic review (Shiffman et al. 1999) evaluated 18 controlled trials and time series studies assessing the effectiveness of computer-based CPGs. This review assessed the quality of included studies in relation to the “Information management services model”, comprising eight components that are detailed in Table 9.

Table 9. Information management services model (Shiffman et al. 1999)

Recommendation: the determination of appropriate, guideline-specified activities that should occur under specific clinical circumstances
Documentation: the collection, recording, and storage of observations, assessments, and interventions related to clinical care
Explanation: the provision of background information on decision variables and guideline-specified actions and the rationale that supports guideline recommendations, including evidence and literature citations
Presentation: the creation of useful output from internal data stores
Registration: the recording and storage of administrative and demographic data to uniquely identify the patient, provider, and encounter
Communication: the transmission and receipt of electronic messages between the clinician and other information providers
Calculation: the manipulation of numeric or temporal data, or both, to derive required information
Aggregation: the derivation of population-based information from individual patient data

Four included studies (of 4) found significant improvements in documentation; 14/18 studies found improved clinician adherence in some of the measured outcomes; 2/4 studies showed that clinicians were satisfied with computer-based CPGs, while the other two studies indicated that clinicians found the data entry tedious and time-consuming; and 3/8 studies showed improvements in clinically relevant patient outcomes.

A good quality randomised controlled trial (Baker et al. 2003a) examined the effectiveness of prioritised review criteria CPGs, in the presence or absence of peer-comparison feedback, on compliance with recommended guidelines for asthma and angina. For each condition, primary care practices were randomised to one of three study arms. Two arms (controls) received the full version of CPGs containing 51 and 59 recommendations for asthma and angina, respectively. Two review criteria arms received a concise version of CPGs with prioritised criteria containing ten recommendations for asthma and 14 for angina. A third study arm (for each condition) received the prioritised review criteria plus feedback comparing the practice performance with that of other participating practices. The key process outcome was practice participation (physician behavioural change) – particularly concerning adherence to recommended guidelines (Table 10). Patient health status (symptoms) and satisfaction were assessed as impact outcomes (Table 11). Multivariate regression analysis of this randomised controlled trial (Baker et al. 2003a) revealed several statistically significant differences between study arms regarding practice adherence to several of the recommended guidelines. An improvement in adherence to some recommendations was evident in all intervention groups. For example, asthma patients in both the review criteria and criteria plus feedback practices were prescribed the cheapest inhaled steroid over one hundred times

more frequently than asthma patients attending the control (full CPGs) practices ( $p=0.04$ ). Overall, however, there was no evidence of consistent compliance with guidelines and, due to the large number of variables examined (10 for asthma and 14 for angina), any differences may be attributable to chance effects. Patients with angina in practices receiving criteria review (with or without feedback) reported improved control of symptoms. Asthma patients receiving care from a review criteria practice reported no change, relative to control practices, in symptom control, whereas those attending a criteria plus feedback practice reported a reduction in asthma symptoms (Table 11). In terms of patient satisfaction with their treatment, there was no difference in the satisfaction of asthma patients in the intervention and control groups, however, angina patients attending intervention practices were less satisfied with their medication than those attending control practices. Approximately 63% of asthma patients and 72% of angina patients completed both the baseline and follow-up questionnaires. Overall, the dissemination of concise prioritised criteria guidelines, with or without additional feedback, does not improve physicians' adherence to recommendations compared to the full version of CPGs. The authors suggest that the shorter format of the review criteria may have reduced the time needed to read the guidelines, but not diminished the burden of complying with them.

There was one poor quality randomised controlled trial that assessed the effectiveness of local adaptation of CPGs (Silagy et al. 2002). Two Divisions of General Practice were randomised to adapt a nationally produced CPG or use the original version. Each group acted as control for the other. That is, Division A adapted guidelines on Stroke Prevention (SP) and received the original CPGs on Lower Urinary Tract Symptoms (LUTS) in men (control for Division B), while Division B adapted guidelines on LUTS and received the original version of CPGs on SP (control for Division A). Process outcomes to assess physicians' participation were self-reported changes in knowledge and practices following dissemination of guidelines (Table 10). Results indicate that the practice of Division A physicians (using locally adapted SP guidelines) became more consistent with guidelines relating to use of aspirin and initial investigations for a patient with carotid stenosis (no significance levels reported). Interpretation of the results in this study is limited by several shortcomings in methodology. Protection against bias was low, less than 80% of professionals were followed up, assessment of outcomes relied on self-reported measures of changes in practice, and the selection of only two Divisions of General Practice, which precludes control of potential confounders, such as years of experience and level of support (practice nurses), reduces the power of this study.

### ***Critical success factors of clinical practice guidelines***

Apart from some evidence of improved documentation (Shiffman et al. 1999), simple dissemination of clinical practice guidelines, with or without modification or simplification, was insufficient to engender consistent change in physician behaviour or, as a consequence, influence patient health.

Table 10. Effectiveness of Clinical Practice Guideline implementation strategy – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Assessment of participation (behavioural change)						
				Control (full CPGs) N=27	Review criteria N=27	Criteria plus feedback N=27	Effect measure <sup>b</sup>			
(Baker et al. 2003a)	Level II: cluster RCT Quality: good	81 Primary care practices	Review criteria: prioritised review criteria CPGs (asthma and angina)  Review criteria plus feedback	<i>Practice adherence to recommendations for asthma, % of patients</i>						
				Recommendation	% change <sup>a</sup>	% change <sup>a</sup>	Relative change	% change <sup>a</sup>	Relative change	P value
				Appropriate basis of diagnosis	+1.3	+4.5	3.5	+1.0	0.8	0.82
				Appropriate diagnosis when symptoms equivocal	+2.0	-0.6	0.3	-2.3	1.2	0.70
				Patients prescribed beta-2 agonist	-0.1	-1.5	15.0	-1.4	14.0	0.89
				Beta-2 agonist compliance checked	-0.3	-5.4	18.0	-0.8	2.7	0.36
				Beta-2 agonist doses checked	+11.3	+1.6	0.1	+5.2	0.5	0.21
				Cheapest beta-2 agonist prescribed	-6.4	+0.3	0.05	-1.9	0.3	0.75
				Cheapest inhaled steroid prescribed	+0.1	+11.2	112.0	+15.9	159.0	0.04
				Patient's inhaler technique checked	+0.6	-2.5	4.2	-3.6	6.0	0.56
				Patients advised on passive smoking	-1.3	+0.3	0.2	+1.9	1.5	0.72
				Patient's smoking status checked	+1.8	+7.6	4.2	+7.7	4.3	0.74
				<i>Practice adherence to recommendations for angina, % of patients</i>						
				Appropriate basis of diagnosis	+2.7	+1.1	0.4	-7.5	2.8	0.23
				Patients' serum cholesterol checked	+5.6	+13.9	2.5	+5.8	1.0	0.26
				Patients' blood pressure checked	+6.8	+4.2	0.6	+5.2	0.8	0.54

Table 10 (cont.) Effectiveness of Clinical Practice Guideline implementation strategy – Process outcomes

				Hypertensive patients managed appropriately	+1.3	-13.8	10.6	+8.8	6.8	0.02		
				Smoking status recorded at diagnosis	+3.1	-2.7	0.9	+2.3	0.7	0.27		
				Patient's compliance with angina medication checked	+3.4	-2.5	0.7	-7.5	2.2	0.02		
				Cheapest beta-blocker prescribed	+14.0	+5.9	0.4	+13.5	1.0	0.45		
				Aspirin prescribed	+3.7	+6.5	1.8	+7.4	2.0	0.76		
				Advice on nitrate use	+4.6	-1.0	0.2	+1.0	0.2	0.32		
				Patient given information on time to use nitrate	+9.7	+2.1	0.2	+2.0	0.2	<0.001		
				Blood pressure tested in past 12 months	+13.8	+5.1	0.4	+5.9	0.4	0.18		
				Smoking status recorded in past 12 months	+3.1	+1.1	0.4	+1.0	0.3	0.43		
				Weight recorded in past 12 months	+10.1	+4.2	0.4	-0.2	0.02	0.29		
(Silagy et al. 2002)	Level II: RCT Quality: poor	243/400 GPs in 2 divisions of General Practice, Adelaide Response rate: 61%	Local adaptation of CPGs: CPGs on Stroke Prevention (SP – Div A) and management of Lower Urinary Tract Symptoms in Men (LUTS – Div B)	<i>Knowledge was consistent with LUTS guidelines, % of physicians</i>							Relative change <sup>f</sup>	
					Control Div A (SP) <sup>c</sup>			Intervention Div B (LUTS) <sup>d</sup>				
				Topic addressed by guideline	Before N=119	After	% change [95% CI] <sup>e</sup>	Before N=122	After	% change [95% CI] <sup>e</sup>		
				Role of prostate size	31.9	40.3	8.4 [3, 14]	26.2	37.7	11.5 [5, 17]		1.4
				Use of PSA estimation	52.9	61.3	8.4 [3, 14]	56.6	62.3	5.7 [1, 10]		0.7
				Use of Finasteride	39.1 <sup>g</sup>	46.0	6.9 [1, 13]	51.0 <sup>h</sup>	33.6	-17.4 [-24, -9]		2.5
Criteria for surgery	26.0	35.1	9.1 [4, 19]	34.4	92.6	58.2 [48, 66]	6.4					

Table 10 (cont.) Effectiveness of Clinical Practice Guideline implementation strategy – Process outcomes

				<i>Knowledge consistent with SP guidelines, % of physicians</i>							
				Control Div B (LUTS) <sup>i</sup>			Intervention Div A (SP) <sup>j</sup>		Effect measure <sup>k</sup>		
				N=119			N=121				
				Use of appropriate screening	59.6	58.8	-0.8 [-3, 2]	67.7	66.1	-1.6 [-5, 1]	2.0 [-3, 5]
				Use of aspirin	81.5	87.4	5.9 [1, 11]	80.8 <sup>m</sup>	81.7	0.9 [-2, 4]	0.2 [0, 11]
				Treatment options	15.3 <sup>l</sup>	22.1	6.8 [2, 12]	17.4	23.1	5.7 [1, 11]	0.8 [-6, 8]
				Criteria for carotid endarterectomy	69.8	63.4	-6.4 [-12, -2]	70.2	65.3	-4.9 [-9, 1]	0.8 [-5, 8]
				Investigations for carotid stenosis	86.4 <sup>l</sup>	93.2	6.8 [2, 13]	92.6 <sup>n</sup>	91.8	-0.8 [-4, 3]	0.1 [1, 12]

<sup>a</sup> pre- and post-intervention scores not included due to space restrictions - available on request; <sup>b</sup> multivariate regression analysis using generalised estimating equations to account for baseline differences; <sup>c</sup> division A, which received original version of CPGs for LUTS, acted as control for Division B; <sup>d</sup> division B received locally adapted CPGs for LUTS; <sup>e</sup> difference between baseline (BL) and follow-up (FU); <sup>f</sup> difference between the change in proportion in Division A-Division B – authors state no significant differences between groups at baseline; <sup>g</sup> n=87; <sup>h</sup> n=91; <sup>i</sup> division B, which received original version of CPGs for SP, acted as control for Division A; <sup>j</sup> division A received locally adapted CPGs for SP; <sup>k</sup> Newcombe's test; <sup>l</sup> n=118; <sup>m</sup> n=120; <sup>n</sup> n=122.

Table 11. Effectiveness of Clinical Practice Guideline implementation strategy – Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Assessment of patient health status (disease symptoms)						
(Baker et al. 2003a)	Level II: cluster RCT Quality: good	81 Primary care practices	Review criteria: prioritised review criteria CPGs (asthma and angina)  Review criteria plus feedback	<i>Symptoms for asthma, mean score±SD<sup>a</sup></i>						
					Control (full CPGs)	Review criteria		Criteria plus feedback		Effect measure <sup>c</sup>
					% change <sup>b</sup>	% change <sup>b</sup>	Relative change	% change <sup>b</sup>	Relative change	P value
					-5.8	-2.6	0.5	+11.2	1.9	0.02
				<i>Symptoms for angina, mean score±SD<sup>d</sup></i>						
				Physical limitation	+2.5	-4.9	2.0	-3.5	1.4	0.15
				Angina stability	-3.0	+8.7	2.9	+4.1	1.4	0.03
				Angina frequency	-2.4	+15.1	6.4	+4.6	2.0	<0.001
				Disease perception	-4.9	+13.0	2.7	+6.8	1.4	<0.001
				Assessment of patient satisfaction <sup>e</sup>						
				<i>Asthma treatment, % of patients</i>						
				Asthma treated satisfactorily	+0.8	-0.3	0.4	-1.4	1.8	0.83
				Satisfactory explanations about asthma	+1.6	+0.7	0.4	-1.4	0.9	0.75
				<i>Angina treatment, % of patients<sup>e</sup></i>						
				Satisfaction with medication	+0.9	-6.1	6.8	-0.3	0.3	0.03
				Satisfactory explanations about angina symptoms	+1.8	+3.2	1.8	+3.0	1.7	0.91

SD=standard deviation. <sup>a</sup> self-report Asthma Symptoms Questionnaire (Steen et al. 1994) – high score indicates severe symptoms; <sup>b</sup> pre- and post-intervention scores not included due to space restrictions - available on request; <sup>c</sup> multilevel modelling using a random effects model at the practice level; <sup>d</sup> self-report Seattle Angina Questionnaire (Spertus et al. 1995) – low score indicates severe symptoms; <sup>e</sup> questions modified from Seattle Angina Questionnaire.

## Continuous Quality Improvement

Continuous quality improvement (CQI) is an iterative process of problem-solving and group decision-making that centres on the analysis of organisational systems and work processes, and is designed to deliver improvements in health outcomes. CQI focuses on improving processes that influence the flow of three principle factors - information (paper or electronic records), material (e.g. blood samples sent to a lab for testing), and patients. CQI is widely used to implement clinical practice guidelines (Brown et al. 2000). It is a dynamic process, rather than a product.

CQI models involve three phases: 1. diagnostic phase – uses data analysis, brainstorming, process flowcharts to identify and prioritise the root causes of a service delivery problem, such as failure to adhere to recommended practice; 2. remedial phase – involves defining and testing possible “solution tracks” and recommending a selected number for implementation; 3. implementation phase (Brown et al. 2000). The product of this model then progresses through another cycle of these phases. Since its inception, CQI has changed the orientation of health care management from the traditional model, aiming to satisfy pre-determined standards of care, to one that engenders continuous enhancement of health care year by year.

Although a large body of literature describes CQI and discusses its effects on health care, there are relatively few good quality controlled studies that describe process and impact outcome measures. As a result, it is difficult to characterise the circumstances that produce change. Identified studies concerning the implementation of CQI are listed in Table 12.

Rapid Cycle Improvement methodology is a format used in the Institute for Health Care Improvement Breakthrough Series. Rapid Cycle Improvement differs from CQI in that changes are tested on a small scale, without the flowchart processes and extensive measuring that are characteristic of CQI. Several studies described the effectiveness of Rapid Cycle Improvement (Breakthrough Series) programs for reducing adverse drug events and medication errors (Meisel et al. 1998). However, this tool is characterised by the absence of extended follow-up and control groups. Therefore, studies assessing Rapid Cycle Improvement failed to meet the inclusion criteria for evaluation of effectiveness.

Table 12. Continuous Quality Improvement (CQI) tools

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Continuous Quality Improvement (CQI): inter-disciplinary daily rounds	Treatment	(Curley et al. 1998)	1. Physician satisfaction	1. Length of hospital stay 2. Number of complications
CQI team	All levels	(Irvine et al. 2002) (Brickman et al. 1998; Francois et al. 2003; Heard et al. 2001; Nardella et al. 1995; Shortell et al. 1998)*	1. Physician participation: <ul style="list-style-type: none"> <li>Physicians' CQI knowledge</li> <li>Physicians' functional / dysfunctional group interaction</li> <li>Physicians' problem-solving effectiveness</li> </ul>	n/a
CQI – Breakthrough Series: health care clinical collaboratives from various hospitals working together with experts to develop and implement “best practice” strategies in a series of rapid-cycle changes.	All levels	(Bonomi et al. 2002; Kosseff & Niemeier 2001; Leape et al. 2000)*	N/E	N/E
Rapid Cycle Improvement: similar iterative process as CQI except changes are not measured or tested extensively	Treatment	(Besserman et al. 1998; Meisel et al. 1998)*	N/E	N/E

n/a = not available; N/E = not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of continuous quality improvement

One poor quality quasi-randomised controlled trial met the inclusion criteria and was evaluated (Table 13). Irvine et al (Irvine et al. 2002) examined the effectiveness of training health care professionals in the theory and methods of continuous quality improvement (CQI) with the goal of improving the care and health outcomes for patients. The CQI methods involved a series of steps: 1. select a specific problem; 2. identify outcomes to measure (e.g. clinical outcomes, functional health, quality of life, satisfaction); 3. use a series of limited changes. Prior to assessing changes in patient outcomes, researchers also measured several intermediate process outcomes. Using a “waiting-list” control design, multidisciplinary health care teams were randomised to an Immediate intervention group or a Delayed intervention group that would receive the intervention three months later. Data were collected at baseline (T1), at three months after the Immediate intervention and before the Delayed intervention began (T2), at six months after the Immediate intervention (T3), and at nine months after the Immediate intervention (T4, 6 months after the Delayed intervention). Participants’ level of CQI knowledge (process outcome) was measured using a 36-item self-report instrument. Repeated measures ANOVA revealed a significant improvement in health care professionals’ knowledge of CQI methods compared to baseline ( $p < 0.05$ ) for both intervention and control groups. However, gains in CQI knowledge were not sustained for either group at T4 as there was a significant reduction in CQI knowledge compared

to T3 ( $p < 0.05$ ). The authors suggest that reinforcement through “booster” sessions may overcome this lack of use over time. It should be noted, however, that the instrument for measuring knowledge of CQI was developed specifically for this study and was not reliably validated (Cronbach’s alpha = 0.51). The relative change between groups was 0.86, indicating there was no evidence of increased CQI knowledge as a result of training in CQI theory and methods.

A more reliable self-report scale (Cronbach’s alpha = 0.85 - 0.98) was used to measure both functional and dysfunctional group interactions (Irvine et al. 2002). A repeated measures MANOVA indicated significant improvement ( $p < 0.05$ ) at T2 in the Immediate intervention group and at T3 in the Delayed intervention group. Scores for dysfunctional group interactions (process outcome) differed significantly from baseline for both groups at T3 ( $p < 0.05$ ), i.e. following the intervention. Functional group interactions increased in the intervention groups, compared to the control. However, statistical analysis of between-group differences was not available.

Irvine et al (2002) also assessed team problem-solving effectiveness (process outcome), particularly the ability of the team to apply the CQI methods that were taught in the workshop. It was assessed by independent evaluation of teams’ worksheets used in developing their plan of action (Cronbach’s alpha = 0.95). Teams were judged by independent reviewers as successful or unsuccessful on the basis of evidence of a positive change in a process/patient outcome indicator (Cronbach’s alpha = 0.76). Nine of 25 teams were deemed successful in providing an improved process of care, seven of which had physician membership. Analysis of baseline measurements between groups revealed no significant difference in the level of CQI and dysfunctional group interaction between successful and unsuccessful teams, whereas the mean baseline score for functional group interaction was higher in successful teams (3.4) compared to unsuccessful teams (3.15,  $p < 0.03$ ). In addition, the authors report that, compared to unsuccessful teams, successful teams had higher scores for problem-solving effectiveness, engaged in more functional group interactions, and were more likely to have physician participation. This study had several weaknesses that reduce its quality and limit its impact. The measures of behavioural change in participants were subjective and generally untested (CQI knowledge) or of moderate validity (functional group interactions), data were incomplete (team problem-solving effectiveness), and potential confounders, such as the scope and complexity of changes implemented by the different teams, were not taken into account.

### ***Critical success factors of continuous quality improvement***

Since only one poor-quality study met the inclusion criteria and showed little evidence that continuous quality improvement training effected changes in health professionals’ knowledge or ability to function in a team, critical success factors cannot be determined.

Table 13. Effectiveness of Continuous Quality Improvement tools – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Assessment of participation (behavioural change)						
							Effect measure <sup>c</sup>			
(Irvine et al. 2002)	Level III-1: quasi-RCT Quality: poor	149 health care professionals from 25 CQI multi-disciplinary health care teams	Continuous quality improvement team	<i>Change in behaviour and CQI knowledge</i>						
				Control (Delayed intervention) N=10 teams			CQI intervention N=15 teams			
				T1 <sup>a</sup> mean±SD	T2 <sup>b</sup> mean±SD	% change	T1 <sup>a</sup> mean±SD	T2 <sup>b</sup> mean±SD	% change	Relative change
				<i>CQI knowledge scores <sup>d</sup></i>						
				49.6±7.2	62.3±6.0	+25.6	52.6±9.3	64.1±7.6	+21.9	0.9
				<i>Functional group interactions scores <sup>e</sup></i>						
				3.3±0.2	3.3±0.2	0	3.2±0.4	3.4±0.3	+6.3	n/e
				<i>Dysfunctional group interactions scores <sup>e</sup></i>						
				3.9±0.2	4.0±0.2	+2.6	3.9±0.2	3.9±0.2	0	0
				<i>Team success at improving patient outcomes and processes of care <sup>f</sup></i>						
				Variable			Success rating		P value <sup>g</sup>	
							Improved outcome Mean±SD	No improved outcome Mean±SD		
				Change in CQI knowledge T2			10.6±6.3	13.0±7.7	NS	
Change in CQI knowledge T3			14.9±8.8	19.3±8.0	NS					
Change in functional group interaction at T2 <sup>h</sup>			0.1±0.1	0.1±0.2						
Change in dysfunctional group interaction T2			0.0±0.2	0.1±0.2	NS					
Change in functional group interaction at T3 <sup>h</sup>			0.2±0.3	0.2±0.2						
Change in dysfunctional group interaction T3			0.3±0.2	0.3±0.3	NS					

SD=standard deviation; NS=not statistically significant (p>0.05); n/e = not estimable. <sup>a</sup> baseline; <sup>b</sup> 3 months following immediate intervention, before delivery of delayed intervention (control); <sup>c</sup> repeated measures ANOVA – differences compared to baseline for CQI knowledge and MANOVA for group interactions; <sup>d</sup> CQI knowledge was measured using newly-developed 36-item instrument; <sup>e</sup> measured by Watson and Michaelsen scale of effective group interactions; <sup>f</sup> effect of changes in CQI knowledge, functional group interactions, and team problem-solving effectiveness on improvement in patient outcomes and processes of care – rated by independent reviewers; <sup>g</sup> independent samples t-test between successful and unsuccessful teams; <sup>h</sup> groups differed significantly at baseline, therefore statistical analysis of between-group differences in 'change from baseline' are not provided (potentially misleading).

## Educational Tools

Educational tools include any replicable educational activity or program intended to improve healthcare practitioner performance and patient outcomes. Examples include: distribution of educational materials, participation in meetings and workshops (continuing medical education), outreach visits (also known as academic detailing), and the use of local opinion leaders. The rationale underpinning educational interventions is that increased knowledge will lead physicians to change their behaviours and/or attitudes to the benefit of patients.

Table 14 lists the identified educational tools, which were implemented predominantly in the primary care setting, and encompassed a continuum of intensity that ranged from passive, didactic presentations to large groups of people, to individualised or highly interactive workshops targeted at small groups. The targeted behaviours also varied substantially, with most focusing on improving physicians' compliance with clinical practice guidelines particularly in the area of prescribing practice.

Table 14. Educational tools

Tools <sup>a</sup>	Level of care	Studies	Effect of service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Continuing medical education: planned educational activities	All levels	(Davis et al. 1999; Thomson O'Brien et al. 2001)  (Davis 1998; Oxman et al. 1995; Ward & Sanson-Fisher 1996)*	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> <li>• Change in communication skills</li> </ul>	1. Patient ability to manage disease <ul style="list-style-type: none"> <li>• No. of patients smoking</li> <li>• Patients' compliance with medication</li> </ul> 2. Patient quality of life <ul style="list-style-type: none"> <li>• Patients' distress scores</li> </ul>
Educational – dissemination and implementation of CPGs: range of different strategies (lectures, reminders, feedback, mail-outs)	All levels	(Grimshaw & Russell 1993)	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> <li>• Change in physicians' knowledge</li> </ul>	1. Patient complications 2. Patient ability to manage disease <ul style="list-style-type: none"> <li>• % patients stopped smoking</li> </ul>
Educational materials: computer-generated materials for patients	Prevention and management	(Graham et al. 2000; Treweek et al. 2002)*	N/E	N/E
Educational program – small group: learner-centred approach, using mixture of small group work with lectures, seminars and interactive discussions.	Palliation	(Thulesius et al. 2002)	1. Physician participation <ul style="list-style-type: none"> <li>• Physician attitude to end-of-life care</li> </ul> 2. Physician satisfaction	n/a
Educational program – Peer-led small group: rational prescribing relating to four topics.	Treatment	(Richards et al. 2003)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in drug prescribing behaviour</li> </ul>	n/a

Table 14 (cont). Educational tools

Educational seminar and workshop: rational prescribing	Treatment	(Zwar et al. 1995)*	N/E	N/E
Educational sessions - patients: information sessions for patients concerning prenatal testing	Prevention	(Thornton et al. 1995)*	N/E	N/E
Educational training: communication skills program	Palliation	(Wilkinson et al. 1999)*	N/E	N/E
Educational outreach visits (academic detailing): face-to-face visit by trained person to improve a specific behaviour in the physician's own setting.	All levels	(Thomson O'Brien et al. 2000a)	1. Physician participation • Compliance with CPGs • Change in drug prescribing	n/a
Evidence-based Outreach trial	Management	(Goldberg et al. 1998) (Brown et al. 2000)*	1. Physician participation • Prescribing behaviour	1. Patient ability to control disease • Control of BP (hypertension) • Depression symptoms
	Treatment	(Schlienger et al. 1999)	N/E	N/E
	Treatment and management	(Nazareth et al. 2002)*	N/E	N/E
	All levels	(Markey & Schattner 2001)	1. Physician participation • Knowledge about evidence-based medicine	n/a
Local opinion leaders: health professionals nominated by their colleagues as 'educationally influential'	All levels	(Thomson O'Brien et al. 2000b)	1. Physician participation • Compliance with CPGs • Physicians' knowledge and attitudes • Physicians' support during labour • Change in drug prescribing	1. Patient health status • Patients' pain 2. Length of hospital stay 3. Post-operative complications
	Treatment	(Young et al. 2003)*	N/E	N/E
Inter-professional educational strategies: educational, training or teaching initiatives, involving more than one profession in interactive learning	All levels	(Zwarenstein et al. 2001)*	N/E	N/E
Smoking cessation strategies: range of educational tools, with or without additional tools, including reminders, feedback, and support groups	Prevention	(Lumley et al. 2000; Rice & Stead 2001; Rigotti et al. 2003)*	N/E	N/E

CPGs = Clinical Practice Guidelines; BP=blood pressure; N/E = not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria; n/a = not available.

## **Effectiveness of educational materials and continuing medical education**

Five systematic reviews, one randomised controlled trial, and two non-randomised controlled studies exploring a variety of educational tools met the inclusion criteria and were evaluated for effectiveness (see Table 17 and Table 18). Another study (Brown et al. 2000), which met the inclusion criteria according to the review protocol, was excluded due to the lack of extractable data for the relevant process outcomes (Appendix F).

*Educational materials*, printed or electronic, are the most widely used strategy for the passive dissemination of information to increase knowledge and awareness, change attitudes, and improve skills, professional behaviour, and, ultimately, patient outcomes (Bero et al. 1998). Educational materials include clinical practice guidelines, audiovisual materials, and electronic publications.

Systematic reviews have consistently shown that although this is an inexpensive and readily accessible strategy, unsolicited information fails to promote voluntary change in patterns of behaviour. That is, the information is necessary but not sufficient to change physicians' (or patients') behaviour (Davis et al. 1999; Thomson O'Brien et al. 2001).

*Continuous Medical Education (CME)*, such as educational conferences, meetings and workshops, are a common method for physicians to keep up-to-date with current health practice.

Three systematic reviews and two non-randomised controlled studies assessing CME met the inclusion criteria. Overall study quality varied substantially from relatively poor (for studies included in the Davis et al (1999) review) to moderately good (for studies included in the Thomson O'Brien (2001) review).

Two good quality systematic reviews evaluated the effectiveness of educational meetings in changing the behaviour of health care professionals (Davis et al. 1999; Thomson O'Brien et al. 2001). Davis et al (Davis et al. 1999) conducted a meta-analysis on 14 randomised controlled trials of 17 interventions targeting health care professionals who attended educational meetings – didactic, interactive, or a combination of didactic and interactive (mixed). Overall, the quality of the included studies was relatively low, with assessment of outcomes blinded in 50% and only one study reported adequate concealment of allocation. In general, studies that examined didactic interventions (lectures, seminars, conferences) indicated that these interventions were ineffective. Four of six studies with more interactive format showed significant improvement in physician performance and five of seven mixed interventions showed positive change in physician performance. Process outcome measures were physician participation – i.e. documented evidence of physician compliance with CPGs for preventive care, such as number of mammograms, cervical smears, and cholesterol screening tests ordered; disease management, such as recording blood pressure; and counselling on lifestyle changes, including smoking cessation, exercise and weight control. Impact outcomes included patient ability to manage disease – i.e. patients' compliance with medication, and smoking behaviour - and patient quality of life, including a measure of patients' emotional distress. Nine (of 17) interventions produced positive improvements in physicians' behaviour and three (of 4) interventions that examined patient outcomes reported positive effects in at least one outcome. Two of seven single, and 10 of 10 multiple, interventions were effective in improving physician performance. Data from seven trials were pooled to calculate effect sizes using a random effects model. Overall, there was no significant difference in physician performance or health care outcomes as a consequence of formal

educational meetings (Standardised effect size<sup>‡</sup> = 0.34 [-0.22 to 0.97, 95% CI]). However, examination of the interactive and mixed educational sessions indicated a trend towards improvements in physician performance (standardised effect size = 0.67 [0.01 – 1.45, 95% CI]).

One good quality systematic review (Thomson O'Brien et al. 2001) evaluated the effectiveness of educational meetings and printed educational materials in 30 randomised controlled trials and two non-randomised controlled studies. Process outcomes measured in these studies included assessment of participation (behavioural change) concerning physicians' compliance with guidelines, including - prescribing behaviour; screening activities for cancer, arthritis, and cholesterol; counselling on smoking cessation; and ability to detect patients' emotional distress. Impact outcomes included patients' ability to manage their disease (i.e. compliance with medication and smoking cessation), patients' satisfaction, and quality of life (e.g. emotional distress scores). Consistent with earlier findings (Davis et al. 1999), the authors reported that six (of 7) didactic interventions had no effect, seven (of 8) interactive interventions showed significant improvement in at least one outcome, and 16 of 18 mixed interventions demonstrated significant effects, ranging from small to moderately large. Studies in this review were of moderate to high quality, with most (31/32) adequately protected from bias. However, less than 50% of the studies reported adequate follow-up and blinding of assessment, and eight of 32 showed a unit of analysis error (which tends to overestimate the significance of positive effects). Of 35 comparisons, 26 showed significant improvement in professional practice, and three of eight studies showed improved patient outcomes. Standardised effect sizes were calculated for 11 studies (12 comparisons) that used an appropriate unit of analysis. Since substantial heterogeneity across comparisons was evident ( $Q=38.1$ ,  $df=11$ ,  $p<0.001$ ), a random effects model was used. There was no difference in physician participation or patient health status as a consequence of providing a didactic intervention (standardised effect size = -0.02 [95% CI, -0.27 to 0.20,  $p=0.26$ ]). Interactive interventions showed a larger impact on physician performance (standardised effect size = 0.84 [95% CI, 0.51 to 1.17,  $p=0.13$ ]). However, wide confidence intervals reflect the small number of studies, the small size of included studies, and the high variability of results. Visual analysis of the source of heterogeneity, using tables and scatterplots, revealed that the size of the effect increased in interventions with more interactive elements and with less complex targeted behaviours.

One average quality systematic review (Grimshaw & Russell 1993) evaluated 59 studies (39 randomised controlled trials and 20 controlled before-and-after or time series studies) examining several strategies involved in disseminating CPGs, such as reminders, feedback, lectures and mail-outs. The authors report that 55 studies showed significant improvements in the process of care, such as physician participation (e.g. changes in prescribing patterns following introduction of CPGs). Of 11 studies that examined impact outcomes, including patient health status (e.g. cholesterol levels, disease complications), nine reported significant improvements. The probability of effectiveness varied between strategies:

- 'high effectiveness' - specific educational intervention (patient-specific reminder during consultation)

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<sup>‡</sup> Standardised effect size = the difference in means divided by the square root of the pooled group variances

- ‘above average effectiveness’ - continuing medical education with patient-specific feedback
- ‘below average effectiveness’ - mailing targeted groups (general feedback)
- ‘low effectiveness’ - publication in a journal (general reminder).

However, since this systematic review failed to report the quality of included studies, it is difficult to determine how much weight should be given to these findings.

A good quality non-randomised controlled pilot study examined the effectiveness of a peer-led small group education program in influencing rational prescribing behaviour of general practitioners (GPs) in New Zealand (Richards et al. 2003). GPs who volunteered to participate in the study were assigned to one of four topics concerning prescriptions – antibiotics, gastrointestinal, asthma, and depression. A ‘waiting-list’ control group of GPs was derived from those who also volunteered, but responded after the cut-off date, and a second control group of GPs who did not volunteer was included to assess the ‘volunteer effect’. In each intervention group, an experienced GP led discussions on evidence-based recommendations for prescribing, including individual prescribing and laboratory data related to the topic. The process outcome was physician participation (behavioural change), measured by extracting prescribing data from a national database. Key messages and measures relating to each topic are shown in Table 15.

Table 15. Key messages and prescribing outcome measures (Richards et al. 2003)

Topic	Key message	Outcome measure
Antibiotics	<ol style="list-style-type: none"> <li>1. Encourage prescription of erythromycin as the first-line macrolide</li> <li>2. Encourage prescriptions of amoxicillin over amoxy-clav as first-line antimicrobial therapy</li> <li>3. Increase the proportion of ‘bd’ amoxy-clav prescriptions in mild-moderate infections</li> </ol>	<p>Erythromycin prescriptions as a proportion of all macrolides prescribed</p> <p>Prescriptions for amoxy-clav as a proportion of all amoxy-clav or amoxicillin prescribed.</p> <p>Proportion of amoxy-clav prescriptions which are ‘bd’</p>
Gastrointestinal	<ol style="list-style-type: none"> <li>4. Reduce the proportion of high dose H2 antagonist scripts by encouraging dose back-titration</li> </ol>	<p>Proportion of H2 antagonists prescribed in high dose (ranitidine <math>\geq</math>300mg or equivalent)</p>
Asthma	<ol style="list-style-type: none"> <li>5. Increase the proportion of prescriptions for metered dose inhalers</li> <li>6. Increase the steroid:<math>\beta</math>2 agonist prescription ratio for patients</li> </ol>	<p>Proportion of inhaler devices prescribed which are metered dose inhalers</p> <p>Ration of inhaled <math>\beta</math>2 agonist:steroid prescriptions</p>
Depression	<ol style="list-style-type: none"> <li>7. Reduce the prescription of high dose SSRIs as a routine</li> <li>8. Slow the rate of growth of SSRI use</li> </ol>	<p>Proportion of SSRI prescriptions which are high dose (&gt;20mg fluoxetine or equivalent)</p> <p>Prescriptions for SSRIs as a proportion of all anti-depressant prescriptions</p>

SSRI = selective serotonin re-uptake inhibitors.

As there was no difference in prescribing rates between the two control groups, the data were pooled. A logistic regression model was used to adjust for baseline differences, and explore the effect of time, intervention status, and socioeconomic characteristics. In addition, a restricted cubic spline function was used to assess the changes in effectiveness over time - across eight repeated quarterly assessments after the intervention. Using

predicted values from the models, investigators calculated standardised prescribing ratios (SPR)<sup>§</sup> to determine the effect sizes for outcomes over time.

The salient findings from this study were that general practitioners (GPs) in the intervention groups showed a significant improvement in prescribing behaviour (process outcome) for five of the eight key messages, although the effectiveness of the intervention declined over time. Overall, the effect sizes (SPRs) for the positive outcomes ranged between seven and 40%. The greatest change occurred with short-term prescriptions (antibiotics) and the mean effect size was 20% for all key messages. Exploration of the effect of time showed variable results, with a mean duration of a significant impact of 14.5 months, the shortest duration of effect (6 months) for messages related to medication dose (message 3 and 4), and an overall tendency for positive effects to decay over time. The results from this study are potentially biased due to lack of randomisation. In addition, throughout the study period GPs were exposed to other interventions, including mail-outs of educational bulletins, audit and feedback of prescribing behaviour, and academic detailing. Thus, it is difficult to determine which factors motivated physicians to change their prescribing behaviour.

A poor quality non-randomised controlled trial examined the effectiveness of a learner-centred education program in changing the attitude and mental wellbeing of health care professionals caring for terminally ill people in rural Sweden (Thulesius et al. 2002). This study was of low quality. The results are not presented as they are likely to be affected by bias.

### ***Critical success factors of educational materials and CME***

There was large variability in the intensity and complexity of educational interventions across studies and systematic reviews. The intensity of interventions ranged from a single 10-15 minute session, or a 1-2 day workshop, to multiple hour-long sessions over an extended period. Similarly, the complexity of interventions varied across the continuum from the more passive, didactic format of lectures and seminars, to highly interactive group discussions and workshops. Overall, studies examining the effectiveness of educational materials and CME have given highly variable results.

- Educational materials alone, whether printed or electronic, have no influence on either process or patient outcomes
- Where educational materials are a component of other tools (e.g. CME or academic detailing), they are more influential in promoting change if the information source is credible (from a trustworthy expert), the message is clear, succinct, and persuasive, and the content is specific to the disease or patient.
- The materials used in educational interventions are more likely to be effective if they are persuasive, informative and relevant to the learner.

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<sup>§</sup> Standardised Prescribing Ratio (SPR) = ratio of the predicted proportion of prescriptions for a particular drug written by a large future cohort of GPs exposed to the educational intervention, compared to the proportion of prescriptions written by an identical cohort not exposed to the intervention.

- The better quality studies suggest that CME tools are more likely to facilitate change in targeted behaviours when the channel of delivery is more interactive (less didactic), and the content is simple (less complex) and more focused on a specific problem (tailored or personalised rather than generic).
- The effect of duration, or decay over time, however, has not been adequately explored.

### **Effectiveness of educational outreach (academic detailing)**

*Educational outreach visits*, also known as academic detailing, involve face-to-face delivery of relevant, visually attractive, and concise information about a well-defined clinical practice by a trained person who meets with health care providers in their own setting. Typically, physicians or pharmacists trained in communication and behaviour modification offer health care professionals brief, specific, one-to-one education and feedback sessions. Outreach visits vary in the content and technique used to influence change. A common method is “social marketing”, which is comprised of a series of steps. The key first step is to assess physicians’ motivation to change behaviour and determine the barriers to change. Other steps include: develop programs for specific physicians and their opinion leaders, develop objectives, establish credibility, encourage physician participation, use concise educational materials, repeat key messages, and provide reinforcement through subsequent visits (Thomson O'Brien et al. 2000a). Other types of outreach visits involve reducing administrative barriers by streamlining office procedures in the practice setting, and using practice-enabling techniques, such as role-play to develop specific skills. Educational outreach is predominantly used to improve prescribing practices and reduce the number of adverse drug events.

One systematic review and three randomised controlled trials assessing educational outreach met the criteria for inclusion in this review (Table 14). Overall, the quality of studies was poor to average, with potential biases and unit of analysis errors evident.

The good quality systematic review evaluated 18 randomised controlled trials examining the effects of educational outreach visits on physicians’ prescribing practice, delivery of preventive care, and general management of health care problems (process outcomes) (Thomson O'Brien et al. 2000a). Most included studies were of relatively low quality and all 18 had some risk of bias. Thirteen studies had inadequate or unclear concealment of allocation, assessment was unblinded in nine, and six had unit of analysis errors. Process outcomes predominantly focused on physician participation (behavioural change), including prescribing patterns, providers’ use of resources, compliance with clinical practice guidelines (CPGs), and provision of preventive services (screening, vaccinations) and counselling (lifestyle risks). Three studies that investigated the effect of outreach visits alone (including educational materials or conferences) on improving prescribing practices demonstrated statistically significant differences compared to controls (with or without educational materials and conferences). The relative improvement ranged from 24% to 50%. Thirteen studies combined educational outreach visits with other interventions, including reminders, audit and feedback, local opinion leaders, and social marketing strategies. Although improvements in physicians’ behaviours after these visits were evident in most studies, the most consistent improvements were demonstrated in trials that combined educational outreach visits with social marketing techniques - 12/13 studies produced positive effects (15-68% improvement).

An average quality cluster randomised controlled trial examined the effectiveness of academic detailing and continuous quality improvement (CQI) in implementing CPGs for depression and hypertension in three different groups of patients – known hypertensives, known depressives, and “unrecognised” depressives (Goldberg et al. 1998). A brief outline of the key criteria of the CPGs is shown in Table 16. Using a firm system\*\* of randomisation, small group practices in the primary care setting were randomised to three groups. One group received an academic detailing intervention involving three one-on-one sessions. In one 15-minute session, a physician opinion leader distributed information about the hypertension and depression CPGs, and in two follow-up sessions, computer-generated profiles of individual provider’s prescribing patterns were compared to their peers. A second group were assigned to a combined academic detailing and CQI intervention. Each CQI group, which formed one team for hypertension and another for depression, used the Shewhart cycle of activities model (Plan, Do, Study, Act) to identify deficiencies specific to their site, to develop and implement a plan, and monitor changes as they occur. A third group of practices were assigned to “usual care”.

Table 16. Key criteria of clinical practice guidelines for management of hypertension and depression

Hypertension	Depression
Prescribing behaviour	
<ul style="list-style-type: none"> <li>Promote prescription of beta-blockers and potassium-sparing diuretics</li> <li>Limit prescription of calcium-channel blockers and ACE-inhibitors</li> </ul>	<ul style="list-style-type: none"> <li>Avoid prescription of 1<sup>st</sup>-generation tricyclics</li> <li>Promote prescription of 2<sup>nd</sup>-generation tricyclics or SSRIs</li> </ul>
Disease control behaviour	
<ul style="list-style-type: none"> <li>Maintain blood pressure within optimal range without “overcontrolling”<sup>a</sup></li> </ul>	<ul style="list-style-type: none"> <li>Improve medication compliance</li> <li>Improve recognition rate<sup>b</sup></li> <li>Monitor drug therapy and assess for referral</li> </ul>

ACE=angiotensin-converting enzyme inhibitors; SSRI=selective serotonin re-uptake inhibitors. <sup>a</sup> Optimal range = mean values <160/90mm Hg, and “over-controlled” = mean diastolic <80 mm Hg; <sup>b</sup> depression recognition = % of eligible patients dispensed anti-depressants within 6 months following initial screening.

The key process outcome in this study was provider participation – specifically, change in physicians’ prescribing behaviour (Table 17). Impact outcomes concerned patients’ ability to control disease, particularly control of blood pressure in hypertensives and depression symptoms in depressives (Table 18). Results from this study showed that across clinics, there were no consistent differences in physician prescribing patterns as a result of receiving either intervention. For example, while prescription of potassium-sparing diuretics increased and calcium-channel blocker prescriptions decreased in all groups, improvement was greatest in the usual care group compared to either intervention group. In contrast, prescriptions for beta-blockers were most effectively increased in the group receiving academic detailing and continuous quality improvement (CQI). Although prescriptions for angiotensin-converting enzyme (ACE)-inhibitors increased in all groups, the rate of increase was lower in the group receiving academic

\*\* Firm systems: using a blocked, blinded technique, patients and physicians are randomised to small groups on an ongoing basis. As a result, firms are separate but equivalent groups Dawson, N. V. (1991). 'Organizing the Metro Firm System for research' *Medical Care*, 29 (7 Suppl), JS19-25..

detailing alone. Blood pressure control was most improved in hypertensive patients treated by physicians receiving both academic detailing and CQI (Table 18).

Compliance with prescribing guidelines for depression were largely consistent with the recommendations, with greater reductions in prescribing 1<sup>st</sup>-generation tricyclics and larger increases in prescribing selective serotonin re-uptake inhibitors (SSRIs) in the groups receiving an intervention, compared to usual care. Academic detailing recipients changed their behaviour compared to the usual care group, in terms of compliance with depression CPGs, particularly in prescribing for 2<sup>nd</sup>-generation tricyclics and in recognition of depression, or depression symptoms, in their patients.

The authors suggest that the wide variability in the amount of effort applied by participants at different sites may explain the variability of effect. For example, the proportion of practitioners who received academic detailing ranged from 48 to 100% and the length of time spent in detailing sessions ranged between three and 30 minutes. Similarly, the CQI teams varied in their commitment to implement changes, with larger Health Maintenance Organisations implementing methods that are known to be weak in effecting change, such as patient education and use of flow sheets. Overall, academic detailing produced more positive attitudes and behaviours in clinicians treating depression and increased use of anti-depressants for both the depressive patients and a cohort from the membership population. However, there was no improvement in depressive patients' self-reported symptoms, and a worsening in two global functioning measures, which may reflect side effects from increased medication. The authors suggest that the depression CPGs, which focus on detection, diagnosis and treatment of new cases of depression, may not be suitable for chronically depressed patients.

A poor quality randomised controlled trial explored the impact of academic detailing on physicians' understanding of evidence-based medicine (EBM) (Markey & Schattner 2001). Results are shown in Table 17. However, there were several potential biases in this study that are likely to militate against the validity of the results – the follow-up response rate of practitioners was poor (48%), process outcome measures were subjective, and practitioners in different groups may have worked in the same practice (contamination).

### ***Critical success factors of educational outreach interventions***

There was wide heterogeneity in the impact of educational outreach interventions on the quality of health service delivery, which may be due to the lack of good quality studies. Overall, the better quality studies indicate that the attributes that contribute most to the effectiveness of academic detailing include:

- Targeting a defined group of clinicians
- Having clear educational and behavioural objectives
- Assessing and addressing barriers to change
- Utilising a detailer (educational outreach visitor) that has credibility
- Having active health care provider participation in sessions
- Using concise graphic educational material

- Identifying and repeating essential messages
- Positively reinforcing messages in follow-up visits
- Using additional tools, particularly social marketing techniques.

### **Effectiveness of opinion leaders**

*Opinion leaders* are clinicians identified by their colleagues in the community as being respected clinicians and effective communicators (Davis & Taylor-Vaisey 1997). Using local opinion leaders who are “educationally influential” to transmit norms and model appropriate behaviour has the potential to change health professionals’ practice.

A good quality systematic review of eight randomised controlled trials examined the effectiveness of opinion leaders at improving the practice of health professionals and patient outcomes (Thomson O'Brien et al. 2000b). Process outcomes included physician participation (behavioural change), specifically - physicians’ compliance with clinical practice guidelines; knowledge and attitudes about pain management; prescribing practices; and support during labour. Impact outcomes included patients’ health status (pain); post-operative complications; and length of hospital stay. The quality of included studies was relatively poor. Concealment of allocation and blinding of assessment was unclear in 75% of studies, 50% had probable unit of analysis errors, and follow-up of professionals was unclear in 38% of studies. Overall, the use of opinion leaders to change professional practice resulted in mixed effects. Statistically significant improvements in the practice of health professional were demonstrated in two trials (of 8), and one (of 3) that measured patient outcomes reported a significant reduction in patient complications. However, most studies did not clearly define the method of selection or role of the nominated opinion leader, and the strength of evidence was not always apparent, making interpretation of the effectiveness of the intervention difficult to determine.

### ***Critical success factors of educational outreach interventions***

On the basis of one systematic review, with mixed results regarding effectiveness, critical success factors for the use of opinion leaders as an educational tool cannot be determined.

Table 17. Effectiveness of Educational tools – Process outcomes

Study	Level and quality of evidence	Target population	Interventions	Outcomes – Assessment of participation (behavioural change)					
(Goldberg et al. 1998)	Level II: RCT Quality: average	95 health care providers 15 small group practices (firms) <sup>a</sup> were randomised in blocks	Academic detailing	Prescribing behaviour					
			Academic detailing + Continuous quality improvement	<i>CPGs for Hypertension, % of patients receiving treatment</i>					
				Drugs	Usual care	AD		AD + CQI	
					% change <sup>b</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>
				All diuretics	+4.3	+3.0	0.7	-0.4	0.1
				K-sparing regimens	+6.3	+3.2	0.5	+3.0	0.5
				Beta blockers	+3.1	+2.5	0.8	+3.7	1.2
				CC blockers	-4.6	-2.3	0.5	-2.0	0.4
				ACE inhibitors	+2.1	+1.3	0.6	+2.8	1.3
				<i>CPGs for Depression, % of patients receiving treatment</i>					
				Drugs	Usual care	AD		AD + CQI	
					% change <sup>b</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>
				1 <sup>st</sup> generation tricyclics	-4.7	-9.4	2.0	-12.1	2.6
				2 <sup>nd</sup> generation tricyclics	-4.2	-6.3	1.5	-3.1	0.7
SSRIs	+12.0	+15.3	1.3	+14.7	1.2				
Eligible unrecognised <sup>d</sup> patients prescribed anti-depressants	-0.2	+2.2	11.0	+0.3	1.5				
(Markey & Schattner 2001)	Level II: RCT Quality: poor	64/132 GPs in the Monash Division of General Practice Response rate: 48%	Academic detailing: to promote EBM in GPs	<i>Knowledge scores, % of physicians answering correctly</i>					
				Control % correct responses (N=30)	Intervention % correct responses (N=34)	Difference in change of scores from baseline [95% CI] <sup>e</sup>			
				54.0	63.0	11.8 [0.8-22.9] <i>p</i> <0.04			

Table 17 (cont.) Effectiveness of Educational tools – Process outcomes

(Thulesius et al. 2002)	Level III-2: non-randomised study Quality: poor	450 health care professionals Pre-test response rate: 99% Post-test response rate: 68%	Education project: to improve attitudes towards end-of-life patients	<i>Assessment of participation (change in attitudes)</i>					Effect measure		
				<i>Anxiety and Depression (HAD<sup>f</sup> scores)</i>	Control group			Education group			
					Before	After	% Change [95% CI] <sup>f</sup>	Before	After	Change [95% CI] <sup>f</sup>	Relative change <sup>g</sup>
				Anxiety score, mean	4.6	5.1	+10.9 [-1.3, 0.3]	5.4	3.8	-29.6 [1.0, 2.2]	2.7
				Depression score, mean	2.2	1.7	-22.7 [-0.1, 1.0]	2.8	1.5	-46.4 [0.9, 1.7]	2.0
				Total score, mean	6.8	6.8	0 [-1.2, 1.2]	8.2	5.3	-35.4 [2.1, 3.7]	n/e

AD=academic detailing; CQI=continuous quality improvement; k-sparing=potassium-sparing; cc=calcium channel; ACE=angiotensin-converting enzyme; EBM=evidence-based medicine; SSRIs= selective serotonin re-uptake inhibitors; GPs=general practitioners; HAD=Hospital Anxiety and Depression scale; n/e = not estimable. <sup>a</sup> serial firms = patients and physicians are randomised to small groups on an ongoing basis. Firms are randomised to intervention or control groups. See Dawson (Dawson 1991) for more detail; <sup>b</sup> pre- and post-intervention scores not included due to space restrictions - available on request; <sup>c</sup> pairwise Student's t-test between intervention and control arms, not adjusted for baseline differences, therefore *p*-values not included; <sup>d</sup> eligible unrecognised depressives = patients who scored above the cut-off point for minor depression, were not receiving anti-depressants, and who returned for treatment in the following 6 months; <sup>e</sup> authors state baseline measures were equivalent between control and test groups. Difference between groups' change in scores was calculated using t-test; <sup>f</sup> student's t-test; <sup>g</sup> difference between post-intervention scores in control and education groups were not adjusted for baseline differences, therefore no *p* values given.

Table 18. Effectiveness of Educational tools – Impact outcomes

Study	Level and quality of evidence	Target population	Interventions	Outcomes – Change in patient health status				
(Goldberg et al. 1998)	Level II: RCT Quality: average	95 health care providers 15 small group practices (firms) <sup>a</sup> were randomised in blocks	Academic detailing	CPGs for Hypertension, % of patients requiring treatment <i>Change in blood pressure control</i>				
			Academic detailing + Continuous quality improvement	Usual care	AD		AD + CQI	
				% change <sup>b</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>
				+9.6	+8.2	0.9	+3.9	0.4
			Academic detailing + Continuous quality improvement	CPGs for Depression <i>Change in mean SCL score for depressive symptoms</i>				
				Usual care	AD		AD + CQI	
				% change <sup>b</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>	% change <sup>b</sup>	Relative change <sup>c</sup>
				+6.8	+5.1	0.8	+5.2	0.8

AD=academic detailing; CQI=continuous quality improvement; CPG=clinical practice guideline; SCL = Hopkins Symptom Checklist, a 20-item scale for depression symptoms – higher score indicates worse symptoms. <sup>a</sup> serial firms = patients and physicians are randomised to small groups on an ongoing basis. Firms are randomised to intervention or control groups. See Dawson (Dawson 1991) for more detail; <sup>b</sup> pre- and post-intervention scores not included due to space restrictions - available on request; <sup>c</sup> pairwise Student's t-test between intervention and control arms was not adjusted for baseline differences, therefore *p*-values not included.

## Decision Support

Decision support systems, which are often based on protocols or clinical practice guidelines, may be computerised or manual, and are aimed at assisting the patient, health care provider, or both at making health-related decisions. The growing sophistication of computer hardware and software enables the information technology field to play a key role in decision-making for both health care providers and patients by providing timely feedback on physicians' performance, detecting and preventing errors, and providing patients with information on the probable consequences of choosing particular treatment alternatives. A computerised Clinical Decision Support (CDS) system is a computer program that compares individual patient characteristics with a 'best practice' knowledge-base and then guides a health care provider (or patient) by offering patient-specific and situation-specific advice. CDS systems synthesise and integrate patient information, perform complex evaluations, and provide rapid advice, such as recommended drug dosage, immunisation reminders, and diagnosis of pain (Hunt et al. 1998).

Computerised physician order entry (CPOE) is a computer-based system that automates the medication ordering process and ensures standardised, legible orders. CPOE and CDS systems frequently work together targeting the ordering phase of prescribing, where most medication errors (errors in ordering, transcribing, dispensing, administering, or monitoring) and preventable adverse drug events occur (Kaushal et al. 2003). Determining and monitoring therapeutic concentrations of drugs is complex and time-consuming, requiring detailed knowledge of pharmacokinetics. CDS may be used to improve physicians' drug prescribing performance. After the physician enters a patient's details (age, weight, current drug therapy) into the computer, the program calculates the most appropriate drug dose. In some cases, the computer also administers the drug as an infusion. Most systems use a mathematical model of pharmacokinetics to predict appropriate doses – ranging from a simple, linear, one-compartment model to more complex three-compartment models. Computers frequently use Bayesian<sup>††</sup> forecasting to achieve target serum drug levels (Walton et al. 2001).

Another form of decision support is the consensus method, a structured facilitation technique that explores consensus among a group of experts by synthesising opinion. That is, providers participate in a discussion, aiming to reach agreement in the approach used to managing a chosen clinical problem. This occurs by a variety of means, including the Delphi technique proposed by the RAND corporation<sup>‡‡</sup>, nominal group technique and iterated consensus rating procedures (Campbell et al. 2003). Social dynamics within a group of physicians may influence a change in practice (Karuza et al. 1995). That is, there may be conflict between physicians' current practice and the pressure to adopt new (untried) practices with potentially greater benefits for patients. Physicians may turn to their peers (local opinion leaders) or experts within the medical community (academic detailing). Consensus is underpinned by three factors: 1) removal of resistance to change by resolving discrepancies in values and expectations between individuals and the group; 2) permitting

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<sup>††</sup> Bayesian approaches use probability theory to enable the processing of current knowledge, such as patient symptoms, disease characteristics and prevalence, to predict patient diagnosis, treatment and outcomes.

<sup>‡‡</sup> Delphi technique is a systematic approach to developing criteria for the appropriateness of medical procedures. It combines knowledge from the medical literature and a systematic approach to collating multidisciplinary expert opinion utilising postal methods.

the sharing of information about barriers that deter the implementation of new behaviours, and proposing means to overcome these barriers; and 3) forging a link between the motivation to change and the required action (Karuza et al. 1995).

Twenty-five studies in the evidence-base identified service improvement tools that fell into the category of computerised decision support (Table 19).

**Table 19. Computerised Decision Support systems**

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Computerised decision support system – physicians: computer software using a knowledge-base designed for use by a clinician involved in patient care as a direct aid to clinical decision making	Prevention, diagnosis and treatment	(Hunt et al. 1998) (Kaushal et al. 2003; Walton et al. 2001)*	1. Physician participation <ul style="list-style-type: none"> <li>• Change in drug prescribing</li> <li>• Compliance with CPGs</li> <li>• Errors in laboratory test ordering</li> <li>• Change in number of unnecessary admissions</li> </ul>	1. Patient ability to control disease <ul style="list-style-type: none"> <li>• Blood pressure control</li> <li>• Weight control</li> </ul> 2. Complications and adverse reactions 3. Quality of life <ul style="list-style-type: none"> <li>• Emotional well-being</li> </ul>
	Management	(Eccles et al. 2002)	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> <li>• Change in drug prescribing</li> </ul>	1. Patient ability to control disease <ul style="list-style-type: none"> <li>• Blood pressure control</li> <li>• Weight control</li> <li>• Smoking status</li> <li>• Medication compliance</li> <li>• Cholesterol levels</li> </ul> 2. Patient satisfaction with care
	Treatment	(Boon-Falleur et al. 1995; East & Morris 1996; McKinley et al. 2001; Tange et al. 2003)*	N/E	N/E
	Diagnosis	(Solomon et al. 1998; van Wijk et al. 2001; Zatti et al. 1988)*	N/E	N/E

Table 19 (cont). Computerised Decision Support systems

Computerised physician order entry: computerised system for physician orders – includes menu of medications, default doses, and consequent orders to improve quality of prescribing	Treatment	(Bates et al. 1998; Nightingale et al. 2000)*	N/E	N/E
Electronic prescribing medicines administration: computerised decision support system to reduce medication errors and improve quality of prescribing	Treatment	(Almond et al. 2002)	1. Physician participation • Change in drug prescribing errors 2. Participant satisfaction with system	n/a
Palmtop drug reference guide: hand-held computerised drug reference database	Treatment	(Rothschild et al. 2002)*	N/E	N/E
Computerised template: based on guidelines for asthma and diabetes management	Management	(Tai et al. 1999)*	N/E	N/E
Decision support systems - patient: brochure, discussion and lecture, computerised or interactive system – to assist decision-making on hormone replacement therapy	Prevention and treatment	(Chewning et al. 1999; Estabrooks et al. 2001; Holmes Rovner et al. 1999; Murray et al. 2001b; O'Connor et al. 1999; O'Connor et al. 2003; Rostom et al. 2002)*	N/E	N/E
Small group consensus process: lecture and discussion on influenza vaccination for the elderly	Prevention	(Karuzza et al. 1995)	1. Physician participation • Change in influenza vaccination rates • Physician attitudes and knowledge of influenza	n/a
Standardised medication order review and evaluation system: decision support system with structured algorithm to assist physicians dispensing-related decisions	Treatment	(Jackson et al. 2002)*	N/E	N/E
Root cause analysis: a tool used to investigate adverse and sentinel events	Treatment, Management, Rehabilitation	(Rex et al. 2000)*	N/E	N/E

CPGs=Clinical Practice Guidelines; n/a = not available; N/E = not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of decision support tools

One systematic review, two randomised controlled trials and a non-randomised controlled trial that examined the effectiveness of computerised decision support (CDS) systems on health service improvement met the inclusion criteria. One further study (Tai et al. 1999), which met the inclusion criteria, was excluded due to the lack of extractable data for the relevant process outcomes (Appendix F). Studies were conducted predominantly in the primary care setting in the USA and UK. Decision support systems were frequently used to influence drug-prescribing behaviour, and less often for preventive care and diagnostic services.

One good quality systematic review (Hunt et al. 1998), which updated a previous one (Johnston et al. 1994), identified 68 randomised or quasi-randomised controlled trials, and studies with concurrent controls. Using a 10-point rating scale the authors reported a significant improvement in the quality of more recent studies (mean=7.7) since the earlier version (mean=6.4,  $p<0.001$ ), leading to stronger conclusions of effectiveness. Process outcomes centred on physician participation. In drug dosing studies, this entailed achieving drug concentrations within a therapeutic range. In preventive care studies, this meant measuring physicians' adherence to protocols, and in diagnostic aid studies this entailed measuring physicians appropriate ordering of tests and proper referral of patients. Impact outcomes assessed patients' health status (pain, complications, adverse drug reactions) and ability to control disease (weight and blood pressure control). Significant improvement in preventive care and drug dosing was shown in 14/19 and 9/15 studies, respectively, while 1/5 studies on diagnostic aids showed a reduction in post-operative complications and a significant improvement in the timely referrals of patients, with use of CDS systems. Of 26 studies, 19 showed improvements in other medical care areas, such as compliance with recommendations for diabetes care. The evidence from this review suggests that, if drug pharmacokinetics is well understood, a CDS system may be effective in administering therapeutic levels of medication. This was true for maintaining therapeutic levels of theophylline, lidocaine hydrochloride or achieving anticoagulation control with heparin – although, the results on warfarin were inconsistent. In addition, CDS systems were more effective in the presence of other tools, such as requiring physicians to acknowledge reminders generated by the CDS and providing personalised feedback to physicians on their adherence to recommendations. Of 14 studies that assessed patient outcomes, six showed benefits for patients (improved weight control and general well-being), but most were underpowered to adequately assess these outcomes.

One good quality cluster quasi-randomised controlled trial examined the impact of computerised clinical practice guidelines (CPGs) on the management of angina and asthma, using an incomplete block design in which each disease acted as control for the other (Eccles et al. 2002). Practices were randomised to receive computerised guidelines for the management of angina or asthma. Each group provided intervention data for one set of guidelines and control data for the other. The primary process outcome was physicians' participation (behavioural change) – specifically, documented evidence of compliance with CPGs, changes in drug prescribing and provision of health services. Impact outcomes were patients' ability to control disease (e.g. control of weight, blood pressure, cholesterol) and patient satisfaction. The wide range of process outcomes abstracted from clinical records (shown in Table 20) indicated that there were no statistically significant differences between the intervention and control groups. No significant effects of computerised CDS on any disease management outcome measures were observed from abstraction of data from medical records. In addition, a self-reported survey showed no impact of CDS on patient

outcomes. Analysis of the usage of CDS revealed that the median number of active interactions was predominantly zero. The very low use of the computerised CDS system may, therefore, underlie the lack of effect.

Table 20. Process outcomes abstracted from clinical records of angina and asthma patients (Eccles et al. 2002)

Angina	Asthma
Documented evidence of action: Blood pressure check Electrocardiogram Haemoglobin concentration Thyroid function test Cholesterol/other lipid concentrations Blood glucose/HbA <sub>1c</sub> Smoking cessation advice Exercise advice Weight recorded or advised	Documented evidence of action: Lung function test Inhaler technique assessed Compliance with medication Asthma education/action plan Smoking cessation advice
Appropriate prescribing of angina drugs: Glyceryl trinitrate Beta blockers Calcium channel blockers Statins	Appropriate prescribing of asthma drugs: Short/long acting $\beta_2$ agonists Inhaled corticosteroids Oral steroids Oral bronchodilators

Another good quality quasi-randomised controlled trial examined the effectiveness of increasing physicians' compliance with clinical practice guidelines (CPGs) for influenza vaccinations using a small-group consensus approach (Karuza et al. 1995). Thirteen separate practices (with 51 physicians) were randomised to either a small-group consensus intervention or a placebo control. The small-group consensus process consisted of two parts: 1. One 10-minute lecture, which was delivered by an opinion leader, on CPGs for influenza vaccinations in the elderly. The lecture contained information concerning the effectiveness of the vaccine, details on its preparation, contraindications and side effects, and data on vaccination compliance rates; and 2. One 40-50 minute group discussion, led by a facilitator, aimed to develop a plan and encourage physicians to commit to increasing vaccination rates in elderly patients. Practice groups implemented a range of plans, including chart reminders, letters to patients, waiting room posters, and organisational changes. Physician participation - change in influenza vaccination rates and physicians' knowledge of influenza and attitudes to vaccination - was the key process outcome. Statistical analysis revealed no significant differences in physicians' or aggregated practice group's vaccination rates between the different strategies. To account for differences in baseline vaccination rates between study arms, ANCOVA was used to produce adjusted post-intervention vaccination rates that reflected the impact of the intervention. Since there were no significant differences in adjusted baseline vaccination rates between practices within study arms, physicians' vaccination rates, rather than practice rates, were used as the unit of analysis. Results, which are detailed in Table 21, demonstrated significantly higher vaccination rates (adjusted: 62.4%) in the intervention group compared with the control group (adjusted: 46.5%,  $p < 0.001$ ). That is, the small-group consensus intervention increased adjusted physicians' vaccination rates by 16% compared to controls.

Table 21. Effectiveness of Computerised Decision Support systems – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of participation (Behavioural change)							
				Control group N=28			Intervention group N=23				
				Before 1990-1991	After 1991-1992 (adjusted) <sup>a</sup>	% change	Before 1990-1991	After 1991-1992 (adjusted) <sup>a</sup>	% change	Relative change (adjusted difference) <sup>a</sup>	
(Karuza et al. 1995)	Level III-1: cluster quasi-RCT, randomised by group practice Quality: good	51 physicians in 13 separate practices	Small group consensus process	<i>Change in physician-practice influenza vaccination rate, mean (%) ±SD</i>							
				46.5±21.0	46.1±20.7 (46.5 <sup>a</sup> )	-0.9 (0.0 <sup>a</sup> )	47.6±23.7	62.8±20.6 (62.4 <sup>a</sup> )	+31.3 (+31.1 <sup>a</sup> )	34.8 (n/e)	p<0.01 p<0.001 <sup>a</sup> )

n/e=not estimable. <sup>a</sup> ANCOVA adjusted rate with pre-vaccination rate as the covariate – practice group was nested within the study arm.

An average-quality controlled before-and-after study examined the effectiveness of an Electronic Prescribing Medication Administration (EPMA) system on improving the quality of clinicians' prescribing and administration of medicines (Almond et al. 2002). The EPMA is a computerised decision support system that provides real-time data storage and retrieval, clinical decision support, and computerised stock control in the ward and pharmacy. The system was introduced into the renal ward, while the respiratory ward, which had similar patient turnover, acted as a control. The key process outcome was physician participation (behavioural change) - including the number of medicines administered, the number of amendments to prescriptions, and the reasons for failure to administer medication – and assessment of productivity (time taken to complete rounds). Authors report that prior to use of EPMA in the renal ward, external review of prescribing errors in both wards showed equivalent rates (approximately 12%) and severity of errors (20% major, 65% moderate, 15% minor). A similar pattern emerged in the respiratory ward (control) after EPMA intervention. In contrast, all prescriptions on the intervention ward were legible and 94% passed clinical screening with  $\leq 1$  modification. The post-intervention success rate in administering medications was significantly higher in the EPMA intervention ward (95.4%) compared to the paper-based system in the control ward (90%,  $p < 0.001$ ,  $\chi^2$  test) – baseline rates were reported as equivalent between groups. In addition, health professionals' attitudes to the use of EPMA were collected by questionnaire (46% response rate). The majority of responding staff believed that the equipment was easy to use, but that it took much longer to create a prescription. Authors conclude that, although the quality of prescribing and the safety of medicine administration were significantly increased with EPMA, the administration time was double that involved in paper-based prescribing.

### ***Critical success factors of decision support systems***

Although the studies that support the evidence base for decision support systems are of relatively good quality, the heterogeneity between studies makes it difficult to determine overall key elements to success. There were, however, several features that appeared consistently in the more effective programs:

- Credibility and accuracy of information which facilitated usage
- Ease of use and interactive characteristics pre-disposed physicians to utilisation of the tool
- Use of additional tools assisted provider uptake - decision support systems were more effective in the presence of additional tools, such as reminders, feedback on performance, and educational materials.

## Prompts and Reminders

Reminders are any intervention (computerised or manual) that prompts the health care provider to perform a clinical action – particularly in the promotion of<sup>2</sup> well-established and effective clinical practices. Examples include concurrent or inter-visit reminders to professionals about recommended actions, including screening, counselling, or other preventive services, appropriate laboratory tests, or enhanced administrative support (e.g. follow-up appointment systems or stickers on charts). Every visit to a physician is viewed as an opportunity to promote good health maintenance, such as updating a child’s immunisation record or performing an overdue Pap smear. This also includes reminders to patients about appointments or screening tests by way of postcards, letters, or telephone calls.

Table 22 lists the identified studies that used prompts and reminders to influence the behaviour of health care professionals and patients.

Table 22. Prompts and Reminders

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Physician prompts: including computerised and non-computerised methods, notes attached to patient’s chart	Prevention	(Balas et al. 2000)	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with CPGs for preventive care</li> </ul>	1. Patient ability to manage disease <ul style="list-style-type: none"> <li>• Blood pressure control</li> <li>• Cholesterol levels</li> <li>• Smoking cessation</li> </ul>
	Treatment	(Rind et al. 1994)*	N/E	N/E
Reminders: computerised or paper-based reminders to health care providers Feedback: peer-comparison and audit feedback	Management	(Bennett & Glasziou 2003) (Ward & Proude 1999)*	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> </ul>	1. Patient ability to manage disease <ul style="list-style-type: none"> <li>• Compliance with medication</li> </ul>
Reminders: computerised	Prevention	(Dexter et al. 2001)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in rates of ordering preventive therapies</li> </ul>	n/a
Reminders: charting deficiencies in ICU	Treatment	(Oniki et al. 2003)*	N/E	N/E
Reminders: to keep appointments 1. telephone reminders 2. mailed reminders	Management	(Gerson et al. 1986; Grover et al. 1983; Shepard & Moseley 1976)*	N/E	N/E
Reminders – patients: postcard reminders for influenza vaccinations in elderly patients	Prevention	(Puech et al. 1998)	1. Physician participation <ul style="list-style-type: none"> <li>• change in influenza vaccination rates</li> </ul>	n/a

CPGs=clinical practice guidelines; ICU=intensive care unit; n/a=not available; N/E=not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of reminders and prompts

Two systematic reviews and one randomised controlled trial met the inclusion criteria for evaluation (Table 23). Set largely in the USA or Canada, prompts and reminders were used in these studies to improve physicians' compliance with clinical practice guidelines (CPGs) for preventive care services and to encourage patients to keep appointments.

In a good quality systematic review and meta-analysis, Balas et al (Balas et al. 2000) evaluated 33 randomised controlled trials investigating the impact of physician prompts on the delivery of preventive medicine to patients. Prompts, which were delivered prior to a scheduled visit, contained a variety of generic or patient-specific information, including recommended tests (vaccinations, mammograms, faecal occult blood tests), counselling (smoking cessation) or overdue tests or procedures (immunisations, blood pressure, Pap smears). The types of prompting tools included checklists attached to a patient's chart, tagged notes, computer-generated forms, prompting stickers, and patient-carried prompting cards. In some studies, patients also received reminders by telephone, letter, or postcard. The quality of studies was appraised using a scoring scale from one to 100. Included studies had a mean quality score of  $69.7 \pm 7.9$  and no study scored less than 50. Physician participation (behavioural change) was the principal process outcome. In most studies, process outcomes were assessed by audit of medical records and targeted actions were included if there was a note in the patient's medical record. A *Health Maintenance Rate* was calculated as a ratio of the number of preventive care actions to the number of eligible physician-patient opportunities. A meta-analysis of studies revealed that physician prompts induced a significant increase in all 16 preventive care procedures examined (cancer screening, immunisations, management of diabetes, blood pressure, cholesterol, and haemoglobin, glaucoma screening, prenatal care, tuberculosis testing and counselling for smoking cessation and alcohol abuse). The overall effect of prompting was determined using a modified DerSimonian-Laird estimator. Pooled estimates of the differences in health maintenance rate between the intervention and control groups for six of the targeted procedures are detailed in Table 23. The other targeted procedures were not reported as they were investigated in fewer than six trials. A random-effects regression model was used to identify sources of heterogeneity, such as clinic size and specialty, the type of prompting technique, quality of the study, and method of reimbursement, that may have contributed to the outcomes. Results showed that physician prompting at sites with a larger patient-clinician ratio had greater improvements in tetanus ( $0.002 \pm 0.000$ ,  $p < 0.001$ ) and pneumococcal vaccinations ( $0.01 \pm 0.003$ ,  $p = 0.004$ ), whereas prompting had significantly less effect on Pap smear rates in capitated outpatient care ( $-0.1 \pm 0.04$ ,  $p = 0.02$ ) and when prompting was computer-generated ( $-0.08 \pm 0.04$ ,  $p = 0.05$ ). There was no significant difference between modes of prompt delivery. Overall, results showed that prompting physicians led to significant improvements in preventive care actions in 26 out of 33 studies, and the cumulative health maintenance rate difference between intervention and control groups was 13.1% [95% CI, 10.5-15.6%]. These results are robust and unlikely to be influenced by publication bias as calculated tolerance levels were large.

Another good quality systematic review (Bennett & Glasziou 2003) evaluated 26 randomised controlled trials (29 comparisons) investigating the effectiveness of computerised reminders and feedback in medication management. Using a quality score system (out of 17), the mean score for methodological quality was 13.6 (range: 9-17). Potential for bias was generally low, with valid randomisation in 25 trials, appropriate blinding of assessment in 24, adequate baseline data in 18, and >95% follow-up in 18 studies. Process outcome measures were physician participation (behavioural change) -

rates of drug prescribing and compliance with clinical practice guidelines (CPGs) - whereas impact outcomes assessed patients' ability to manage disease (medication compliance). Reminders to providers in an outpatient setting showed general improvement in prescribing practice, with relative rates of improvement ranging from 1% to 42% compared to controls. Feedback to providers in an outpatient setting showed a small improvement in prescribing practice, with relative rates ranging from 1% to 2.5% compared to controls. There were no added benefits in prescribing practice when reminders and feedback were combined. Reminders to patients had no significant effect on physician prescribing behaviour and none of the interventions had significant effects on patients' medication compliance rates. Overall, studies showed small to moderate improvements in medication management with reminders to providers and little or no improvement with feedback. The authors suggest that reminders are more effective as they are presented closer to the time of decision-making.

A good quality randomised controlled trial (Dexter et al. 2001) tested the impact of a computerised reminder system on preventive care in the hospital setting. The system provided clinical decision support to physicians using rule-based reminders, termed "Care rules". Care rules generated a reminder when a patient's medical record indicated the need for a specific preventive therapy, particularly concerning the use of pneumococcal and influenza vaccinations, prophylactic enteric-coated aspirin for cardiovascular disease, and prophylactic subcutaneous heparin to prevent thromboembolic events in susceptible patients. Physicians in general medicine were randomised to eight independent teams and patients admitted to general medicine wards were distributed evenly among the teams. Teams were then randomised to intervention or control groups. It is not clear whether the allocation to groups was concealed adequately. If a physician in the intervention group did not order preventive therapies at the time of admission, they received a computer-generated reminder, which they could choose to accept or reject. For control group physicians, the computer logged reminders without displaying them. The process outcome for this study was physician participation (behavioural change) – specifically, the change in rates of ordering preventive therapies (Table 23). Results indicate that computerised reminders significantly increased the delivery of preventive care to hospitalised patients for all four preventive therapies ( $p < 0.001$ ). Although baseline measurements were not provided, the authors report using the generalised estimating equation method to statistically adjust for differences in baseline measures between study arms, and potential clustering of the data (unit of randomisation was team; unit of analysis was patient hospitalisation).

Another good quality randomised controlled trial investigated the effectiveness of mailing postcard reminders to elderly patients to increase influenza vaccination rates (Puech et al. 1998). Elderly patients ( $\geq 65$  years of age) in a large general practice were stratified by gender and randomised to the intervention or usual care group. Patients in the intervention group received a postcard outlining the seriousness of influenza, the safety of the influenza vaccine, and an invitation to attend the practice for vaccination. Process outcome was physician participation (behavioural change) regarding influenza vaccination rates. Documentation of influenza vaccinations was abstracted from the medical records of eligible elderly patients. Influenza immunisation status for 1995 was used as the baseline. Results (Table 23) indicate that, although immunisation rates were similar for men and women, the postcard reminder induced a statistically significant increase in immunisation rates for men ( $p = 0.01$ ), though not for women ( $p = 0.24$ ). That is, after adjusting for the baseline 1995 immunisation status, the odds that the men receiving a postcard reminder would have an influenza vaccination was threefold greater

than the odds for men in the control group. It is not clear why there was a gender differential in these results and, since this study was conducted in one general practice, it is difficult to determine its generalisability.

### ***Critical success factors of prompts and reminders***

Although prompts and reminders varied in format (computer-generated, stickers or tagged notes), they typically produced small to moderate improvements in physicians', and some patient, performance. It is likely that these tools are successful due to:

- Timing – the prompt to take action occurs at the time of decision-making
- Simplicity - response to the prompt (accept or reject suggested course of action) requires minimal input from the physician or patient.

Table 23. Effectiveness of Prompts and Reminders – Process outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of participation (behavioural change)			
				Targeted action	No. of studies	Rate difference, % [95% CI] <sup>a</sup>	Calculated tolerance <sup>b</sup>
(Balas et al. 2000)	Level I: meta-analysis Quality: good	33 studies involving 1547 clinicians and 54,693 patients	Physician prompts	Faecal occult blood test	11	13.7 [4.7-22.8]	189
				Mammogram	14	11.5 [7.1-16.0]	226
				Pap smear	15	5.8 [1.5-10.1]	165
				Influenza vaccination	9	18.3 [11.6-25.1]	151
				Pneumococcal vaccination	8	17.2 [6.1-28.4]	132
				Tetanus vaccination	8	11.1 [5.0-17.5]	152
				Reminder method	No. of studies	Rate difference, % [95% CI] <sup>c</sup>	Calculated tolerance <sup>b</sup>
				Computer-generated	25	13.6 [10.9-16.3]	415
				Non-computerised	8	10.1 [1.3-18.9]	72
				In front of chart	26	14.0 [11.1-16.9]	374
				Alternative delivery	7	12.1 [5.4-18.9]	113
(Dexter et al. 2001)	Level II: RCT Quality: good	Resident physicians and medical students on general medicine teams	Computerised reminder system	% Hospitalisations with order for therapy <sup>d</sup>			
				Therapy	Control N=5070 hospitalisations	Intervention N=4995 hospitalisations	P value <sup>e</sup>
				Pneumococcal vaccination	0.8	35.8	<0.001
				Influenza vaccination	1.0	51.4	<0.001
				Subcutaneous heparin	18.9	32.2	<0.001
Aspirin at discharge	27.6	36.4	<0.001				

Table 23 (cont). Effectiveness of Prompts and Reminders – Process outcomes

(Puech et al. 1998)	Level II: RCT Quality: good	325 patients aged ≥ 65 years	Postcard reminders	<i>Change in influenza vaccination rates, % of patients vaccinated</i>				Effect measure <sup>f</sup>			
				Control			Intervention			Relative change	
				Before 1995	After	% change	Before 1995	After	% change		
				Men (N=58)	43	46	3	38	64	26	8.7
				Women (N=96)	35	44	9	29	49	20	2.2
				<i>Effect of the postcard, adjusting for immunisation status in 1995</i>							
					Crude OR [95% CI]		Adjusted OR [95% CI] <sup>g</sup>		Wald Chi-square		P value
				Men	2.0 [1.0, 4.2]		3.0 [1.3, 6.9]		6.2		0.01
				Women	1.2 [0.7, 2.1]		1.5 [0.8, 2.8]		1.4		0.24

<sup>a</sup> meta-analysis of studies – pooled estimates of the health maintenance rate difference (%) between prompted and unprompted groups using a random effects model (modified DerSimonian-Laird estimator); <sup>b</sup> the number of additional but unpublished negative studies that would be required to reverse the conclusions of this study; <sup>c</sup> random effects regression model; <sup>d</sup> ordering rates were adjusted for baseline differences using Generalised Estimating Equation models; <sup>e</sup> logistic regression was used to determine the effect of the intervention on binary responses (therapy ordered, not ordered); <sup>f</sup> logistic regression model fitted to control for baseline differences; <sup>g</sup> adjusted for baseline (1995) immunisation status – Wald Chi-square test.

## Feedback

While prompts and reminders are delivered before, or at the time a decision is made about treating a particular patient, feedback is delivered after decisions have been made and involves evaluating the consequences of decisions. It entails aggregating information on performance with the aim of changing future decision-making (Bennett & Glasziou 2003). Passive feedback is the “unsolicited provision of information with no stated requirement for action”, whereas active feedback occurs when “the interest of clinicians has been engaged in a particular aspect or aspects of practice” (Mugford et al. 1991).

*Audit and feedback* is “any summary of clinical performance of health care over a specified period, with or without recommendations for clinical action. The information may have been obtained from medical records, computerised databases, patients or by observation” (Oxman et al. 1995). The rationale underlying audit and feedback is that health care providers may not be aware that their behaviours (e.g. prescribing patterns) are not optimal and will be more likely to change their behaviour if feedback shows that their clinical practice deviates from that of their peers or the recommended clinical practice guidelines (CPGs). There are two main formats of feedback interventions. One involves providing individual physicians with a report of their own specific professional practice, such as prescribing behaviour, and describes the discrepancies between their actual performance and that recommended by CPGs. The other approach is to present a profile of their performance compared to their peers, without the “gold standard” of CPGs.

*Root cause analysis* is another type of feedback tool that is used to identify and prioritise performance improvement in health care delivery (Rex et al. 2000). Following an “adverse event” (e.g. an inappropriate drug dose that results in death or disability), the traditional response has been to identify and focus blame on the individual responsible. Those involved are less likely to report an incident if punitive measures or the threat of litigation ensues. In contrast, root cause analysis uses a systematic, blame-free, quality improvement approach to determining the underlying root cause of the adverse event. By analysing various aspects of the system (environment, equipment, communication, procedures), and identifying factors that contribute to an adverse event, systemic changes can be implemented.

Table 24 lists the service improvement tools that have feedback as a primary technique, as well as the studies that have explored the effect of feedback on process and impact outcomes.

Table 24. Audit and Feedback

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Audit and feedback: any summary of clinical performance and peer-comparison feedback	All levels	(Jamtvedt et al. 2003)	1. Physician participation <ul style="list-style-type: none"> <li>• No. of prescriptions, tests ordered</li> <li>• Compliance with CPGs</li> </ul>	1. Patient ability to control disease <ul style="list-style-type: none"> <li>• Control of disease (blood pressure, cholesterol level)</li> </ul> 2. Length of hospital stay
	Treatment	(Melander et al. 1999)*	N/E	N/E
Feedback: practice received feedback on ordering of specific tests compared to recommended guidelines	Diagnosis	(Baker et al. 2003b)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in ordering diagnostic tests</li> </ul>	n/a
Feedback: mailed information on antibiotic prescription pattern and CPGs on diagnosis and treatment of respiratory tract infections.	Treatment	(Sondergaard et al. 2003)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in antibiotic prescribing</li> </ul>	n/a
Feedback: written and verbal one-to-one feedback to physicians' on length of hospital stay for low-risk cardiac patients	Treatment	(Ellrod et al. 1995)*	N/E	N/E
Feedback: individualised 10-15 minute feedback session Report card: summary of personal and group performance	Prevention and management	(Kogan et al. 2003)	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with guidelines (performance scores)</li> </ul>	n/a
Practice-profiling: measures of quality, utilisation, and patient satisfaction are delivered to practicing physicians	Treatment and management	(Callahan et al. 2002)*	N/E	N/E
Root cause analysis: a systematic, blame-free, continuous quality improvement approach to identifying the underlying causes of adverse events.	Treatment	(Rex et al. 2000)*	N/E	N/E

CPGs=Clinical Practice Guidelines; n/a = not available; N/E = study not evaluated for effectiveness. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of feedback

One systematic review and three randomised controlled trials met the inclusion criteria and were assessed to determine the effectiveness of feedback tools. Studies varied widely in the types of settings – hospitals, outpatient clinics, primary care practices, and community clinics in the USA, Canada, UK, Europe, Asia and Africa. Feedback was primarily used to target behaviours that would improve compliance with clinical practice guidelines (CPGs) across all levels of care. Overall the study quality was average.

A recent good quality systematic review (Jamtvedt et al. 2003), which updated previous reviews, examined the effectiveness of various audit and feedback interventions in 85

randomised controlled trials concerning preventive care, test ordering, or general management of various health problems. Process outcomes included provider compliance with CPGs for a range of conditions and protocols, including hypertension, asthma, cancer prevention, drug prescribing, and test ordering. Ten of the included studies reported impact outcomes, such as length of hospital stay and patients' ability to control disease (specifically, hypertension and depression). The majority of studies (61) were of moderate quality, 14 were high, and ten were low in quality. Concealment of allocation was reported in 43 trials; assessment was blinded in 45 trials; and there was adequate follow-up of participants in 50 of the included studies.

In contrast to an earlier systematic review (Oxman et al. 1995), the authors found no evidence of increased effectiveness for multi-faceted interventions compared with audit and feedback alone. Studies using a peer-comparison feedback also showed variable results (from 60% improvement to 20% reduction in performance). A meta-regression analysis was undertaken. Adjusted risk differences<sup>§§</sup> of non-compliance with desired practice ranged from 0.09 to 0.71 [median=0.07, inter-quartile range=0.02, 0.11], indicating a 9% absolute increase in non-compliance ranging to a 71% decrease in non-compliance. Low baseline performance was the best predictor of a successful intervention. This is reflected in results from the better quality studies, which indicated that the effectiveness of audit and feedback is greater when the baseline compliance rate is poor. This makes sense, as health care providers who deviate seriously from recommended practices have a greater capacity for improvement. The authors concluded that audit and feedback is effective in improving professional practice, although the effects are generally small to moderate unless the baseline performance is very poor. Therefore, audit and feedback should be targeted to areas where adherence to recommended guidelines is low (Jamtvedt et al. 2003).

An average quality randomised controlled trial (Baker et al. 2003b) investigated the impact of providing feedback on the overall number of selected diagnostic tests ordered by providers. General practices were randomised to two groups, each receiving feedback and clinical guidelines on a different set of tests selected for their group. Group 1 practices received clinical practice guidelines (CPGs) and feedback on tests for thyroid function, rheumatoid factor, and urine culture tests (recommending a reduction), whereas Group 2 practices received CPGs and feedback on tests for serum lipids (recommending an increase) and plasma viscosity. The process outcome was physician participation (behavioural change) – specifically, the number of tests ordered by the practice. Each group of practices also acted as control for the other by providing data on the tests for which they did not receive feedback or CPGs. The authors reported no significant changes in test ordering rates between practices receiving CPGs and feedback on selected tests and those that did not receive feedback on the same tests (Table 25). However, baseline differences between groups were not adjusted for in the analysis. Importantly, there was substantial variability between practices within study arms, as shown by the wide inter-quartile ranges not only at baseline, but also 12 months after intervention. This variability may be attributed to numerous factors. Individual practices' participation in the study was not voluntary as it was determined by a third party (primary care group), and this may have impacted on the motivation to change

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<sup>§§</sup> Adjusted risk difference = the difference in the risk of non-compliance after the intervention minus the difference before the intervention. With a positive risk difference, non-compliance is reduced more in the intervention group compared to controls.

behaviour. Unsolicited dissemination of CPGs may be insufficient to predispose physicians to the effects of the feedback intervention. Confounding factors, such as the experience and characteristics of practitioners, number of support staff (e.g. nurse practitioners), and overall patient profiles (e.g. demographic characteristics), may also have influenced the types of tests ordered. In addition, outcome measures were limited to the number of tests, without considering the appropriateness of the tests ordered.

A good quality quasi-randomised controlled trial (Kogan et al. 2003) evaluated the effectiveness of report cards based on chart audits in promoting physicians' adherence to clinical practice guidelines (CPGs) for diabetes, hypertension, coronary artery disease, asthma and preventive services (such as screening, immunisations and counselling). Report cards are generally a specific, objective and, sometimes public, method of publishing physicians' performance in providing quality health care. A chart abstraction instrument was used to abstract ten items from a random sample of twelve patients per provider. The process outcome was physician participation (behavioural change) regarding compliance with CPGs. Abstractors, who were blinded to intervention status, scored items according to patients' medical progress notes. For example, if a mammogram was ordered, or a patient was counselled about smoking, the provider received credit for taking action. Internal medicine residents were randomised to a control or intervention group. The intervention group received a report card summarising their personal performance (percentage of indicated actions taken by the resident), the performance of the peer group (percentage of indicated actions taken by the group), followed by a 10-15 minute feedback session on the report card. Controls received the usual feedback from faculty supervisors. Summary performance scores were calculated for categories of items that included: immunisations, screening, and counselling (total preventive health); diabetes, hypertension, asthma, and coronary heart disease management (total disease management).

Baseline measures (phase 1) were equivalent between control and intervention groups. The authors justified using patient-level data on the basis that there was no difference in the results when compared to analysis at the physician-level (i.e. there was no clustering effect). For the majority of compliance behaviours, results (Table 25) demonstrated no significant improvement in performance scores for residents receiving the report card intervention, although there was a statistically significant comparative reduction in screening performance scores for the intervention group ( $p < 0.01$ ). The main limitation of this study is that the measured outcome (documented action) is highly dependent on residents' record-keeping, which may not necessarily reflect the actual level of care provided.

An average quality cluster quasi-randomised controlled trial examined the effectiveness of mailed feedback on physicians' own prescription rates for antibiotics together with recommended clinical practice guidelines (CPGs) on the diagnosis and treatment of respiratory tract infections (Sondergaard et al. 2003). In a region of Denmark, 97% of practices were randomised to the intervention (CPGs + feedback) or a control group (CPGs only). Data on the prescription rates of all practices were collected from the Odense University Pharmaco-Epidemiologic Database and the National Health Service, which register data from pharmacies on the sales of all subsidised drugs, including the antibiotics investigated in this study. Details on each practice, such as the characteristics of the physicians, patients, drugs and services were provided. Baseline measures on prescription rates and the proportion of prescriptions requesting narrow-spectrum penicillins (narrow-spectrum penicillins/all classes of antibiotics) were collected from the abovementioned databases for the control and intervention groups during the three

months prior to intervention. Physicians in both groups received a 45-page booklet detailing information on acute infections (e.g. tonsillitis, otitis media, sinusitis, and asthmatic bronchitis), guidelines for antibiotic prescribing, and the strength of the evidence for these guidelines. The intervention group also received mailed feedback on their individual prescribing rates, from a previous three-month period, for each class of antibiotics (narrow-spectrum penicillins, broad-spectrum penicillins, macrolides, quinolones). A penicillin-therapeutic index (number of narrow-spectrum penicillin prescriptions/number of broad-spectrum penicillin prescriptions) was provided to the intervention group in the feedback mail-out. The process outcome was physician participation (behavioural change) – as measured by the antibiotic prescription rate and the proportion of prescriptions for narrow-spectrum penicillins. The calculations for these measures are shown in Box 2.

**Box 2. Measures of the impact of the intervention**

Change in the antibiotic prescription rate (for each practice) = number of prescriptions for antibiotics per 1000 patients per month in the 3-month period post-intervention - number of prescriptions for antibiotics per 1000 patients per month in the 3-month period pre-intervention.

Change in the proportion of all prescriptions that were for narrow-spectrum penicillins (for each practice) = the proportion of prescriptions for narrow-spectrum penicillins (narrow-spectrum penicillins/all antibiotics) in the 3-month period post-intervention - the proportion of prescriptions for narrow-spectrum penicillins in the 3-month period pre-intervention.

Results (Table 25) indicate that a mailed feedback intervention had no significant effect on improving physicians' antibiotic prescribing practice. In the three-month period after feedback was provided, physicians' overall antibiotic prescribing rate increased by 49% (a decrease was recommended) and the proportion of narrow-spectrum penicillins fell to 43% (an increase was recommended), compared to the three-month pre-intervention period. Baseline measurements were equivalent for intervention and control groups and no significant differences existed between groups on any outcome measures at three-months post-intervention or longer (12 months post-intervention, no data provided). Although the databases provided an objective means of collecting data, it is not clear how well the physicians' prescribing behaviour matched the pharmacy records of antibiotics dispensed. The format of the feedback intervention was relatively weak as it was unsolicited, passive, and was provided only once during the study. The presentation of an interactive package to motivated physicians may be more successful.

Table 25. Effectiveness of Audit and feedback tools – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Assessment of participation (Behavioural change)							
				Control (Group 1 <sup>b</sup> ) N=17			Feedback intervention (Group 2 <sup>c</sup> ) N=16			Effect measure <sup>d</sup>	
				Diagnostic tests	Before median [IQR]	4 <sup>th</sup> quarter median [IQR]	% change	Before median [IQR]	4 <sup>th</sup> quarter median [IQR]	% change	Relative change
(Baker et al. 2003b)	Level II: cluster RCT, by practice Quality: average	33 general practices	Feedback	<i>Physicians' test ordering, number of tests<sup>a</sup></i>							
				Control (Group 1 <sup>b</sup> ) N=17			Feedback intervention (Group 2 <sup>c</sup> ) N=16			Effect measure <sup>d</sup>	
				Diagnostic tests	Before median [IQR]	4 <sup>th</sup> quarter median [IQR]	% change	Before median [IQR]	4 <sup>th</sup> quarter median [IQR]	% change	Relative change
				Serum lipids (cholesterol, triglyceride)	17.3 [8.4, 42.8]	15.1 [5.7, 34.3]	-12.7	15.1 [8.9, 27.6]	24.5 [14.7, 38.9]	+62.3	4.9
				Plasma viscosity	14.7 [9.6, 33.7]	16.0 [6.8, 42.6]	+8.8	15.4 [6.1, 27.8]	11.7 [6.6, 32.7]	-31.6	3.6
				Control (Group 2 <sup>c</sup> ) N=16			Feedback intervention (Group 1 <sup>b</sup> ) N=17				
				Thyroid function	22.7 [10.4, 30.9]	20.9 [13.3, 35.3]	-7.9	17.4 [8.0, 39.5]	13.2 [6.3, 35.7]	-24.1	3.1
				Rheumatoid factor	17.2 [7.3, 29.8]	22.2 [7.6, 39.5]	+29.1	12.8 [5.5, 45.2]	14.3 [5.1, 40.7]	+11.7	0.4
Urine culture	16.7 [11.1, 28.8]	17.8 [11.8, 24.3]	+6.6	18.4 [8.7, 38.3]	17.1 [7.9, 37.9]	-7.1	1.1				
(Kogan et al. 2003)	Level III-1: quasi-RCT Quality: good	44 resident interns	Report card and feedback session	<i>Summary performance scores for physicians<sup>e</sup></i>							
				Control group			Intervention group			Effect measure <sup>f</sup>	
				Before <sup>g</sup>	After <sup>h</sup>	% change	Before <sup>g</sup>	After <sup>h</sup>	% change	Relative change P value	
				<i>Screening, % of actions taken (No. of patients)</i>							
				68 (249)	77 (145)	+9.0	69 (248)	70 (39)	+1.0	0.1	$p=0.01$
				<i>Immunizations, % of actions taken (No. of patients)</i>							
				24 (249)	26 (145)	+2.0	25 (248)	30 (139)	+5.0	2.5	$p=0.48$
				<i>Counselling, % of actions taken (No. of patients)</i>							
				25 (249)	14 (145)	-11.0	28 (248)	17 (139)	-11.0	1.0	$p=0.41$
				<i>Total preventive health, % of actions taken (No. of patients)</i>							
53 (249)	55 (145)	+2.0	54 (248)	52 (139)	-2.0	1.0	$p=0.13$				

Table 25 (cont.) Effectiveness of Audit and feedback tools – Process outcomes

				<i>Diabetes management, % of actions taken (No. of patients)</i>							
				44 (133)	50 (15)	+6.0	39 (112)	43 (22)	+4.0	0.7 $p=0.31$	
				<i>Hypertension management, % of actions taken (No. of patients)</i>							
				53 (115)	41 (44)	-12.0	56 (103)	39 (57)	-17.0	1.4 $p=0.59$	
				<i>Total disease management, % of actions taken (No. of patients)</i>							
				55 (150)	49 (62)	-6.0	54 (134)	43 (76)	-11.0	1.8 $p=0.13$	
(Sondergaard et al. 2003)	Level III-1 Quality: average	181 primary care practices with 299 GPs	Feedback: mailed information on each physician's antibiotic prescription pattern	<i>Antibiotic prescription rate (No. of prescriptions per 1000 patients per month)</i>							
					Control			Intervention			Effect measure
				Antibiotic	Before- mean [IQR]	After mean [IQR]	Change mean [95% CI] <sup>i</sup>	Before mean [IQR]	After mean [IQR]	Change mean [95% CI] <sup>i</sup>	Difference in change, mean [95% CI] <sup>j</sup>
				Narrow-spectrum antibiotic	11.2 [8.2, 13.7]	13.6 [9.7, 16.3]	2.4 [1.6, 3.2]	11.5 [7.8, 14.3]	14.6 [9.9, 17.9]	3.1 [2.4, 3.8]	0.7 [-0.4, 1.7]
				Broad-spectrum antibiotic	4.7 [2.4, 6.2]	6.5 [3.1, 8.4]	1.8 [1.2, 2.4]	5.8 [2.2, 7.1]	7.3 [3.3, 9.7]	1.5 [1.0, 2.0]	-0.3 [-1.1, 0.4]
				Macrolides	5.8 [3.3, 7.4]	12.9 [7.6, 17.5]	7.1 [5.9, 8.4]	5.5 [3.2, 7.6]	11.8 [6.7, 13.9]	6.3 [5.0, 7.6]	-0.8 [-2.6, 0.9]
				Quinolones	0.7 [0.1, 1.2]	1.0 [0.1, 1.3]	0.3 [0.1, 0.4]	0.7 [0.1, 0.8]	0.9 [0.0, 1.0]	0.2 [0.0, 0.4]	-0.1 [-0.4, 0.2]
				All broad-spectrum antibiotics	11.1 [6.3, 14.0]	20.4 [11.8, 27.6]	9.3 [7.8, 10.8]	12.0 [6.4, 16.4]	20.0 [12.0, 25.3]	8.0 [6.6, 9.4]	-1.3 [-3.3, 0.7]
				All antibiotics	22.3 [17.1, 26.8]	34.0 [24.2, 40.8]	11.7 [10.1, 13.3]	23.5 [16.7, 30.9]	34.6 [23.4, 44.8]	11.1 [9.6, 12.6]	-0.6 [-2.8, 1.6]
Fraction of prescriptions for narrow-spectrum penicillins <sup>k</sup>	0.52 [0.43, 0.62]	0.43 [0.34, 0.54]	-0.09 [-0.11, -0.07]	0.52 [0.44, 0.62]	0.45 [0.39, 0.53]	-0.07 [-0.09, -0.05]	0.02 [-0.01, 0.05]				

IQR=inter-quartile range. <sup>a</sup> median number of tests per 1000 registered patients per 3 months by practices in each study group; <sup>b</sup> group 1 practices received feedback on thyroid function, rheumatoid factor and urine culture tests – a reduction in testing was recommended; <sup>c</sup> group 2 practices received feedback on serum lipids and plasma viscosity tests – an increase in testing was recommended; <sup>d</sup> no adjustment for baseline differences, therefore no  $p$ -values are given; <sup>e</sup> performance scores indicate the percentage of actions taken in the different categories; <sup>f</sup> no differences between groups at baseline; <sup>g</sup> phase 1 = July 1998 to March 1999; <sup>h</sup> phase 2 = April 2000 to December 2000; <sup>i</sup> change in mean prescription rate = no. of prescriptions per 1000 patients per month post-intervention – no. of prescriptions per 1000 patients per month pre-intervention; <sup>j</sup> student's t-test; <sup>k</sup> fraction of prescriptions for narrow-spectrum penicillins = no. of narrow-spectrum penicillin prescriptions/total no. of antibiotics prescriptions.

### ***Critical success factors of feedback***

Several factors, including intensity, complexity and timing have been proposed as critical to the success of audit and feedback interventions. However, when Jamvedt et al (2003) examined these factors in a recent systematic review and meta-analysis, they found that the variation in results could not be explained by study quality, type of intervention, intensity, complexity or timing of feedback.

- Although physician motivation was not specifically evaluated in this review, low baseline performance by a physician emerged as the best predictor of the effectiveness of audit and feedback interventions.
- Audit and feedback may have limited benefits for the provider that is already performing well.
- Physicians must be predisposed to change to some extent. Although motivation was not directly assessed, the lack of effect in a recent randomised controlled trial may be partly explained by the fact that the physicians in the intervention did not volunteer to participate (Baker et al. 2003b).
- An inherent part of feedback is timing and the interval between the performance and the feedback. If feedback is infrequent, or the interval between action and feedback is too long, it is possible that the feedback becomes disassociated from the initial activity and may fail to influence subsequent actions. If the feedback is too frequent and the interval too short, it may become tedious and be ignored.

### **Financial Incentives**

Financial incentives involve some form of payment system, whereby individual physicians or health care providers receive remuneration that directly affects their personal disposable income. Financial incentives include capitation, salary, fee-for-service and target payments. Under capitation, the physician receives a payment for the services provided to each registered patient. Salaried physicians receive an annual salary for a specified number of hours per week. The fee-for-service system pays physicians a fee for each item of care provided, such as consultations, immunisations, and prescriptions. The target payment system, which exists predominantly in the UK, is similar to fee-for-service, except physicians are remunerated only if they reach a certain target level of service. (Gosden et al. 2001). Table 26 lists the studies that investigated the impact of financial incentives on health service delivery.

Table 26. Financial Incentive tools

Tools <sup>a</sup>	Level of care	Studies	Effect of service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Financial incentives: including fee-for-service, salary, capitation, target payments, sanctions/ bonuses according to productivity, quality of care, volume of prescriptions	All levels	(Chaix-Couturier et al. 2000; Gosden et al. 2001)*	N/E	N/E
Performance-based reimbursement: physicians used a target-based poster to increase influenza immunisation rates in elderly patients aged ≥65 years.	Prevention	(Kouides et al. 1998)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in influenza immunisation rates</li> </ul>	n/a

N/E=not evaluated; n/a=not available. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of financial incentives

One good quality quasi-randomised controlled trial examined the effectiveness of performance-based physician reimbursement at improving influenza immunisation rates in the elderly (Kouides et al. 1998). Practices that were participants in the Medicare Influenza Vaccination Demonstration Project in 1990 and with at least 50 elderly patients were stratified, according to the proportion of elderly clientele, and randomised to a control or incentive group. In addition to the regular \$US8 administration fee for influenza vaccinations of Medicare patients, the incentive group physicians received a 10% (\$0.80 per injection) or 20% reimbursement (\$1.60 per injection) if their practice immunisation rates reached 70% or 85%, respectively. The primary outcome was physician participation (behavioural change) – which was measured by the immunisation rates in 1991 compared to the baseline (1990) rates. Results (Table 27) showed improved influenza immunisation rates in 1991 in both control and intervention groups compared to the 1990 rates. The overall immunisation rates (total immunisations/total eligible patients) for all practices were 67% for the intervention group and 60% for the control group. A significantly higher median practice-specific improvement in immunisation rate was evident for the target-based financial incentive group (10.3%) compared with the improvement in the control group (3.5%,  $p=0.03$ , Wilcoxon Rank Sum test). Using a regression model to determine which factors were likely to predict the change in immunisation rates, randomisation to the intervention group accounted for a 7% increase in immunisation rate ( $p<0.05$ ; 95% CI: 0, 14.3%). A limitation of this study is that it is difficult to determine its generalisability as it followed an intensive promotion of influenza vaccination during the Demonstration Project in 1990, leading to baseline rates that were greater than the national average for immunisation.

### *Critical success factors of financial incentives*

In the one study that reported on financial incentives, it would appear that target-based financial incentives may have a moderate impact on physician behaviour.

Table 27. Effectiveness of financial incentive tools – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Assessment of participation (Behavioural change)		
(Kouides et al. 1998)	Level III-1: quasi-RCT, allocated by practice, stratified by median number of elderly patients in the practice Quality: good	54 primary care practices with ≥50 elderly patients	Performance-based physician reimbursement	<i>Influenza immunisation rates</i> <sup>a</sup>		
				Control group N=27	Incentive group N=27	Effect measure
				Change in rates (1991-1990) median [IQR]	Change in rates (1991-1990) median [IQR]	Relative change P value <sup>b</sup>
				3.5 [-5.5, 8.6]	10.3 [0, 19.0]	1.9 <i>p</i> =0.03

<sup>a</sup> immunisation rates = total no. of immunisations reported per practice/total no. of non-institutionalised patients ≥65 years in the practice; <sup>b</sup> Wilcoxon Rank Sum test

## Record Systems

“A nursing record system is the record of care planned and/or given to individual patients/clients by qualified nurses, or by other care givers under the direction of a qualified nurse” (Currell & Urquhart 2003). Used for the storage and exchange of information, nursing record systems vary considerably and include manual or computerised versions, centrally-held or patient-held records, and structured or unstructured systems. For example, a structured nursing record system involves entering data in a structured format, with standardised phrasing and unambiguous terminology. Examples include care plans and flow charts. Three studies in the evidence-base identified different record systems (Table 28), one of which was suitable for an evaluation of effectiveness. This systematic review of eight trials met the inclusion criteria.

Table 28. Nursing record tools

Tools <sup>a</sup>	Level of care	Studies	Effect of service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Electronic medical records: computer-based documentation system – Automated Record for Child Health	Prevention and treatment	(Adams et al. 2003)*	N/E	N/E
Electronic clinical information system: computer-based data management and documentation system – CLINFOSYS keyboard or palm-computing device includes decision support for nutritional supplementation calculations	Treatment	(Apkon & Singhaviranon 2001)*	N/E	N/E
Nursing record system: computerised documentation or care plans; nursing flow sheets or pain management sheet; patient-held records	All levels	(Currell & Urquhart 2003)	1. Participation <ul style="list-style-type: none"> <li>• Nurses’ attitudes to system</li> </ul> 2. Productivity <ul style="list-style-type: none"> <li>• Quality of documentation</li> <li>• Nurses’ time (e.g. preparation of care plans)</li> <li>• Number of nursing activities</li> </ul> 3. Participant satisfaction <ul style="list-style-type: none"> <li>• Nurses’ satisfaction with job</li> </ul>	1. Patient functional ability <ul style="list-style-type: none"> <li>• Activities of daily living scores</li> <li>• Perception of pain</li> <li>• Cognitive abilities</li> </ul> 2. Patient satisfaction           3. Length of hospital stay

N/E = not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of nursing record systems

Currell et al. produced a good quality systematic review that examined the effectiveness of various types of nursing record systems (Currell & Urquhart 2003). Interventions included a range of different nursing record systems, such as multi-disciplinary care records, patient-held records, use of care plans, and specific records on pain control or

wound management. Process outcomes included assessment of participation (behavioural change – specifically, quality of documentation and change in attitude), productivity (nurses' time spent preparing care plans or documenting activities) and participant satisfaction (nurses' satisfaction with the system). Impact outcomes included patients' health status, satisfaction and length of hospital stay. Impact outcome measures varied depending on the patient population. For example, in an elderly patient population, cognitive abilities, perception of pain and activities of daily living were the key focus, whereas in pregnant mothers or paediatric patients, clinical outcomes for mother and baby, satisfaction with care and length of hospital stay were the primary outcomes. The quality of the eight included studies was generally poor, with methodological flaws, such as unit of analysis errors (2), small sample size and lack of power (4), unblinded assessment (8), and little protection against contamination between control and study groups. Concealment of allocation was done in one study. Measures were generally subjective (attitudes, satisfaction, estimate of time spent charting) and dependent on participants' motivation and engagement in the study. Computerised records showed an increased number of recording activities, but it took longer to complete documentation compared to paper-based record-keeping, and had no impact on patient outcomes. Care flow sheet studies reported some improvement in pain management and standards of documentation, but the poor methodology of these studies makes them prone to assessment biases. Currell and colleagues suggest that the form and purpose of a nursing record system may determine the extent to which it can improve patient outcomes (Currell & Urquhart 2003). Patient-held records showed no overall positive or negative effects, most pregnant women showed a preference for holding their own notes, and there was some evidence of fewer missing notes in the study group. There was no significant difference in the rate of immunisation or development checks in parent-held children's records. These findings suggest that simply automating an existing record system is unlikely to generate significant changes in care, whereas integrating a computerised system with other functions (reminders, decision support) may add impact to the system.

### ***Critical success factors of nursing record systems***

Results from the systematic review suggest that nursing record systems may have the most impact when:

- Tailored to the environmental context, and/or
- Including additional functionality through the combination with other tools (multi-faceted).

## Patient-Centred Interventions

Lack of communication between health care providers and patients is often cited as the basis for dissatisfaction with the quality of care (Stewart 1995). Patient-centred medicine evolved in response to criticism of the traditional focus on treatment of the illness, which largely ignores the patient as a unique individual. Patient-centred care involves two main features: 1. Shared decisions about interventions or management of a patient's illness; and 2. a holistic approach to treatment with a focus on the patient as a person, rather than the illness. Chronic disease management is time and labour-intensive, frequently requiring one-to-one interaction with a patient about lifestyle modification and disease-specific education. The delegation of tasks to trained nursing or ancillary staff may be a more timely and cost-effective way of providing quality health care. Table 29 lists the tools used in patient-centred approaches to health care.

Table 29. Patient-centred interventions

Tools <sup>a</sup>	Level of care	Studies	Effect of service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Chronic disease self-management program: community-based patient self-management course – addresses a range of topics common to people with chronic diseases	Management	(Lorig et al. 1999; Schreurs et al. 2003)*	N/E	N/E
Patient-centred care – training: strategies directed at health care professionals to promote patient-centred care in clinical consultations	All levels	(Lewin et al. 2001; Moral et al. 2001)*	N/E	N/E
Patient-centred care – training: 5-day training for Indonesian health service providers to improve counselling and communication skills in family planning; includes self-assessment and peer-review workshops	Prevention	(Kim et al. 2000)*	N/E	N/E
Preference-based care planning: hand-held computer-based support system to record patients' preferences at the bedside	Management	(Ruland 2002)*	N/E	N/E
Study to understand prognoses and preferences for outcomes and risks of treatments (SUPPORT)	Palliation	(SUPPORT Investigators, 1995)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in no. of days until DNR order was written</li> <li>• Agreement between patient and provider on DNR</li> </ul>	1. Patient functional status <ul style="list-style-type: none"> <li>• Patient pain</li> <li>• No. of days in "undesirable state"</li> </ul>

N/E = not evaluated; DNR=do not resuscitate order. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## **Effectiveness of patient-centred interventions**

One good quality cluster randomised controlled trial set in the USA, met the inclusion criteria. This study aimed to improve end-of-life decision-making and encourage physician-patient communication (SUPPORT Investigators, 1995). The SUPPORT (Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments) intervention was intended to provide timely and reliable prognostic information to patients, elicit and document patient and family preferences and understanding of disease prognosis and treatment, and provide a skilled nurse to liaise between patients and medical staff. The primary process outcome was physician participation (behavioural change), pertaining to documented evidence of physicians' discussions or decisions on a range of issues, such as use of dialysis, withdrawal from a ventilator, and do not resuscitate (DNR) orders (Table 30). Impact outcomes concerned patient health status (pain, activities of daily living scores, APACHE III scores, and hospital mortality) and length of time spent in intensive care (Table 31). Data were abstracted from medical records and interviews (patients and physicians). Although SUPPORT physicians received reliable prognostic information (94%), timely reports of patient and surrogate perceptions (74%), and thought SUPPORT nurses' involvement improved patient care (22%), the intervention had no effect on any of the process or impact outcome measures. That is, improved information, enhanced communication, and explicit emphasis on use of patient preferences in decision-making, was ineffectual in changing physician behaviour.

### ***Critical success factors of patient-centred interventions***

The best quality study available that reported on patient-centred interventions was not successful at influencing process (provider behaviour) or patient outcomes.

Table 30. Effectiveness of Patient-centred interventions – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes Assessment of participation (Behavioural change)	
(SUPPORT Investigators, 1995)	Level II: RCT, allocated by physician specialty Quality: good	Physician specialists	SUPPORT intervention	<i>Change in physicians' communication and understanding of patients' preferences</i>	
				Outcome measure	Adjusted ratio of intervention vs control group [95% CI] <sup>a</sup>
				Median time until DNR order was written, days	1.0 [0.9, 1.2] <sup>b</sup> NS
				DNR physician-patient agreement, %	1.2 [1.0, 1.5] <sup>c</sup> NS

DNR = do not resuscitate; NS=not significant (p>0.05). <sup>a</sup> baseline differences were controlled for using multivariate risk scores derived by generating models to predict outcomes that incorporated interactions between physician specialty and hospitals. Observed differences in baseline patient characteristics were adjusted using a propensity score that corrected for selection bias associated with being assigned to the intervention group; <sup>b</sup> log-normal regression model – Kaplan-Meier; <sup>c</sup> binary logistic regression.

Table 31. Effectiveness of Patient-centred interventions – Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of patient health status	
(SUPPORT Investigators, 1995)	Level II: RCT, allocated by physician specialty Quality: good	Physician specialists	SUPPORT intervention	<i>Change in patients' health status</i>	
				Outcome measure	Adjusted ratio of intervention vs control group [95% CI] <sup>a</sup>
				Median days in ICU	1.0 [0.9, 1.1] NS
				Frequency and severity of pain, %	1.2 [1.0, 1.3] NS
				Mortality	1.0 [0.9, 1.0] NS

ICU=intensive care unit; NS=not significant (p>0.05). <sup>a</sup> baseline differences were controlled by using multivariable risk scores derived by generating models to predict outcomes that incorporated interactions between physician specialty and hospitals. Observed differences in baseline patient characteristics were adjusted using a propensity score that corrected for selection bias associated with being assigned to the intervention group.

## Telemedicine

Telemedicine is defined as “the use of telecommunications technology for medical diagnosis and patient care” (Currell et al. 2001). Telemedicine involves use of telecommunications as a medium to deliver medical services to sites distant from the health service provider. It utilises conventional telephone services, computer modems, satellites, and other equipment or software to transmit and receive data. Initially developed as part of military and space technology research (Currell et al. 2001), telemedicine has been used to provide expert specialist advice, and to transmit images, data and educational information to patients whose access to medical care is limited due to remote location, or for other reasons. Due to the rapid advances in technology, the miniaturisation of computer components, and the greater acceptability and accessibility of information technology, health care organisations are exploring new ways of delivering improved health care within this rapidly expanding forum. Alongside the newly acquired knowledge and technology is the need to determine how safe, efficient and effective this conduit of information is in delivering quality health services.

Six studies (Table 32) explored the effect of telemedicine interventions. None, however, met the inclusion criteria for assessing the effectiveness of the tool.

Table 32. Telemedicine

Tools	Level of care	Studies	Effect of service delivery	
			Process outcomes	Impact outcomes
Telemedicine: interactive telecommunications technology between hospital consultant and general practitioner, or patient and health professional	All levels	(Balas et al. 1997; Currell et al. 2000; van der Kam et al. 2001; McDonald 2000)*	N/E	N/E
Telemedicine: Tele-home health project using “video visits” for management of chronic diseases (diabetes, heart disease and stroke, respiratory illness, cancer), anxiety and wound care.	Management	(Johnston et al. 2000)*	N/E	N/E
Telemedicine – telephone call-back system: telephone consultation system	Treatment and management	(de Groot et al. 2002)*	N/E	N/E
Telemedicine: interactive video-based system in emergency medicine	Treatment	(Brennan et al. 1999)*	N/E	N/E

N/E=not evaluated. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Alternative Care Approach

In general, health care services are provided by a general practitioner in the primary care setting, or a clinician in the hospital setting. A different approach is to introduce an alternative health care provider or setting in which patients receive treatment, recover from treatment, or manage a chronic disease. For example, tasks or consultations usually provided by a physician may be undertaken by a nurse practitioner. Similarly, health care typically provided in the general practice setting may be referred to a specialist clinic. Table 33 lists five studies that investigated the alternative care approach to improving the delivery of health services. One of these studies met the inclusion criteria for an assessment of effectiveness (Gardner 1991).

Table 33. Alternative care approach

Tools <sup>a</sup>	Level of care	Studies	Effect of service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Hospital-at-home: service providing active treatment by health professionals, in the patient's home, of a condition that otherwise would require acute hospital in-patient care	Rehabilitation and palliation	(Grande et al. 2000; Shepperd & Iliffe 2001)*	N/E	N/E
Home-based primary care: primary care manager, 24-hour contact for patients, inter-disciplinary team participation in discharge planning	Management	(Hughes et al. 2000)*	N/E	N/E
Medical day hospital care: multi-disciplinary rehabilitation for the elderly in an outpatient setting	Rehabilitation	(Forster et al. 2000)*	N/E	N/E
Nurse practitioners	Treatment	(Horrocks et al. 2002)*	N/E	N/E
Primary nursing	Treatment	(Gardner 1991)	1. Participant satisfaction <ul style="list-style-type: none"> <li>• Impact on nursing staff (Nursing Stress Scale)</li> </ul>	1. Patient quality of life <ul style="list-style-type: none"> <li>• Total quality of patient care scale (Qualpacs)</li> </ul>

N/E = not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of alternative care approaches

A poor quality non-randomised controlled trial (Gardner 1991) compared primary nursing to team nursing. Primary nursing is a patient-centred approach that allows hospital-based nurses to carry out individual assessments of patients' needs and to determine the level of care required. In contrast, the traditional team approach follows a more bureaucratic delivery of care irrespective of patients' actual needs. Nursing units were allocated to primary nursing (intervention) or team nursing (control) groups. The process outcome was participant satisfaction, measured by nurses' level of stress

(Nursing Stress Scale<sup>\*\*\*</sup>). Impact outcomes were patients' satisfaction with care, as measured by the Quality Patient Care Scale (Qualpacs)<sup>†††</sup>, Hospital Stress Rating Scale<sup>‡‡‡</sup>, and the Nursing Support Scale<sup>§§§</sup>. No significant differences in nurses' stress were evident between primary and team nursing groups. Results of impact outcomes are shown in Table 31. Thirty months after implementation of the intervention, the mean Qualpacs score (scored by nurses) was higher in the primary nursing group ( $3.2 \pm 0.2$ ) compared to the team nursing group ( $3.0 \pm 0.3$ ). However, since no adjustment was made for baseline differences, the reported statistical difference cannot be evaluated and the clinical significance of the difference appears to be minimal (i.e. a mean difference of 0.2 Qualpacs score). No significant differences were found between the groups with respect to patients' reports of nursing support or hospital stress, although changes appeared to be in the right direction.

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<sup>\*\*\*</sup> Gray-Toft's Nursing Stress Scale = measure of nurses' stress, completed by nurses who rate 44 stressful situations.

<sup>†††</sup> Qualpacs = a measure of quality of care, completed by nurses required to observe and rate the care of patients.

<sup>‡‡‡</sup> Hospital Stress Rating Scale = a measure of quality of care, completed by patients who rank stressful events.

<sup>§§§</sup> Nursing Support Scale = measure of quality of care, completed by patients who rate how frequently nurses provide particular supportive behaviours.

Table 34. Effectiveness of alternative care approaches – Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of patient health status							
				Control Team nursing			Intervention Primary nursing			Effect measure <sup>a</sup>	
				Before Mean±SD	After 30 months Mean±SD	% change	Before Mean±SD	After 30 months Mean±SD	% change	Relative change	
(Gardner 1991)	Level III-2: non-randomised controlled study Quality: poor	Nurses in 8 medical units in an urban tertiary care teaching hospital, New York	Primary nursing	<i>Change in patient quality of life</i>							
				Outcome measures							
				Quality of life (Qualpac scores)	2.7±0.5	3.0±0.3	+11.1	2.8±0.6	3.2±0.2	+14.3	1.3
				Hospital stress rating scale	353±181	328±183	-7.1	377±171	321±197	-14.9	2.1
				Nursing support scale	4.9±1.1	4.9±1.2	0	4.6±1.2	5.1±1.0	+10.9	n/e

n/e = not estimable. <sup>a</sup> p values for Student's t-tests are not provided as baseline differences were not accounted for.

## Interdisciplinary Team Approach

Interdisciplinary or team case-management, which is frequently used in the management of patients with chronic diseases, includes any health care approach that involves complementary inter-professional collaboration (clinicians, nurses, pharmacists). The efficiency and quality of health care may depend on the extent to which inter-professional relationships are collaborative. Table 35 lists the tools used in the interdisciplinary approach to health service delivery. None of the studies examining this approach met the inclusion criteria for an assessment of effectiveness.

Table 35. Interdisciplinary approach

Tools	Level of care	Studies	Effect of service delivery	
			Process outcomes	Impact outcomes
Chronic care clinic: interdisciplinary approach to delivery of primary care services to the elderly in a dedicated block of practice time; self-management training and team case management	Management and palliation	(Coleman et al. 1999)*	N/E	N/E
Geriatric evaluation services: multidisciplinary team of health professionals (geriatric clinical nurse specialist, physical therapist, occupational therapist, speech and audiology therapist, social worker, nutritionist) provide counselling and family support to the elderly and chronically ill whose functional health status is deteriorating	Treatment, management, rehabilitation	(Lefton et al. 1983; Rubenstein et al. 1984; Stuck et al. 1993; Williams et al. 1987)*	N/E	N/E
Inter-professional collaboration: nurse-doctor collaboration	Treatment	(Zwarenstein & Bryant 2000)*	N/E	N/E
Physician-nurse practitioner team	Management	(Litaker et al. 2003)*	N/E	N/E
National health development fund general practice integration project (diabetes, asthma)	Management	QH*	N/E	N/E
Queensland zonal improvement projects (asthma, diabetes)	Management	QH*	N/E	N/E
Zonal improvement projects Continuous care pathways (asthma, diabetes)	Management	QH*	N/E	N/E

N/E = not evaluated; QH = Queensland Health. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Multi-faceted Interventions

Multi-faceted interventions employ two or more tools (such as those described above) to address several aspects of health care from a variety of perspectives. Table 36 lists 18 studies or programs that provided or assessed multi-faceted interventions for health service improvement.

Table 36. Multi-faceted interventions

Tools <sup>a</sup>	Level of care	Studies	Effect of service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Acute Care for Elders	Treatment	(Counsell et al. 2000; Landefeld et al. 1995)*	N/E	N/E
Audit and feedback Educational reminder Audit and feedback plus educational reminder	Diagnosis	(Eccles et al. 2001)	1. Physician participation • Compliance with CPGs for radiographs	n/a
Client-oriented, provider-efficient services: a problem-solving process and set of tools to involve all levels of staff in assessing and improving services - self-assessment guides, client interview guides, client flow analyses, and action plans	All levels	(Dohlie et al. 1999)*	N/E	N/E
Comprehensive chronic care program: multi-disciplinary team-based approach to managing chronic disease (diabetes, hypertension, and hyperlipidaemia), including nurse educators, and clinical pathways with reminders and prompts.	Management	(Lim et al. 2002)*	N/E	N/E
Cooperative health care clinic: interdisciplinary team case management provided to groups of older patients with chronic illnesses	Management	(Beck et al. 1997)*	N/E	N/E
CME Educational materials Feedback Reinforcement	Treatment	(Gutierrez et al. 1994) (Guiscafre et al. 2003)*	1. Physician participation • Change in treatment and prescribing for diarrhoea	n/a
CME Educational materials: patient and clinician Feedback Academic detailing	Treatment	(Gonzales et al. 1999)	1. Physician participation • Change in treatment and prescribing for uncomplicated acute bronchitis	n/a

Table 36 (cont.) Multi-faceted interventions

CME Peer-comparison feedback Academic detailing	Prevention	(Kim et al. 1999)*	N/E	N/E
CME Feedback	Treatment and management	(Rantz et al. 2001)*	N/E	N/E
Electronic and printed materials: CPGs on urinary tract infections and sore throat for patients. Computer-based CDS system and reminders: during consultations Interactive course: for GPs and practice assistants Financial incentive: increased fee for telephone consultations for the two diagnoses	Treatment	(Flottorp et al. 2002)	1. Physician participation • Compliance with recommendations for treatment of urinary tract infections in women and for sore throat	n/a
Facilitation intervention: used 7 intervention strategies - audit and feedback, consensus building, opinion leaders, academic detailing and educational materials, reminder systems, patient-mediated activities	Prevention	(Lemelin et al. 2001)	1. Physician participation • Compliance with recommendations for preventive care	n/a
Feedback Educational outreach visits Educational material Local opinion leaders.	Treatment	(Nilsson et al. 2001)	1. Physician participation • Rates of prescribing for hypertension, peptic ulcers/ dyspepsia, and depression	n/a
Office system: combines patient-level (patient education materials, reminders), provider-level (academic detailing, reminders, risk assessment), and practice-level (chart screening, flow sheets) tools	Prevention	(Bordley et al. 2001)*	N/E	N/E
Practice-based strategy: personalised graphical feedback; comparison to peers; dissemination of guidelines; regular small group meetings on quality improvement	Diagnosis	(Verstappen et al. 2003)	1. Physician participation • Ordering of appropriate and inappropriate diagnostic tests	n/a
NSW chronic & complex care program: multidisciplinary team-based approach to managing chronic disease (cardiovascular disease, cancer, respiratory disease and generic), including record systems, financial incentives, decision aid, interdisciplinary team approach and education	Management	NSW Government Action Plan*	N/E	N/E
Zonal stroke care network project: interdisciplinary	All levels	QH*	N/E	N/E

N/E=not evaluated; CPGs=Clinical Practice Guidelines; CME=continuing medical education; CDS=computerised decision support; GP=general practitioner; n/a = not available; QH=Queensland Health. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of multi-faceted interventions

Four randomised controlled trials and three non-randomised controlled trials met the inclusion criteria. These studies varied widely in their settings (USA, UK, Canada, Europe), quality, and targeted behaviours. Most process outcomes were concerned with compliance with clinical practice guidelines (CPGs) for a range of activities (test ordering, drug prescribing) and across all levels of care.

One good quality randomised controlled trial examined the effectiveness of audit and feedback, educational messages, or a combination of the two, in reducing general practitioners (GPs) requests for lumbar spine and knee radiographs (Eccles et al. 2001). General practices were stratified by the radiology department used for referrals and all GPs received radiography referral guidelines. Practices were then randomised to either a control group, which received guidelines only, or one of three intervention groups focussing on either lumbar spine or knee radiograph referrals. Interventions consisted of audit and feedback, an educational reminder message, or a combined audit and feedback plus educational reminder message. Using a factorial design, groups receiving intervention on knee radiographs acted as a control for the groups receiving intervention on lumbar spine radiographs, and vice versa. The process outcome was GP participation (behavioural change) regarding reduction of referrals for lumbar spine or knee radiographs in concordance with the guidelines. Results of the effectiveness of the interventions are shown in Table 38, with similar effects shown for both lumbar spine and knee radiograph requests. GPs in the audit and feedback group reduced their requests for radiographs at almost twice the rate compared to controls that received guidelines only. Educational reminders were three and five times as effective in reducing GP requests for lumbar spine and knee radiographs, respectively, whereas the combined reminder and audit and feedback intervention had additional benefit, over the effect of reminders alone, for knee radiograph requests but not for lumbar spine radiograph requests.

Another good quality multi-centre randomised controlled trial, with a balanced, incomplete block design, examined the impact of a multi-faceted practice-based feedback intervention on test-ordering performance among health care professionals (Verstappen et al. 2003). Overuse of unnecessary testing procedures may result in a number of undesirable consequences, such as avoidable exposure to radiation, or false-positive results that could induce needless fear or anxiety in patients and generate a cascade of further testing. After stratification by region and group size, groups of primary care physicians were randomised to one of two study arms. Physicians in Arm A underwent the intervention for cardiovascular diseases and hypertension, and abdominal complaints, while Arm B received intervention for chronic obstructive pulmonary disease and asthma, degenerative joint complaints, and general complaints. To counteract a potential Hawthorne effect, the physicians in Arm A acted as blinded controls for the clinical problems in Arm B and vice versa. The intervention consisted of: 1. dissemination of clinical practice guidelines (CPGs); 2. individualised feedback incorporating comparison of physicians' performance with those of colleagues; and 3. regular small group discussions on quality improvement. The primary process outcome was physician participation (behavioural change) – measured by the number of targeted tests ordered by physicians, including a range of appropriate and inappropriate tests that are detailed in Table 37.

Table 37. Clinical problems and diagnostic tests evaluated

Clinical problem	Appropriate tests	Inappropriate tests
<p><b>Arm A:</b></p> <ul style="list-style-type: none"> <li>• Cardiovascular disease/hypertension</li> <li>• Upper abdominal complaints</li> <li>• Lower abdominal complaints</li> </ul>	<p>Cholesterol, subfractions, potassium, sodium, creatinine, ECG (exercise)</p> <p>Serum glutamic-pyruvate transaminase, <math>\gamma</math>-glutamyltransferase, ultrasound of hepatobiliary tract</p> <p>Prostate-specific antigen, C-reactive protein, ultrasound of kidney, intravenous pyelogram, double-contrast barium enema, sigmoidoscopy</p>	<p>Blood urea nitrogen</p> <p>Serum glutamic-oxaloacetic transaminase, lactic dehydrogenase, amylase, bilirubin, alkaline phosphatase</p>
<p><b>Arm B:</b></p> <ul style="list-style-type: none"> <li>• COPD/asthma</li> <li>• Degenerative joint complaints</li> <li>• General complaints</li> </ul>	<p>Allergic screening, chest radiograph</p> <p>Erythrocyte sedimentation rate, uric acid, rheumatoid factors</p> <p>Erythrocyte sedimentation rate, haemoglobin, hematocrit, thyroid-stimulating hormone, Monospot</p>	<p>Immunoglobulin E</p> <p>Radiographs of lumbar spine, cervical spine, shoulder, knee, hip</p> <p>Leukocyte count</p>

ECG=electrocardiogram; COPD=chronic obstructive pulmonary disease.

Results, shown in Table 38, demonstrated significant decreases in the number of tests ordered (12% reduction from baseline at six months follow-up) for Arm A compared to control group (no change). Similarly, there were fewer inappropriate tests ordered by physicians in Arm A following intervention ( $p < 0.01$ ). In agreement with clinical practice guidelines (CPGs), there was also a reduction in total and inappropriate tests ordered by physicians in Arm B following intervention, although the results were not statistically significant. The difference in effectiveness between intervention arms may reflect the variability in clinical problems. That is, it may be more difficult to change physicians' test ordering habits for some conditions compared to others. This study showed that a relatively brief intervention period (6 months) with limited contact (3 feedback reports, 3x90 minute meetings) resulted in a significant reduction in the number of tests ordered (total and inappropriate). The authors suggest that, although the numbers are small, the results are important as Dutch physicians already order fewer tests compared to other countries (Verstappen et al. 2003). However, it is possible that only highly motivated physicians in well-functioning practices participated in this trial, raising questions regarding the generalisability of this strategy to other settings.

A good quality quasi-randomised controlled trial (Lemelin et al. 2001) investigated the effectiveness of a multi-faceted intervention, delivered by nurse facilitators to medical practices, to improve preventive practices in primary health care. Primary care practices were randomised to control (no intervention) or facilitated intervention, entailing a combination of seven strategies – audit and feedback, consensus building, opinion leaders, academic detailing and educational materials, reminder systems, patient-mediated activities and patient educational materials. Nurse facilitators discussed the seven approaches with the practice physicians and staff, and tailored strategies to meet the needs and preferences of the individual practice, using a series of quality improvement steps that are detailed in Box 3.

**Box 3. Quality improvement steps taken by facilitators (Lemelin et al. 2001)**

- Present preventive performance rates before intervention
- Facilitate the development of a practice policy for preventive care
- Assist in the setting of goals and desirable levels of performance
- Assist in the development and adaptation of tools and strategies to implement the prevention plan
- Facilitate meetings to assess progress and modify the plan if necessary
- Conduct performance feedback to measure the effect of any changes

Targeted preventive practices included up to eight recommended and five inappropriate activities and the process outcome pertained to physician participation (behavioural change) as a result of the intervention. Investigators used three measures of behavioural change: 1. an overall index of preventive performance<sup>\*\*\*\*</sup>; 2. an up-to-datedness index<sup>†††</sup>; and 3. an inappropriateness index<sup>‡‡‡</sup>. The intervention was delivered in an average of 33 (21-50) practice visits over a period of 18 months and analysis of preventive performance was conducted at nine, 15, and 18 months by auditing 100 patient charts per practice. Except for hypertension management, which was inconsistent with recommended practice, overall results, shown in Table 1, indicate improvements in preventive care performance (increase in recommended activities and decrease in inappropriate practice) in physicians who received the tailored multi-faceted intervention. The greatest improvement in preventive care performance occurred in the last three months of the intervention ( $p < 0.001$ ), by which time all of the intervention strategies had been introduced.

An average quality cluster quasi-randomised controlled trial examined the effectiveness of a multi-faceted intervention to improve the management of urinary tract infections in women and for sore throat (Flottorp et al. 2002) (Table 36). The clinical practice guidelines (CPGs) for treatment of sore throat recommended a reduction in the number of unnecessary laboratory tests and decreased use of antibiotics for patients with sore throat, whereas CPGs for treatment of urinary tract infections in women recommended the prescription of antibiotics and suggested treatment consultations by telephone for those who have had previous infections, without sending them for testing. General practices were randomised to receive a multi-faceted intervention to support dissemination of guidelines for urinary tract infections in women or for sore throat. Practices receiving guidelines and intervention for one condition acted as control for the other. The key process outcome was physician participation (behavioural change) regarding compliance with recommended guidelines. Results (Table 38) indicate that patients with sore throat in the intervention physician group were three times less likely to receive antibiotics than patients with sore throat in the control physician group ( $p = 0.03$ ). There was no significant change in antibiotic use in consultations for urinary tract infections (as expected – consistent with CPGs). Women with urinary tract infections in the intervention group were approximately two and a half times less likely to

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\*\*\*\* Preventive performance index = % of eligible patients receiving recommended preventive care - % of eligible patients receiving inappropriate preventive care

††† Up-to-datedness index = % of recommended preventive procedures completed

‡‡‡ Inappropriateness index = % of inappropriate procedures completed

have a laboratory test ordered than women in the control group ( $p < 0.05$ ). There were no significant differences between the groups for use of laboratory tests for sore throat. There were also no significant changes in the use of telephone consultations.

One good quality non-randomised controlled trial examined the effect of a multi-faceted intervention on the prescribing of antibiotics in adults (Gonzales et al. 1999). Four of the largest medical practices in the Kaiser Permanente health maintenance organisation were selected for the study. Two received an intervention – one full intervention and one limited intervention. Two usual care practices were matched to each intervention on membership size, age, gender, and relative prevalence of chronic medical conditions. The intervention sites received information concerning issues related to antibiotic use and misuse. Full intervention comprised three elements: 1. Household educational materials (refrigerator magnets, pamphlets, and a letter from the medical director) were mailed to all households receiving primary care services at the site; 2. Office-based educational materials (colourful posters); and 3. continuing medical education with feedback consisted of a 30-minute presentation including a description of the patient educational materials, education on the evidence-based management of acute bronchitis, the site-specific antibiotic prescription rates from the previous winter (equivalent period), and advice on dealing with patients demanding antibiotics. The limited intervention site received the office-based educational material only. At each site, consecutive adult patients, aged  $\geq 18$  years and diagnosed with uncomplicated acute bronchitis, were included in the study. The key process outcome was health provider participation (behavioural change) regarding antibiotic prescribing behaviour. Prescribing data were extracted from a pharmacy database that contained the number of antibiotic prescriptions dispensed. This is a relatively indirect measure of provider behaviour, as a proportion of the prescribed medicines are not necessarily dispensed. Control site data were combined for analysis – although it is not clear whether there were statistically significant differences between the control groups prior to pooling.

Baseline measures were equivalent between groups. A mixed-effects statistical model was used to control for clustering of clinicians by site, as well as potential confounders such as patient age and gender, clinician type and specialty. Results are shown in Table 38. Although all groups showed a reduction in the proportion of patients receiving antibiotics for acute bronchitis, the reduction was significantly greater in the full intervention group, which targeted not only health care providers but also patients ( $p = 0.02$ ). It should be noted that during the study period, there was general media attention focussing on antibiotic resistance. However, this appeared to have little effect on the relatively high antibiotic prescription rates at the control site. Importantly, there was no evidence of increased antibiotic prescribing for other similar conditions (sinusitis, uncomplicated upper respiratory infections), indicating that physicians did not use an alternate diagnosis for a condition that requires antibiotics. The rates of change in treatment of acute bronchitis with non-antibiotic medications (bronchodilators, cough suppressants, analgesics) were not significantly different between groups.

A poor quality non-randomised controlled trial aimed to improve general practitioners' (GPs) prescribing practices using a multi-faceted intervention that combined educational outreach visits, including educational material and local opinion leaders, with feedback on prescribing rates (Nilsson et al. 2001). GPs received the intervention for one of three pharmacotherapy fields – hypertension, peptic ulcer/dyspepsia, or depression. The groups receiving intervention for one field provided control data for the other fields. The intervention comprised three visits by teacher-physicians, a hospital specialist and a

clinical pharmacologist and involved dissemination of educational material, recommendations on treatment, group discussions regarding the pharmacotherapy of the field in question, and feedback on individual prescribing rates. The key process outcome was GP participation (behavioural change) pertaining to drug prescribing, which was measured by defined daily doses per 1,000 patients seen in a year. Prescriptions and the total number of patients treated were collected from the electronic patient records system for each GP during the year before (baseline) and the year after the intervention. Results are shown in Table 38. However, interpretation of the findings is limited by several methodological shortcomings and potential biases. It is not clear how the groups of practitioners were formed or whether they were protected from contamination. Moreover, there was no adjustment for baseline differences, thus leading to potential overestimation of the differences between the groups.

Another poor quality non-randomised controlled study examined the effectiveness of a multi-faceted educational intervention on the prescribing behaviour of family practice physicians treating diarrhoea in Mexico City (Gutierrez et al. 1994). Thirty-six physicians attending an initial workshop formed the intervention group, while non-attendees formed the control group. The intervention comprised an initial training workshop, with five one-hour sessions concerning the correct treatment of acute diarrhoea, feedback on physicians' current treatment and prescribing practices for diarrhoea, development of an algorithm (which participants were encouraged to use in subsequent consultations), and practice using the algorithm on simulated cases. The algorithm included the following recommendations: 1. Increase liquids and maintain normal feeding for all patients; 2. Use oral rehydration therapy for children under five years; 3. Avoid use of antibiotics or anti-parasitic drugs if stools are not bloody; 4. Prescribe appropriate antibiotics if stools are bloody; 5. Suspect shigellosis in the case of fever or toxicity and prescribe antibiotics; and 6. Suspect amoebiasis, if no fever or toxicity. Five months after the workshop, a peer-review committee was formed to reinforce the objectives discussed during the workshop. The process outcome was physician participation (behavioural change) regarding physicians' change in treatment according to the algorithm for patients with acute diarrhoea. Results, shown in Table 38, are weakened by several methodological limitations. There was little evidence of protection against biases, with unblinded assessment of primary outcomes, less than 60% follow-up of health professionals, and no reported protection against contamination. These factors undermine the strength of reported improvements in prescribing behaviour.

Table 38. Effectiveness of Multi-faceted interventions – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of participation (behavioural change)							
(Eccles et al. 2001)	Level II: RCT Quality: good	GPs in 244 practices	Audit and feedback Educational reminder Combined intervention: Audit and feedback + educational reminder	<i>Lumbar spine radiograph referrals per 1,000 patients across practices, % change from baseline<sup>ab</sup></i>							
				Control (CPGs only) % change	Audit and feedback % change	Effect measure Relative change	Reminder % change	Effect measure Relative change	Combined intervention % change	Effect measure Relative change	
				-9.7	-17.5	1.8	-29.7	3.1	-37.0	3.8	
				<i>Knee radiograph referrals per 1,000 patients across practices, % change from baseline<sup>a</sup></i>							
				+5.2	-10.1	1.9	-27.3	5.3	-44.2	8.5	
(Lemelin et al. 2001)	Level III-1: quasi-RCT Quality: good	46 community primary care practices	Facilitated intervention	<i>Reported preventive practices (abstracted from patient chart review)</i>							
					Control mean % of eligible patients [95% CI]			Intervention mean % of eligible patients [95% CI]			Effect measure <sup>c</sup>
				<i>Recommended preventive practices<sup>d</sup></i>	Before	After	% change	Before	After	% change	Relative change, P value
				Folic acid supplementation	9.3	12.9	+3.6	6.9	21.6	+14.7	4.1 <i>p</i> <0.05
				Smoking cessation counselling	40.5	38.7	-1.8	37.6	41.2	+3.6	2.0 NS
				Hypertension management	65.9	81.7	+15.8	82.2	79.7	-2.5	0.2 <i>p</i> <0.01
				Mammography (women 50-69 years)	53.4	58.7	+5.3	53.6	67.5	+13.9	2.6 NS
				STD screening	21.7	20.6	-1.1	14.2	21.6	+7.4	6.7 NS
				Pap smear	57.9	59.1	+1.2	60.8	66.2	+5.4	4.5 NS
				Influenza vaccination	49.4	53.4	+4.0	46.1	64.8	+18.7	4.7 <i>p</i> <0.05
Blood pressure measurement	69.9	72.4	+2.5	68.6	75.1	+6.5	2.6 NS				
Overall up-to-datedness	54.6 [51.0, 58.2]	57.4 [54.1, 60.7]	+2.8	52.3 [48.6, 56.0]	62.3 [58.2, 66.4]	+10.0	3.6 <i>p</i> <0.01				

Table 38 (cont.) Effectiveness of Multi-faceted interventions – Process outcomes

				<i>Inappropriate preventive practices<sup>e</sup></i>								
				Proteinuria screening	24.8	24.7	-0.1	21.4	13.5	-7.9	79.0	$p<0.01$
				Blood glucose screening	26.1	33.7	+7.6	25.4	27.9	+2.5	0.3	$p<0.05$
				Prostate-specific antigen testing	20.5	24.6	+4.1	16.7	28.4	+11.7	2.9	NS
				Chest radiography	5.2	5.0	-0.2	2.4	3.9	+1.5	7.5	NS
				Mammography (women 40-49 years)	5.5	9.9	+4.4	12.3	12.0	-0.3	0.1	NS
				Overall inappropriateness	22.5	25.5 [20.0-31.0]	+3.0	20.5	19.1 [15.6-22.6]	-1.4	0.5	$p<0.05$
				Overall preventive performance	32.1 [27.2-37.0]	31.9 [26.8-37.0]	-0.2	31.9 [27.3-36.5]	43.2 [38.4-48.0]	+11.3	56.5	$p<0.001$
(Verstappen et al. 2003)	Level II: multi-centre RCT, allocated at group level Incomplete block design Quality: good	174 primary care physician groups in five regions, Netherlands	Practice-based strategy: personalised graphical feedback for three specific clinical problems.	<i>Physicians' rate of ordering diagnostic tests</i>								
				Arm A (cardiovascular and abdominal complaints), No. of diagnostic tests per physician per 6 months								
					Control (Arm B) <sup>f</sup>			Intervention (Arm A)			Effect measure <sup>h</sup>	
				Clinical problem	Before mean±SD	After mean±SD	% change	Before mean±SD	After mean±SD	% change	Relative change P value	
				Total tests	507±293	503±281	-0.8	478±309	422±234	-11.7	14.6 $p<0.01$	
				Cardiovascular, hypertension	290±182	302±184	+4.1	293±189	276±157	-5.8	1.4 $p<0.01$	
				Upper abdominal complaints	192±128	174±114	-9.4	165±125	128±82	-22.4	2.4 $p<0.01$	
				Lower abdominal complaints	25±25	27±29	+8.0	20±20	18±19	-10.0	1.3 $p<0.02$	
				Arm B (respiratory, joint and general complaints), No. of diagnostic tests per physician per 6 months								
					Control (Arm A) <sup>g</sup>			Intervention (Arm B)				
				Total tests	640±394	624±357	-2.5	724±386	664±356	-8.3	3.3 $p=0.22$	
				COPD, asthma	39±31	31±25	-20.5	53±27	38±19	-28.3	1.4 $p=0.58$	
				General complaints	548±340	544±310	-0.7	599±340	568±321	-5.2	7.4 $p=0.36$	
Degenerative joint complaints	54±38	49±36	-9.3	72±43	58±37	-19.4	2.1 $p=0.34$					

Table 38 (cont.) Effectiveness of Multi-faceted interventions – Process outcomes

				Arm A (cardiovascular and abdominal complaints), No. of inappropriate diagnostic tests per physician per 6 months								
				Control (Arm B) <sup>f</sup>			Intervention (Arm A)					
				Total tests	66±55	63±56	-4.5	63±75	45±41	-28.6	6.4	<i>p</i> <0.01
				Control (Arm A) <sup>g</sup>			Intervention (Arm B)					
				Total tests	134±81	126±74	-6.0	163±89	138±74	-15.3	2.6	<i>p</i> =0.11
(Flottorp et al. 2002)	Level III-1: cluster quasi-RCT, allocated by practice Quality: poor	142 GP practices	Electronic and printed materials Computer-based CDS system and reminders Interactive course Financial incentive	<i>Physicians' practices</i>								
				Sore Throat								
				Control (Urinary Tract Infection)				Intervention			Effect measure <sup>i</sup>	
					Before	After	% change	Before	After	% change	Relative change P value	
				Use of antibiotics, %	50.8	49.5	-1.3	48.1	43.8	-4.3	3.3 <i>p</i> =0.03	
				Use of laboratory tests, %	41.9	39.7	-2.2	44.6	42.0	-2.6	1.2 <i>p</i> =0.64	
				Use of telephone consultations, %	12.5	14.1	+1.6	12.5	12.9	+0.4	0.3 <i>p</i> =0.13	
				Urinary Tract Infection								
				Control (Sore throat)				Intervention				
				Use of antibiotics, %	43.2	43.4	+0.2	46.5	46.3	-0.2	1.0 <i>p</i> =0.64	
				Use of laboratory tests, %	53.5	55.0	+1.5	53.4	49.8	-3.6	2.4 <i>p</i> <0.05	
				Use of telephone consultations, %	20.1	18.9	-1.2	20.1	19.8	-0.3	0.3 <i>p</i> =0.87	
				(Gonzales et al. 1999)	Level III-2: non-randomised controlled study Quality: good	93 health professionals (physicians, nurse practitioners and nurses) 2,027 adult patients	Patient educational materials Office-based educational materials CME and feedback	<i>Antibiotic prescribing, % of patients with acute bronchitis receiving prescriptions</i>				
Controls (pooled)		Limited intervention						Full intervention				
Prescription	% change		% change					Relative change	% change		Relative change P value	
Antibiotics	-2.0		-5.0					2.5	-26.0		13.0 <i>p</i> =0.02	
Bronchodilators	+11.0		+9.8					0.9	+15.3		1.4	
Cough suppressants	+8.8		+0.7					0.1	+8.3		0.9	
Analgesics	-0.2		-1.6					8.0	+0.2		1.0	

Table 38 (cont.) Effectiveness of Multi-faceted interventions – Process outcomes

(Nilsson et al. 2001)	Level III-2: non-randomised controlled study Quality: poor	50 GPs	Feedback Educational materials Educational outreach Local opinion leader	<i>Prescribing practice, mean % prescribed defined daily doses</i>							
				Pharmacotherapeutic field and drug group	Control N=22			Intervention N=18			Effect measure <sup>k</sup>
				Hypertension	Before [95% CI]	After [95% CI]	% change	Before [95% CI]	After [95% CI]	% change	Relative change
				Diuretics	48.7 [44.6, 52.8]	45.5 [41.0, 50.0]	-3.2	43.5 [40.4, 46.6]	43.2 [39.8, 46.6]	-0.3	0.1
				Beta-blocking agents	27.2 [23.2, 31.2]	26.5 [23.5, 29.6]	-0.7	24.2 [20.8, 27.5]	25.8 [21.0, 30.6]	+1.6	2.3
				Calcium channel blockers	12.6 [9.4, 15.9]	13.5 [10.8, 16.3]	+0.9	16.9 [13.8, 20.0]	15.4 [13.0, 17.9]	-1.5	1.7
				Anti-renin/angiotensin agents	10.9 [8.2, 13.6]	14.1 [10.5, 17.8]	+3.2	15.0 [11.4, 18.6]	14.8 [11.3, 18.3]	-0.2	0.1
				Peptic ulcer/dyspepsia	Control N=32			Intervention N=8			
				Proton-pump inhibitors	68.1 [62.2, 74.0]	76.0 [70.5, 81.6]	+7.9	61.0 [42.3, 79.8]	52.6 [28.6, 76.6]	-8.4	1.1
				H2-receptor antagonists	30.2 [23.7, 36.7]	23.3 [17.8, 28.9]	-6.9	37.8 [19.6, 55.9]	44.9 [20.2, 69.6]	+7.1	1.0
				Depression	Control N=26			Intervention N=14			
				Tricyclic anti-depressants	15.8 [12.6, 18.9]	18.1 [12.8, 23.4]	+2.3	15.3 [5.7, 24.9]	15.4 [8.4, 22.4]	+0.1	0
				SSRIs	81.7 [78.1, 85.3]	78.8 [72.3, 85.3]	-2.9	82.1 [71.5, 92.7]	82.6 [76.2, 89.1]	+0.5	0.2

Table 38 (cont.) Effectiveness of Multi-faceted interventions – Process outcomes

(Gutierrez et al. 1994)	Level III-2: non-randomised controlled study Quality: poor	69 family practice physicians	Multi-faceted educational intervention: CME, feedback, reinforcement	<i>Physicians' treatment and prescribing behaviour, mean % of cases treated by each physician according to algorithm</i>						
				Control			Intervention			Effect measure <sup>l</sup>
				Baseline N=33	6-month follow-up N=28	% change	Baseline N=36	6-month follow-up N=28	% change	Relative change
				30.8	32.4	+1.6	31.3	76.5	+45.2	28.3
	18-month follow-up N=20	% change		18-month follow-up N=20	% change					
	34.5	+3.7		74.0	+42.7	11.5				

CPG=clinical practice guidelines; STD=sexually transmitted disease; NS=not significant ( $p>0.05$ ); COPD=chronic obstructive pulmonary disease; CDS=computerised decision support; GP=general practitioner; SSRI=selective serotonin re-uptake inhibitors; CME=continuing medical education. <sup>a</sup> pre- and post-intervention means not included due to space restrictions – available on request; <sup>b</sup> multi-level modelling – variation between practices and between years was modelled as random effects. Treatment effects were included as fixed effects. Practice list size was weighted using the least-squares procedure; <sup>c</sup> general linear model repeated measures ANOVA; <sup>d</sup> guidelines recommend an increase in these activities; <sup>e</sup> guidelines recommend a decrease in these activities; <sup>f</sup> arm B (respiratory, joint and general complaints) provided control data for Arm A; <sup>g</sup> arm A (cardiovascular and abdominal complaints) provided control data for Arm B; <sup>h</sup> ANCOVA – reflects the total change between baseline and follow-up in mean  $\pm$  SD numbers of tests in the intervention group minus the total change between baseline and follow-up mean numbers of tests in the control group, adjusted for baseline and region; <sup>i</sup> hierarchical logistic regression – authors report equivalent baseline measures between groups; <sup>j</sup> baseline measures were equivalent between groups - a mixed-effects statistical model was used to control for potential clustering (random effects) of clinicians by site, and patient age and gender, clinician type and specialty, and site were included as fixed effects; <sup>k</sup> since baseline differences were not adjusted for,  $p$  values are not given.; <sup>l</sup> authors report no statistically significant differences between groups at baseline.

### ***Critical success factors of multi-faceted interventions***

While multi-faceted interventions may be effective in some circumstances, they raise difficulties in ascertaining which components, or combination of components is responsible for the measured effects. However, although there is minimal evidence for additive effects of multi-faceted interventions, it is possible that multiple tools influence more individuals within a targeted population. For example, implementing a single tool, such as a physician reminder, may contribute to behavioural changes for a proportion of participants and have minimal or no effect on the remainder. Similarly, academic detailing may influence a proportion of physicians - not necessarily the same proportion that respond to reminders - to change their practice. Given the differences between individuals (personalities, motivation, learning styles) and settings (practice sizes, resources, administrative procedures), the combined use of several well-chosen tools has the potential to impact on a wider range of individuals. The choice of tools may well depend on the characteristics of the target population, the targeted behaviour, and the context in which the tools are implemented.

### ***Critical success factors of universally applicable tools***

Among the better quality studies that were evaluated, there was considerable heterogeneity, particularly in the intensity, complexity, and duration of interventions, and in the settings, levels of care, and targeted behaviours. However, several common features of the more effective tools have become apparent:

- Clear and focussed objectives;
- Simple concise messages that are reinforced and repeated;
- The importance of a credible/trustworthy information source;
- A specific disease/problem, patient, or setting that is relevant to the targeted population;
- Interactive programs that require active participation rather than the passive dissemination of information;
- Simple, convenient and easy to use, in terms of time, effort and resources;
- The use of pre-disposing strategies. This involves consultation with health care professionals to enhance motivation and recognise the need to improve their current behaviours, by persuading them that the proposed changes would be beneficial to their patients' health;
- The use of enabling strategies – primarily, removal of barriers to change, such as procedural or equipment limitations and perceived threats to physicians' autonomy or competence; and
- The combination of effective strategies to address a focussed issue.

# Arthritis and Musculoskeletal Conditions

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Arthritis and musculoskeletal conditions comprise mainly of three diseases – rheumatoid and non-rheumatoid chronic inflammatory arthritis, osteoarthritis, and osteoporosis. These conditions are the most prevalent forms of musculoskeletal disease in Australia and place the highest burden on the community, particularly through loss of quality of life associated with pain and disability. Arthropathies, including rheumatoid, non-rheumatoid and juvenile arthritis, resulted in 172,489 hospital separations in 2001-2002. In the same time period, osteopathies and chondropathies resulted in 29,618 hospital separations in Australia (Source: AIHW National Hospital Morbidity Database). However, these separations represent the severest form of these musculoskeletal disorders. The majority of cases occur in the community, with 2.7 million Australians (or 14% of the population) estimated to suffer from arthritis in 2001 (Australian Bureau of Statistics 2002). In the 2001 National Health Survey, the prevalence of arthritis was found to increase with age from one in three Australians aged 55-64 years to just over half (52%) of those aged 75 years and over (Australian Bureau of Statistics 2002). As such, this category of disease was recognised as a National Health Priority Area by the Australian government in July 2002 (National Health Priority Action Council 2003).

Rheumatoid and non-rheumatoid arthritis are characterised by chronic inflammation of the joints. Rheumatoid arthritis is an auto-immune disease that is more common in women. There is also a juvenile form of the disease. An individual's own immune defences attack the connective tissue in the joints, causing thickening of the tissue and eventual erosion (Pugh 2000). The disease is not preventable or curable. Health service delivery is aimed primarily at early diagnosis of the condition so as to slow the progression of the disease, treatment of acute symptoms, management of chronic symptoms, and rehabilitation of mobility and physical functioning (Arthritis Foundation & Centers for Disease Control and Prevention 1999).

People affected by osteoarthritis have a slow degeneration of the cartilage in their joints. The degenerated cartilage is unable to act as cushion between bones in the affected joints and thus there is considerable pain and joint swelling (Pugh 2000). Both men and women are equally affected by osteoarthritis and it commonly develops between the ages of 45 and 90 years (National Health Priority Action Council 2003). Health service delivery is aimed primarily at the prevention of osteoarthritis (through occupational and sport injury prevention), management of chronic symptoms (through weight control – diet and exercise – and pain control), surgical treatment (for example, hip or knee arthroplasty) in serious cases, and rehabilitation of mobility and physical functioning particularly after surgery (Arthritis Foundation & Centers for Disease Control and Prevention 1999).

Osteoporosis is a musculoskeletal disorder characterised by a deterioration of bone density and structural quality. This leads to an increased risk of fracture, a major cause of morbidity (Pugh 2000). Women are at risk of osteoporosis more than men due to the loss of oestrogen at menopause. Oestrogen assists in maintaining the balance of bone mass. Health service delivery is aimed primarily at preventing osteoporosis through modification of lifestyle, particularly exercise, hormonal activity and nutrition which all impact on bone strength. Osteoporosis can also be treated or managed with medication.

The literature available for this section of the report consisted of forty-four papers that were retrieved for full text assessment. Twenty-one studies and reports were found that

described service improvement tools that specifically targeted the care of patients with arthritis and musculoskeletal conditions. Within these studies, six types of service improvement tool were identified. These are outlined in Table 39.

The tools identified for arthritis and musculoskeletal conditions fell into four categories along the continuum of care:

1. Diagnosis – strategies to improve public health nurses’ screening for arthritis in their patients;
2. Treatment – tools to primarily improve the treatment of patients with active rheumatoid arthritis (not under control);
3. Management – strategies to improve the management of osteoarthritis, rheumatoid arthritis or osteoporosis in patients; and
4. Rehabilitation – strategies to improve the functional capability of patients with arthritic disorders, primarily through physiotherapy.

Table 39. Health service improvement tools identified for arthritis and musculoskeletal conditions

Tools <sup>a</sup>	Level of care	Studies	Effect of service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Clinical practice guidelines: various types of CPGs for osteoporosis management developed through consensus and/or evidence-based processes	Management	(Cranney et al. 2002)*	N/E	N/E
<b>Educational tools</b>				
Continuing medical education: planned educational activities for (1) public health nurses - arthritis screening and management in the elderly	Diagnosis and Management	(Mazzuca et al. 1987)	1. Nurses' participation <ul style="list-style-type: none"> <li>• Change in arthritis screening behaviour</li> </ul>	n/a
and (2) primary care physicians to manage osteoarthritis in patients	Management	(Davis & Suarez-Almazor 1995)*	N/E	N/E
Specialist training: training physiotherapists in specialist techniques for care of patients with rheumatoid arthritis	Rehabilitation	(Helewa et al. 1994)*	N/E	N/E
Patient education: educating patients in self-management of pain associated with rheumatoid arthritis	Management	(Multon et al. 2001)*	N/E	N/E
Educational outreach visits (academic detailing): face-to-face visit by trained person (and subsequent reminders) to improve physician prescribing for patients with osteoarthritis	Management	(Ray et al. 2001; Stein et al. 2001)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in drug prescribing</li> </ul>	1. Patient health status <ul style="list-style-type: none"> <li>• Pain</li> <li>• Functional status</li> </ul> 2. Number of complications
Decision support: use of a computerised summary medical record to increase information flow to the physician	Management	(Whiting-O'Keefe et al. 1985)	1. Physician participation <ul style="list-style-type: none"> <li>• Change in predictive accuracy concerning patients' future clinical events</li> </ul>	n/a
Feedback: routine arthritis monitoring measurements fed back to the rheumatologist	Treatment	(Fransen et al. 2003)*	N/E	N/E
Alternative care approach: addition or substitution of services provided by a particular health professional, often in a different setting e.g. transmural nurse, nurse practitioner, or physiotherapy clinics	Management	(Hill et al. 1994; Temmink et al. 2000; Tjihuis et al. 2003)*	N/E	N/E
	Rehabilitation	(Bell et al. 1998)*	N/E	N/E

Table 39 (cont.) Health service improvement tools identified for arthritis and musculoskeletal conditions

Interdisciplinary team approach: multiple health disciplines providing tailored team care to patients with active rheumatoid arthritis	Treatment	(Anderson et al. 1988; Vliet Vlieland et al. 1996)*	N/E	N/E
	Management	(Schned et al. 1995) (Ahlmen et al. 1988; Feinberg & Brandt 1984; Gold et al. 1989)*	1. Health professional participation <ul style="list-style-type: none"> <li>• Change in drug prescribing</li> <li>• Change in referrals</li> <li>• Change in blood test ordering</li> </ul>	1. Patient health status <ul style="list-style-type: none"> <li>• Pain</li> <li>• Functional status</li> <li>• Arthritis health status</li> </ul> 2. Patient ability to manage disease 3. Patient quality of life
	Rehabilitation	(Crowe & Henderson 2003; Nordstrom et al. 1996)*	N/E	N/E

CPG=clinical practice guidelines; N/E=not evaluated; n/a=not available. <sup>a</sup> more detailed descriptions of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

Studies were usually excluded from the effectiveness assessment because information on process outcomes (i.e. showing a change/improvement in the service) was not reported. Invariably these excluded studies focussed solely on the therapeutic impact of the intervention. Of the identified studies in Table 39, eight met the inclusion criteria delineated in the review protocol and therefore enabled an assessment of tool effectiveness. However, three of these eight studies were late exclusions due to an inability to extract the relevant data (particularly baseline data) for the process outcomes (see Appendix F).

Therefore, five studies remained that assessed the effectiveness of educational tools, decision support and interdisciplinary team approaches at facilitating improvements in service delivery (process outcomes) and, ultimately, the health of patients with arthritis and musculoskeletal conditions.

## Educational Tools

Three quasi-randomised or randomised controlled trials assessed the effectiveness of educational tools for health service improvement (Table 40 and Table 41). All three trials were targeting the management of patients with, primarily, osteoarthritis. The educational interventions were all conducted in a community setting in the USA, specifically in older-adult clinics, general practice and nursing homes.

### Continuous Medical Education

The aim of the study, undertaken by (Mazzuca et al. 1987), was to improve the arthritis screening behaviour of public health nurses, compared to their control group peers, through the utilisation of an in-service continuing medical education program. The primary process outcome was nurses' participation (behavioural change) and was defined

as the translation of program recommendations into clinical practice in older-adult clinics of health departments. In this case behavioural change was reported as the proportion of elderly patients screened for arthritis as indicated by joint pain, joint swelling and joint-related limitations of activity.

Randomisation was undertaken by clinic although as the randomisation method was not given, the study design was designated a quasi-randomised controlled trial. The quality of this trial was poor. Concealment of allocation was not clear, so it is possible that selection bias was introduced. There was also no adjustment for baseline differences between the intervention and control groups. As a consequence, the authors' statistical analysis is potentially misleading and has not been reported. The main flaw of the study, however, was the unit of analysis error. Allocation to the intervention or control condition was conducted by clinic/provider but statistical analysis occurred with the client as the unit of analysis. There was no assessment or correction for possible clustering. However, since the statistical analysis is not reported in this review because of the lack of adjustment for baseline differences, the increased power afforded by a unit of analysis error has no bearing on the results as presented. The effect size remains the same.

Results indicate that the continuing medical education program appears to have affected the awareness of public health nurses concerning a possible diagnosis of arthritis in their elderly patients (Table 40). Accounting for baseline differences, results indicate that patients from intervention clinics were screened for arthritis considerably more frequently than patients in control clinics. The difference in nurses' behaviour was most apparent for the identification or screening of joint pain. However, given the flaws in this study's design it is not possible to determine whether these results are statistically significant or indeed valid.

### **Academic Detailing**

Two average quality randomised or quasi-randomised controlled trials, undertaken by the same group in Nashville, Tennessee, assessed the effectiveness of academic detailing in promoting change in the prescribing behaviour of physicians responsible for the management of elderly patients with osteoarthritis. One of these studies was aimed at general practitioners in the community (Ray et al. 2001), while the other was aimed at physicians and staff working in nursing homes (Stein et al. 2001).

In the average quality study conducted by (Ray et al. 2001), physicians were matched according to the number of elderly, non-steroidal anti-inflammatory (NSAID) users in their practices. One member of each pair was then randomised to either the intervention or control group. The intervention was a physician education program, delivered through academic detailing, that communicated guidelines for the management of osteoarthritis in elderly patients and emphasised the risks associated with continuous NSAID-use. The program consisted of a brief visit to the physician by physician-educators who presented the program, answered queries and left pertinent educational materials. This was followed-up by a study nurse who subsequently contacted the office and left reminders in the charts of the targeted patients. The main process outcome was change in prescribing practice, specifically to reduce the number of days patients with arthritis were supplied NSAID medication and to increase the number of days that arthritic patients were supplied with acetaminophen. Impact (or patient-relevant) outcomes that were measured included sustainability of the program; and change in patient health status, as

measured by the valid and reliable SF-36 sub-scales concerning general health, bodily pain, and physical functioning.

Intention-to-treat data only have been reported from this study (Ray et al. 2001), although the authors also conducted an efficacy analysis. The follow-up of patients and physicians was approximately 70%, which is also less than ideal in terms of being able to generalise the findings. Concealment of allocation of physicians to the intervention and control group was not clear, allowing for the possibility of selection bias. However, these flaws were offset by the use of objective primary outcome measures, protection against contamination through the randomisation by practice, and the correct statistical analysis (adjusting for baseline differences and the clustering effect).

With respect to the process outcome, physician participation, results indicate that physicians in the intervention group complied with the messages presented within the academic detailing educational program (Table 40). Patients in the intervention group were supplied with NSAIDs, on average, for significantly fewer days (21.3) than those in the control group, after adjusting for baseline differences. Similarly, the supply of acetaminophen significantly increased – by 10.4 days - to patients in the intervention group compared to the control group. In terms of sustainability, according to the authors the impact of the academic detailing program persisted for at least one year after the educational visit. Encouragingly, the changes in medication supply, and presumably usage, did not significantly worsen the general health, bodily pain and physical functioning of patients in the intervention groups, when compared to patients in the control group (Table 41). There was no change in patient health status.

A similar average quality study was reported by (Stein et al. 2001). The goal was to reduce NSAID usage among nursing home residents by providing an educational program to nursing home physicians and staff through academic detailing. This consisted of an initial meeting with the administrator of the nursing home and director of nursing; a 30 minute structured training session on one to three occasions for nursing staff; and a meeting with the study coordinator in each nursing home to review objectives and educational materials. The physician-educator called or visited physicians of patients in the nursing home and provided a brief educational message, followed up by the provision of three journal articles and a laminated card carrying the main educational messages, as well as an algorithm for stopping NSAIDs. Physicians also received a subsequent reminder from the study coordinator. The primary (process) outcome was provider participation (behavioural change) as measured by prescribing behaviour. Impact outcomes included patient health status, as determined by level of pain and the impact of arthritis on their activities of daily living, and number of complications.

The study (Stein et al. 2001) was designated a quasi-randomised controlled trial as the randomisation method was not reported. There was considerable loss to follow-up of nursing home patients in both the intervention and control groups (38%) as some were discharged home and others died. The data were not analysed on an intention-to-treat basis but as the loss to follow-up was not distributed differently between the two groups, it is unlikely that this resulted in bias. It is unclear whether allocation to the intervention and control groups was concealed at randomisation. However, the trained nurse who undertook the assessment of process outcomes was blind to the allocation status of the nursing homes. Furthermore, contamination is unlikely as randomisation was undertaken by nursing home. There was no unit of analysis error, with appropriate statistical adjustment for clustering effects and baseline differences between the groups.

Consistent with the messages promoted in the educational program, patients in the intervention group in this study (Stein et al. 2001) were supplied with NSAIDs, on average, for significantly fewer days in the previous week than those in the control group, after adjusting for baseline differences ( $p < 0.001$ ). The percentage change from baseline in the intervention group was six times that of the percentage change in the control group (Table 40). Similarly, acetaminophen was supplied to patients in the intervention group for significantly more days in the previous week than patients in the control group ( $p < 0.001$ ) (Table 40). The percentage change from baseline in the intervention group was nine times that of the percentage change in the control group. This occurred despite the fact that not all nursing staff attended the educational sessions (estimated 60-65%).

With respect to the patient-relevant impact outcomes, there was a higher baseline arthritis pain score in patients in the control group compared to the intervention group. Thus, improvement could occur in fewer patients in the intervention group than in the control group (“ceiling effect”). To overcome this problem, the authors measured pain in terms of a worsening of patients’ pain score as opposed to an improvement. After analysis of the results and an adjustment for baseline differences, however, it was determined that there was no difference between the groups, with respect to a worsening of patient arthritic pain (Table 41). There were also no statistically significant differences between the groups, in changes from baseline, with respect to health status as measured by difficulty with performing activities of daily living (Modified Health Assessment Questionnaire) or as measured by the Sickness Impact Profile (nursing home version). Gastrointestinal symptoms comparatively increased in patients in the intervention group, although this increase was not statistically significant (Table 41). The educational program, delivered through academic detailing, which promoted a change in the prescribing of high-risk (NSAIDs) pain and symptom-relieving medications to the low-risk - and presumably less efficacious - medications (acetaminophen), had no impact on patient outcomes.

### ***Critical success factors of educational tools***

Limited, poor quality evidence from one study indicates that:

- In-service, small group **continuing medical education programs** on arthritis screening and management, including personalised audit and feedback on clinical practice, may improve nurses’ ability to screen elderly patients for arthritis.

Average quality evidence from two studies suggests that:

- **Academic detailing** – including one-on-one visits by a physician-educator, the provision of educational materials and the use of reminders - is effective at changing providers’ prescribing behaviour and these changes are sustainable in the long-term (up to one year). However, changes in provider behaviour are not necessarily reflected in changes in the health status of patients with osteoarthritis.

The common thread in the success of an educational tool for service improvement appears to be the use of *personalised* or interactive education – such as, one-on-one sessions in academic detailing; personalised audit and feedback on clinical practice (i.e. performing a consultation while being watched and assessed and then receiving constructive feedback); and personalised reminders for ‘best practice’.

Table 40. Effectiveness of educational tools for arthritis and musculoskeletal conditions – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of participation (behavioural change)							
(Mazzuca et al. 1987)	Level III-1: quasi-RCT Quality: poor	29 public health nurses from seven older-adult clinics	Continuing medical education: in-service education program on arthritis screening and management in older adults	<i>Proportion of patients' screened for arthritis, % of patients</i>							
				Intervention message	Control		Intervention		Effect measure <sup>a</sup>		
					Before	After	% Change	Before	After	% Change	Relative change
				Screen for joint pain	22.2	22.1	-0.1	14.0	46.9	+32.9	329.0
				Screen for joint swelling	20.0	19.5	-0.5	10.0	45.7	+35.7	71.4
Screen for joint-related limitations of activity	20.0	15.6	-4.4	10.0	35.8	+25.8	5.9				
(Ray et al. 2001)	Level II: RCT Quality: average	220 physicians in general practice treating arthritis patients with regular NSAIDs	Academic detailing: physician-educator visit, followed up by study nurse placing chart-reminders for qualifying patients	<i>Prescribing practice – supply of medication to patient, mean no. of days</i>							
				Prescribing practice message	Control, Mean days		Intervention, Mean days		Effect measure		
					Before	After	% Change	Before	After	% Change	Relative change Absolute change, <sup>b</sup> mean days [95%CI]
				Reduce NSAIDs	284.9	238.4	-16.3	287.2	219.4	-23.6	1.4 -21.3 [-32.4, -10.2]
Increase acetaminophen	3.0	5.3	+76.7	4.0	17.9	+347.5	4.5 +10.4 [5.5, 15.3]				
(Stein et al. 2001)	Level III-1: quasi-RCT Quality: average	20 nursing homes randomised in pairs	Academic detailing: meetings with nursing home staff; in-service education; educational materials; reminder	<i>Prescribing practice – supply of medication to patients, mean no. of days in the previous week</i>							
				Prescribing practice message	Control, Mean±SD (days)		Intervention, Mean±SD (days)		Effect measure		
					Before N=71	After N=71	% Change	Before N=76	After N=76	% Change	Relative change P value <sup>b</sup>
				Reduce NSAIDs	7.0±0.8	6.2±2.5	-11.4	7.0±0.1	1.9±3.5	-72.9	6.4 <i>p</i> <0.001
Increase acetaminophen	1.8±2.5	2.1±2.5	+16.7	2.0±3.5	5.1±2.6	+155.0	9.3 <i>p</i> <0.001				

NSAIDs=non-steroidal anti-inflammatory drugs; SD=standard deviation. <sup>a</sup> authors' statistical analysis does not adjust for baseline differences and so is not reported; <sup>b</sup> generalised linear modelling conducted by the authors, adjusting for clustering effect and baseline differences.

Table 41. Effectiveness of educational tools for arthritis and musculoskeletal conditions – Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Patient health status							
				Control, Mean score			Intervention, Mean score			Effect measure	
				Before	After	% Change	Before	After	% Change	Relative change Mean absolute change, <sup>a</sup> [95%CI]	
(Ray et al. 2001)	Level II: RCT Quality: average	220 physicians in general practice treating arthritis patients with regular NSAIDs	Academic detailing: physician-educator visit, followed up by study nurse placing chart-reminders for qualifying patients	<i>Patient health status, mean score on SF-36: 0 = worst, 100 = best</i>							
				SF-36, general health	41.0	37.4	-8.8	40.3	40.6	+0.7	0.1 +3.9 [-1.0, 8.8]
				SF-36, bodily pain	46.0	41.0	-10.9	44.7	45.9	+2.7	0.2 +1.7 [-5.4, 8.8]
				SF-36, physical functioning	37.9	35.1	-7.4	33.5	31.8	-5.1	0.7 +1.1 [-4.9, 7.1]
(Stein et al. 2001)	Level III-1: quasi-RCT Quality: average	20 nursing homes randomised in pairs	Academic detailing: meetings with nursing home staff; in-service education; educational materials; reminder	<i>Patient health status</i>							
				Control			Intervention			Effect measure	
				Before	After	% Change	Before	After	% Change	Relative change P value <sup>a</sup>	
				Worsening of arthritis pain (% patients)	n/a N=40	n/a N=40	-32.5	n/a N=48	n/a N=48	-35.4	1.1 $p=0.81$
				Prevalence of complications (% patients) <sup>b</sup>	42.9 N=63	44.4 N=63	+1.5	40.0 N=65	49.2 N=65	+9.2	6.1 $p=0.35$
				Ability to perform activities of daily living (mean MHAQ score±SD)	1.3±0.8 N=67	1.2±0.8 N=67	-7.7	1.2±0.8 N=69	1.2±0.8 N=69	0.0	0 $p=0.46$
Patient health status (Mean SIP-NH score±SD)	37.7±15.6 N=61	34.5±16.4 N=61	-8.5	35.2±17.3 N=68	34.5±18.1 N=68	-2.0	0.2 $p=0.19$				

SF-36=short form - 36 item questionnaire; MHAQ=modified health assessment questionnaire (0=best, 3=worst); SD=standard deviation; SIP-NH=sickness impact profile – nursing home version (0=best, 100=worst).

<sup>a</sup> group differences in patient outcomes at follow-up were assessed using generalised estimating equation analysis to adjust for baseline differences and clustering; <sup>b</sup> measured by the change in gastrointestinal symptom prevalence.

## Decision Support

Only one study was available to assess the effectiveness of decision support in improving health service delivery to patients with arthritis and musculoskeletal conditions (Whiting-O'Keefe et al. 1985). This average quality study assessed the impact on health professional decision-making of the addition of a Summary Time-Oriented Record (STOR), to the standard Medical Record, when seeing outpatients in an arthritis clinic situated in San Francisco, California. The goal was to improve the clinical decision process by providing clear, concise and relevant information on patients' clinical histories. Patients at the arthritis clinic were randomised to either the intervention (STOR and MR) group or the control (MR only) group. If the patient was in the intervention group, the health professional – including staff physicians, rheumatology fellows, nurse practitioners and medical residents - received the STOR and MR at the consultation. If the patient was in the control group, the health professional only received the MR.

The study design has been designated a quasi-randomised controlled trial as the method of randomisation was not given. The major methodological flaw of the study was the lack of protection against contamination as the health professional was his/her own control. This did, however, mean that baseline differences were non-existent. It was unclear whether there was concealment of allocation and so the possibility of selection bias cannot be ignored. A blinded research assistant undertook assessment of the mainly objectively measured primary outcome. The primary (process) outcome was the physicians' ability to predict future clinical patient events.

Results of this study indicate that a decision support tool can improve the accuracy of health professionals' predictions concerning future clinical events of their arthritic patients (including laboratory results, physical symptoms and both combined). The mean accuracy scores in the intervention group indicated improvements in prediction, over the control group, although the change in accuracy for predicting laboratory results was not statistically significant. The authors attribute these positive results to the additional and more relevant patient information provided to the health professional in the form of a computerised summary medical record (Table 42).

Table 42. Effectiveness of decision support tools for arthritis and musculoskeletal conditions – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of participation (behavioural change)				
(Whiting -O'Keefe et al. 1985)	Level III-1: quasi-RCT Quality: average	12 health professionals in an arthritis clinic	Decision support: computerised summary time-oriented medical record	<i>Health professionals' accuracy score for predicting patient events, mean±SD</i>				
				Clinical event	Control (MR) N=12 <sup>a</sup>	Intervention (STOR + MR) N=12	Absolute difference, P value <sup>b</sup>	
				Symptoms	-10.7±11.2	17.4±11.2	28.1 $p<0.01$	
				Laboratory results	40.1±9.6	48.0±10.0	9.9 NS	
Combined	9.4±11.6	32.7±7.3	20.9 $p<0.01$					

SD=standard deviation – this was originally reported incorrectly as a standard error; MR=medical record; STOR=summary time-oriented medical record; NS=not significant ( $p>0.05$ ). <sup>a</sup> only eleven subjects provided data for laboratory results; <sup>b</sup> health professionals acted as their own control and so baseline differences were not observed. Authors calculated the mean of the differences between the paired groups and utilised a paired, one-sided t-test to test the statistical significance of the results ( $p<0.05$ ).

### *Critical success factors of decision support*

Limited, average quality evidence from one study indicates that:

- **Decision support** to health professionals in the form of a computerised summary time-oriented medical record can improve their ability to predict clinical events or symptoms in their patients. Whether this improvement in service has a flow-on effect at improving the health status of patients is unknown.

## Interdisciplinary Team Approach

An interdisciplinary team approach is defined as several disciplines working together to produce a tailored/individualised treatment or management strategy for the patient. This is a quite common tool in the area of arthritis and musculoskeletal conditions as management strategies are varied and include symptom-control, assistance with activities of daily living including work, and assistance with maintaining physical functioning and mobility over the lifespan. Management of the disease(s) may therefore require the input of primary care physicians, rheumatologists, physiotherapists, psychologists and social workers, podiatrists and dietitians.

Despite the numerous studies that have been undertaken on the use of interdisciplinary team approaches in improving the quality of health service to patients with arthritis and musculoskeletal conditions, only one study met the inclusion criteria for this systematic review. This poor quality quasi-randomised controlled trial conducted by (Schned et al. 1995) investigated the impact of team managed care, compared to the non-standardised usual care provided by primary care physicians and rheumatologists, on the clinical outcomes of patients with early-onset chronic inflammatory arthritis. The main process outcome was provider participation (behavioural change) measured by provider prescribing practice, referrals to other health professionals and the ordering of blood tests. Impact outcomes included patient health status (measured by functional status, pain and arthritis health status), ability to self-manage the disease, and quality of life.

Patients were apparently randomised to the two types of care but the randomisation process was not described and it is unclear if there was any concealment of allocation to prevent selection bias. There was significant loss to follow-up of patients (approximately 30%) one year after recruitment, which may limit the external validity of the results. There was no blinded assessment of the outcomes and for the most part the outcomes were measured via patient self-report, introducing possible measurement and reporting biases. One strength of the study was that baseline data were measured and statistical adjustment for baseline differences was undertaken in all analyses.

In terms of the main process outcome of provider participation (behavioural change), there was no statistically significant difference in changes in prescribing practice between the two types of care. Similarly, there was no statistically significant difference between the intervention and control groups in the change from baseline of referrals to other health professionals and of the ordering of blood tests (Table 43). Results on the impact outcomes indicate that team managed care had no effect on patient health status as a whole (including functional status, pain and arthritis health status), on the ability to self-manage the disease, or on patient quality of life (Table 44). In this study an interdisciplinary team approach to health care afforded no advantage over the usual routine outpatient care, which was characterised by mainly one-on-one relationships between patients and their primary care physicians and rheumatologists. It is unclear whether the lack of effect was in fact real or due to the poor design of the study.

### ***Critical success factors of the interdisciplinary team approach***

Limited, poor quality evidence from one study indicates that:

- **Interdisciplinary team approaches**, in the form of team managed outpatient care of arthritis patients, are no more effective at changing provider practice or improving the health status, quality of life or disease-management of patients, than traditional outpatient care provided by a primary care physician or a rheumatologist.

Table 43. Effectiveness of the interdisciplinary team approach for arthritis and musculoskeletal conditions – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of participation (behavioural change)							
(Schned et al. 1995)	Level III-1: quasi-RCT Quality: poor	107 patients with early onset chronic inflammatory arthritis	Inter-disciplinary team approach: team managed outpatient care	<i>Prescribing practice, mean number±SD</i>							
				Medications	Control (usual care)			Intervention (team care)			Effect measure
					Before	After	% Change	Before	After	% Change	Relative change P value <sup>a</sup>
				NSAIDs N=24 for both groups	3.5±1.8	1.4±0.7	-60.0	4.1±1.9	1.1±0.3	-73.2	1.2 $p=0.27$
				DMARDS (group 1) N=13 (control), 21 (interv.)	0.5±0.7	1.0±0.5	+100.0	0.7±0.7	1.1±0.4	+57.1	0.6 $p=0.23$
				DMARDS (group 2) N=8 for both groups	0.9±0.6	1.0±0.0	+11.1	0.4±0.5	1.1±0.4	+175.0	15.8 $p=0.07$
				Corticosteroids (total mg/month) N=25 (control), 33 (interv.)	260.4±521.8	281.4±477.0	+8.1	483.9±1151.8	438.6±606.6	-9.4	1.2 $p=0.92$
				<i>Referrals, mean±SD</i>							
				Referrals to other health professionals	Control (usual care)			Intervention (team care)			Effect measure <sup>a</sup>
					Before	After	% Change	Before	After	% Change	Relative change
				Total number of referrals in six months N=41 (control), 36 (interv.)	6.4±5.0	3.5±5.3	-45.3	5.8±4.7	3.6±4.0	-37.9	0.8 $p=0.88$
				<i>Ordering of blood tests, mean±SD</i>							
					Control (usual care)			Intervention (team care)			Effect measure <sup>a</sup>
					Before	After	% Change	Before	After	% Change	Relative change
Total number of blood tests in six months N=37 (control), 35 (interv.)	5.4±7.2	3.4±4.7	-37.0	3.8±4.5	5.0±5.6	+31.6	0.8 $p=0.08$				

SD=standard deviation; NSAIDs=non-steroidal anti-inflammatory drugs; DMARDS (group1)= disease modifying anti-rheumatic drugs - including hydroxychloroquine, sulphasalazine, auranofin; DMARDS (group 2)=disease modifying anti-rheumatic drugs - including injectable gold salts, methotrexate, D-penicillamine and azathioprine. <sup>a</sup> repeated measures ANOVA, controlling for baseline differences.

Table 44. Effectiveness of the interdisciplinary team approach for arthritis and musculoskeletal conditions – Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Patient health status							
							Effect measure				
(Schned et al. 1995)	Level III-1: quasi-RCT Quality: poor	107 patients with early onset chronic inflammatory arthritis	Inter-disciplinary team approach: team managed outpatient care	<i>Functional status, mean±SD</i>							
					Control (usual care)			Intervention (team care)			Relative change P value <sup>a</sup>
					Before	After	% Change	Before	After	% Change	
				Physical function (MHAQ)	3.8±3.1	2.4±2.6	-36.8	3.0±3.2	2.5±2.9	-16.7	0.5 <i>p</i> =0.30
				Mobility (AIMS)	0.7±1.3	0.5±1.2	-28.5	0.4±1.3	0.2±0.6	-50.0	1.8 <i>p</i> =0.67
				Physical activity (AIMS)	5.0±2.9	4.7±2.8	-6.0	4.7±2.5	3.9±2.5	-17.0	2.8 <i>p</i> =0.64
				Dexterity (AIMS)	3.7±3.3	2.5±2.5	-32.4	3.8±3.1	3.0±3.0	-21.1	0.6 <i>p</i> =0.85
				<i>Level of pain, mean±SD</i>							
				Pain (AIMS)	5.8±2.3	4.6±2.2	-20.7	5.2±2.2	4.8±2.4	-7.7	0.4 <i>p</i> =0.24
				Pain (VAS)	43.5±26.2	34.5±25.6	-20.7	35.6±25.6	26.4±19.5	-25.8	1.2 <i>p</i> =0.08
				<i>Arthritis health status, mean±SD</i>							
				Global Arthritis Rating (Stanford)	37.5±21.8	31.2±19.4	-16.8	37.2±22.0	27.3±14.8	-26.6	1.6 <i>p</i> =0.55
				<i>Management of disease, mean±SD</i>							
					Control (usual care)			Intervention (team care)			Effect measure
					Before	After	% Change	Before	After	% Change	Relative change P value <sup>a</sup>
				Helplessness (AHI)	40.0±6.9	37.6±6.2	-6.0	39.5±7.0	37.9±6.7	-4.1	0.7 <i>p</i> =0.81
				<i>Change in patient quality of life, mean±SD</i>							
	Control (usual care)			Intervention (team care)			Effect measure				
	Before	After	% Change	Before	After	% Change	Relative change P value <sup>a</sup>				
Life satisfaction (MHAQ) <sup>b</sup>	4.0±1.4	4.8±1.4	+20.0	4.8±1.2	5.4±1.0	+12.5	0.6 <i>p</i> =0.43				

MHAQ=modified health assessment questionnaire (0=best, 3=worst); AIMS=arthritis impact measurement scales (0=best, 10=worst); VAS=visual analogue scale (0=no pain, 100=pain as bad as it could be); AHI=arthritis helplessness index (15=least degree of helplessness, 60=greatest degree of helplessness). <sup>a</sup> repeated measures ANOVA, controlling for baseline differences; <sup>b</sup> this scale is measured as 1=completely dissatisfied, 7=completely satisfied.

## ***Critical success factors of tools for arthritis and musculoskeletal conditions***

Average quality evidence indicates that the common thread in the success of an educational tool for service improvement, in the area of arthritis and musculoskeletal conditions, appears to be the use of *personalised* or interactive education. This includes one-on-one educational sessions as used in academic detailing; personalised audit and feedback on clinical practice (i.e. performing a consultation while being watched and assessed and then receiving constructive feedback); and personalised reminders for ‘best practice’. Academic detailing is effective at promoting sustainable change in provider prescribing practice but does not necessarily impact on patient health status. Similar results are reported for continuing medical education although the evidence-base is of poorer quality.

One average quality study assessing decision support tools indicates that a computerised summary time-oriented medical record can improve the ability of health professionals to predict clinical events or symptoms in their arthritic patients. However, it is unknown whether this improvement in service has a flow-on effect at improving the health status of these patients. It appears that the streamlining of clinical information into a summarised, relevant, accessible tool improves the clinical assessment of patients by health professionals. This translation of patient medical records into clinically relevant summaries would, however, require considerable resources.

Finally, one poor quality study suggests that interdisciplinary team approaches, in the form of team managed outpatient care of arthritis patients, are no more effective at changing provider practice or improving the health status, quality of life or disease-management of patients, than traditional outpatient care provided by a primary care physician or a rheumatologist. It appears that the less-structured referral and management process offered through usual care is as effective as a structured referral and team managed process.

In summary, critical success factors for arthritis service improvement tools, include:

- Interactive or personalised programs that require active participation rather than the passive receipt of information; and
- Summarised, streamlined information that is simple, relevant and accessible.

# Asthma

Asthma is an inflammatory disease that induces bronchospasm and narrowing of the air passages. This can cause shortness of breath and coughing, as the passage of air in and out of the lungs is made more difficult (Braunwald et al. 2001). Asthma has varying levels of severity ranging from mild symptoms to severe cases where acute attacks can result in death. This is a disease that can impact on all age groups and not only result in physical symptoms but also affect quality of life. In most cases asthma symptoms are amenable to treatment but in some instances, over many years, persistent asthma can cause a chronic respiratory condition (AIHW 2003b).

Asthma often begins in childhood with on average one in four primary school children, one in seven adolescents and one in ten adults developing asthma in Australia (NHPAC 2003). In 1996, asthma contributed 2.6% to the total burden of disease in Australia (AIHW 2003b) and this together with the financial burden that asthma places on the health system, was influential in targeting asthma as a National Health Priority Area in 1999 (AIHW 2003b).

All ten categories of tools have been implemented to improve asthma health service delivery and are predominantly concerned with the treatment and management of asthma. The identified tools are listed in Table 45.

Table 45. Identified tools for improving health service delivery to asthma patients

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Clinical practice guidelines: computer-based CPGs paper-based CPGs	Treatment	(Shiffman et al. 2000)*	N/E	N/E
	Treatment & Management	(Maskell et al. 2001)*	N/E	N/E
Continuous quality improvement: asthma management guidelines	Management	(Gibson & Wilson 1996)*	N/E	N/E
Educational tools: CME	Treatment, Management	(Clark et al. 1998; Evans et al. 1997)  (Blackstien-Hirsch et al. 2000; Hodges et al. 1993; Premaratne et al. 1999; Stergachis et al. 2002)*	1. Assessment of participation  • Change in physician behaviour • Compliance and up-take of new strategy	1. Patient's health status 2. Patient quality of life 3. Patient ability to manage disease 4. Number of readmissions
Academic detailing	Diagnosis, Treatment, Management	(Tomson et al. 1997) (Thoonen et al. 2003)*	1. Assessment of participation  • GPs' knowledge of diagnosis & treatment	n/a
Specialist training: physician training	Management	(Cloutier et al. 2002)*	N/E	N/E

Table 45 (cont.) Identified tools for improving health service delivery to asthma patients

Decision support: computer/internet based	Treatment	(Kuilboer et al. 2002; Thomas et al. 1999)*	N/E	N/E
Prompts and reminders: paper-based reminders for health care providers	Management	(Ruoff 2002)*	N/E	N/E
Audit and feedback: summary of clinical performance and peer- comparison feedback	Treatment	(Lagerlov et al. 2000; Veninga et al. 1999) (Lagerlov et al. 2001)*	1. Assessment of participation • Change in prescribing behaviour • GPs knowledge & attitudes	n/a
Alternative care approach: alternative care provider	Treatment & Management	(Diette et al. 2001; Greineder et al. 1999; Knoell et al. 1998; Levy et al. 2000; Smith et al. 2000; Wu et al. 2001)*	N/E	N/E
alternative care setting	Treatment & Management	(McDermott et al. 1997)*	N/E	N/E
Interdisciplinary team approach: clinical pathway	Management	(Johnson et al. 2000; Kelly et al. 2000)*	N/E	N/E
education	Management	(Ludwig-Beymer et al. 1998)*	N/E	N/E
Multi-faceted interventions: CPGs, CQI, Education, Feedback, Record systems	Management	(Akerman & Sinert 1999; Battleman et al. 2001)*	N/E	N/E
CPGs, education	Treatment and Management	(Groban et al. 1998; Peleg et al. 2002)*	N/E	N/E

CPG=clinical practice guideline; N/E=not evaluated; CME=continuing medical education; GP=general practitioner; CQI=continuous quality improvement; n/a=not available. <sup>a</sup> more detailed descriptions of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

Of the 32 studies that described health service improvement tools for asthma, five studies met the inclusion criteria in the review protocol and, thus, could be assessed for effectiveness. These studies assessed two types of tools - educational tools (specifically, continuing medical education and academic detailing) and audit and feedback.

## Educational Tools

Three of the five included studies looked at educational tools for improving services to asthma patients (Clark et al. 1998; Evans et al. 1997; Tomson et al. 1997). Two assessed the effectiveness of continuing medical education in paediatric settings in New York (Clark et al. 1998; Evans et al. 1997), while the remaining study evaluated academic detailing in Stockholm county general practices (Tomson et al. 1997). All of the studies evaluated the effectiveness of health service improvement tools in relation to asthma treatment and one also targeted improvement in the diagnosis of asthma (Tomson et al. 1997).

## Effectiveness of continuing medical education

(Clark et al. 1998) carried out a good quality quasi-randomised controlled trial aimed at improving paediatric asthma outcomes. The study investigated the effect of an interactive seminar for paediatricians on their behaviour, parents' (of patients) views of paediatrician performance, medical care utilisation, and the health status of the children. The seminar made use of a variety of educational materials to convey key messages regarding optimal clinical practice. These were based on the National Asthma Education and Prevention Program guidelines and patient teaching and communication. Educational materials were delivered through the medium of brief lectures, videos, case study presentations and handouts of protocols. The control group received no intervention but was given a date from which to begin patient follow-up.

Some aspects of the study design were not made clear and may have introduced bias, including: the randomisation process, whether there was concealment of treatment allocation, and an intention-to-treat analysis. However, only one paediatrician from each practice was enrolled to minimise contamination between groups, and patients were blinded to their group allocation. The change in paediatrician behaviour, which was the primary process outcome, was measured by the use of a survey. It was unclear whether this survey was constructed or already validated. The questions prompted self-reported assessment, a form of potential reporting bias, and as such was not regarded as a reliable measure. The authors tried to overcome this limitation by asking the parents of the paediatric patients to assess the paediatricians' performance. This was considered to be a more reliable and objective measure of the primary outcome and therefore is discussed in this report (Table 46).

The continuing medical education (CME) seminar appeared to positively impact on paediatrician behaviour, resulting in statistically significant changes in the treatment of patients as well as in the education of, and communication with, patients and families. According to parental report, paediatricians improved their behaviour for all aspects of communication and practice that were measured. In two cases, however, the improvements were not statistically significant - paediatricians asking the child to demonstrate how to use a metered-dose inhaler and enabling parents to make asthma management decisions. Some variables are not reported here as they were only assessed at follow-up and did not control for baseline effects (Table 46).

The impact outcomes indicated that patients of paediatricians in the intervention group reduced their scheduled and follow-up doctor office visits compared to those in the control group, however emergency visits and hospitalisations did not differ between the intervention and control groups (Table 47).

(Evans et al. 1997) carried out a good quality controlled before-and-after study assessing the impact of training workshops for clinic staff and tutorial sessions for physicians on the access, continuity and quality of care provided to low-income children in New York City. The intervention consisted of three components, including five three-hour educational sessions for the entire clinic staff, a tutorial session for the clinic physicians and a nurse educator making monthly visits to the intervention clinics for assistance in problem solving. The sessions incorporated education on a specific asthma program, a performance play of how the program would work and how to establish the program in the physicians' own clinics. Following this, prevention and treatment protocols based on the National Asthma Education and Prevention Program guidelines were presented. The recommendations comprised 1) the use of inhaled therapy for all patients, and 2) daily

anti-inflammatory therapy for children with more than one asthma exacerbation every two months. Patient-physician communication skills were addressed, as was the introduction of easy-to-read treatment plans to encourage patient adherence to prescribed therapy. Additionally, a screening process was developed whereby children with asthma in the clinic could be effectively identified and subsequently invited to receive treatment. The clinic staff in the control group did not receive the training but were given the opportunity to receive training upon completion of the two-year study.

The study by (Evans et al. 1997) had some methodological flaws, including only a 50% follow-up of patients. Although there was poor patient follow-up, data obtained through the clinics' database was regarded as a reliable measure of the primary outcome, that is, the percentage of children receiving care in the clinics and establishing continuity of care. The study reported baseline measurements, allowing an estimate of the size of the effect. The authors' clearly stated that monitoring of their staff assisted in minimising any contamination between the control intervention group clinics.

Results of the study indicate that the continuing medical education impacted on the primary process outcome – of physician participation (behavioural change). There was a considerably large improvement in the intervention group in physicians' ability at identifying new patients, with a relative change from baseline eleven times that of the change in the control group (Table 46). Additionally, results indicated that intervention group staff were following recommendations of scheduling preventative care visits to educate and adjust the treatment plans of patients. There was a greater increase in the average number of scheduled and unscheduled visits in the intervention clinics in comparison to the control clinics (Table 46).

### **Effectiveness of academic detailing in asthma**

(Tomson et al. 1997) conducted a controlled before and after study to evaluate the impact of academic detailing on general practitioners' (GPs) knowledge regarding asthma diagnosis and treatment, their prescribing behaviour and also patients' knowledge about asthma. Two areas of Stockholm County were divided into the intervention and control groups. While the control area received no education, a clinical pharmacologist and pharmacist visited health centres in the intervention area and met with small groups of GPs to discuss asthma treatment. The intervention included oral information conveying the three following key messages (Box 4):

#### **Box 4. Key messages (Tomson et al. 1997)**

- 1) Inhaled glucocorticoids should be prescribed as prophylactic treatment and inhaled  $\beta$ -adrenoreceptor agonists as symptomatic treatment for asthma.
- 2) Peak expiratory flow (PEF) meters should be used to diagnose and assess the severity of asthma and patients should be taught how to use such PEF meters as part of self-management plan.
- 3) Reversibility tests should be employed to distinguish between asthma and chronic obstructive pulmonary disease.

This was considered to be a poor quality study. There was a lack of reporting of baseline characteristics, insufficient follow-up of GPs and unclear blinding. The questionnaire given to the GPs at baseline and at one-year follow-up consisted of three questions that appeared to be constructed by the authors, as there was no mention of questionnaire

validity. In addition, the questions required self-report data and this, together with the inability to blind the GPs, suggests that the data are not likely to be reliable. Furthermore, allocation to the intervention and control groups was by Stockholm County area but analysis of the data was at the level of the GP and did not account for clustering in the health centres in the two areas. Asthmatic patients were also evaluated in this study by means of a questionnaire aimed at identifying their knowledge level about their disease. This questionnaire was given to patients entering the pharmacy at baseline and at one year follow-up. However this resembled a cross-sectional survey as the patients at baseline differed to those at follow-up. Given the flaws in the study design, the results of (Tomson et al. 1997) are considered unreliable and are not reported here.

### ***Critical success factors of educational tools***

It appears that the most striking critical success factor amongst the good and average quality studies that looked at educational tools for asthma service improvement was the interactive, face-to-face nature of the interventions. (Clark et al. 1998) and (Tomson et al. 1997) utilised small group educational sessions, with 4-8 physicians per group (Clark et al. 1998) and up to 12 per group (Tomson et al. 1997). Additionally, the interventions in all three studies were made up of a combination of activities, which may have had an impact on compliance with the new strategy but also reinforced the importance of the program. Thirdly, the two good quality studies discussed the willingness or motivation of the health professionals to be involved in the study – possibly impacting on their rate of up-take or compliance with the intervention. One study (Evans et al. 1997) included an educational program occurring over five 3-hour sessions, with the intensive nature possibly contributing to its success.

Therefore the main critical success factors appear to be:

- Interactive, small group teaching
- Combined educational interventions
- Physician motivation
- Intensity of the educational program.

Table 46. Effectiveness of educational tools - process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Assessment of participation (behavioural change)				
(Clark et al. 1998)	Level III-1: quasi-RCT Quality: Good	74 paediatricians and 637 of their patients	Continuing medical education: interactive seminar	<i>Physician behaviour - Parents' reports of Provider Actions, % of patients</i>				
				Paediatrician	Control	Intervention	Odds Ratio <sup>a</sup>	P value <sup>b</sup>
				Prescribed inhaled anti-inflammatory therapy	70.3	82.7	n/a	$p=0.02^c$
				Asked child to demonstrate how to use MDI	18.5	33.6	2.1	$p=0.07$
				<i>Parents' views of Provider Performance</i>				
				Paediatrician	Control	Intervention	P value <sup>d</sup>	
				Was reassuring and encouraging	4.4	4.6	$p=0.06$	
				Looked into how family managed day to day	3.7	4.0	$p=0.02^c$	
				Gave information to relieve specific worries	3.9	4.1	$p<0.01^c$	
				Enabled family to know how to make asthma-management decisions	4.2	4.3	$p=0.07$	
				<i>Physician behaviour - Provider Self-report, adjusted mean of group responses<sup>ef</sup></i>				
				Variables	Control	Intervention	P value <sup>d</sup>	
				Address specific fears about new medication	4.7	5.1	$p=0.03^c$	
				Give written instructions for later reference about using the medication	3.9	4.5	$p=0.06$	
				Go over the instruction for the new medication	4.4	5.0	$p=0.01^c$	
Write down for the family how to adjust the medicine when symptoms change	3.5	4.3	$p<0.01^c$					
Variables	Control	Intervention	P value <sup>d</sup>					
Time spent on a visit for a newly diagnosed child with asthma (in minutes)	27.1	22.8	$p<0.01^c$					

Table 46 (cont.) Effectiveness of educational tools - process outcomes

(Evans et al. 1997)	Level III-2: CCT Quality: Good	22 clinics	Continuing medical education: interactive educational sessions tutorial session nurse educator monthly visits	<i>Compliance and up-take of new strategy, mean asthma patients per 1000 clinic patients</i>					Relative Change		
				Screening activity results <sup>g</sup> N=22 clinics	Control			Intervention			
					Before	After	% change	Before	After	% change	
				Newly identified patients	14.6	15.9	+8.9	20.0	39.6	+98.0	11.0
				<i>Compliance and up-take of new strategy, mean annual visits for asthma by children</i>					Relative Change		
				N=22 clinics	Control <sup>h</sup>			Intervention <sup>h</sup>			
					Before	After	% change	Before	After	% change	
				Scheduled visits	1.0	0.9	-11.1	1.2	1.9	+55.5	5.0
Walk-in visits	0.3	0.4	+16.1	0.2	0.6	+163.6	10.2				
Total visits	1.3	1.2	-4.6	1.4	2.4	+71.6	15.6				

MDI=metered dose inhaler; n/a=not available. <sup>a</sup> odds ratios are only reported for dichotomous variables and means reported for scaled variables; <sup>b</sup> ordinary multiple regression and logistic regression were used to identify differences between treatment and control groups at follow-up, controlling for baseline; <sup>c</sup> statistically significant, p<0.05; <sup>d</sup> analysis of covariance with baseline data as covariate. No significant differences between treatment and control groups at baseline were identified for these variables; <sup>e</sup> standard deviations were not reported; <sup>f</sup> these adjusted mean values are representative of the Likert -type response format where 1=never and 6=always; <sup>g</sup> the data were obtained from maximum likelihood estimations; <sup>h</sup> random effects analysis was carried out to obtain change in the mean annual visits.

Table 47. Effectiveness of educational tools - Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Number of readmissions			
				Mean number <sup>a</sup>	Control	Intervention	P value <sup>b</sup>
(Clark et al. 1998)	Level III-1: quasi-RCT Quality: Good	74 paediatricians and 637 of their patients	Continuing medical education: interactive seminar	Scheduled doctor office visits	2.3	1.2	p<0.01 <sup>c</sup>
				Follow-up doctors office visits after an episode of symptoms	1.6	0.9	p<0.01 <sup>c</sup>
				Emergency Department visits	0.7	0.7	NS
				Hospitalisations	0.01	0.01	NS

NS=not significant (p>0.05); <sup>a</sup> assuming these values are means, although not directly stated by the authors; <sup>b</sup> generalised estimating equation model to control for baseline scores; <sup>c</sup> statistically significant, p<0.05.

## Feedback

The remaining two studies included in this report of asthma service improvement tools focussed on audit and feedback.

### Effectiveness of audit and feedback in asthma

(Lagerlov et al. 2000) appeared to be a sub-study of the bigger study conducted by (Veninga et al. 1999). (Veninga et al. 1999) assessed the impact of the program to improve the treatment of asthma patients in four different countries: The Netherlands, Norway, Sweden and Slovakia. (Lagerlov et al. 2000) only reported outcome measures from Norway. Although there were slight differences in the quality and analysis of the studies, they did not represent high quality evidence.

The intervention conducted in both of the studies consisted of two educational meetings. At the first meeting the general practitioners (GPs) were audited and given feedback on their treatment principles. There was also an interactive discussion regarding the guidelines about asthma, its management and reasons for the treatment protocols used by GPs. The second meeting consisted of a lecture where international and national guidelines about asthma were presented. After the educational sessions, the GPs' prescriptions were monitored, according to the recommended prescribing guidelines, and judged as appropriate or inappropriate and feedback was provided. The control group received an educational program on urinary tract infection, except in Slovakia where the control group did not receive any intervention. Data concerning treatment of asthma was collected for all groups at baseline and follow-up and the primary process outcome was considered to be changes in prescribing behaviour, although knowledge and attitude data were also collected. Blinded assessment of the primary outcome and concealment of treatment allocation was unclear in both studies. There was less than optimal follow-up of physicians. The study conducted by (Lagerlov et al. 2000) lacked any protection against contamination and utilised unreliable primary outcome measures (GP self-reported behaviour).

Findings from the better quality study (Veninga et al. 1999) indicated that the audit and feedback intervention facilitated large, statistically significant effects for two of the four aspects of GP prescribing behaviour in The Netherlands (Table 48). These two prescribing practices were in concordance with asthma guidelines. Other countries also revealed moderate to large effects for some aspects of prescribing behaviour. The study suggests that although overall knowledge did not show any statistically significant effects, the educational program appeared to have a significant impact on physicians' attitudes and parts of their prescribing behaviour (Table 48). The non-significant results also indicated trends in the right direction. With regard to physicians' knowledge, only Slovakia demonstrated a large statistically significant effect for knowledge on treatment of asthma exacerbations. Physicians' attitudes in agreement with the guidelines appeared to show large statistically significant improvements in The Netherlands, Norway and Slovakia.

Table 48. Audit and feedback - process outcomes

Study	Level of evidence	Target population	Intervention	Outcomes - Assessment of participation (behavioural change)									
				Prescribing indicators	Country	Control			Intervention			Statistic	
				Physician prescribing behaviour <sup>ab</sup>									
				Proportion of patients on inhaled corticosteroids		Before	After	% change	Before	After	% change	Effect size <sup>c</sup>	
(Veninga et al. 1999)	Level III-1 Quality: Average	665 GPs from The Netherlands, Sweden, Norway & Slovakia	Audit of practice Educational meeting Feedback on practice			NL	0.6	0.6	-0.02	0.6	0.6	+0.85	+1.27*
				S		0.5	0.5	+0.04	0.5	0.5	+0.06	+0.33	
				N		0.5	0.5	+0.04	0.5	0.5	+0.07	+0.51	
				SK		0.4	0.5	+0.06	0.4	0.5	+0.12	+0.74	
				ALL								+0.66*	
				Proportion of patients on continuous bronchodilator monotherapy		NL	0.3	0.3	0.0	0.3	0.2	-0.03	+0.31
						S	0.5	0.4	-0.11	0.5	0.4	-0.09	-0.18
						N	0.2	0.2	-0.04	0.2	0.2	-0.04	+0.15
						SK	0.2	0.2	-0.01	0.3	0.2	-0.07	+0.82
						ALL							+0.20
				Proportion of patients on inadequate level of inhaled corticosteroids		NL	0.2	0.2	+0.01	0.2	0.1	-0.03	+0.75
						S	0.2	0.1	-0.02	0.1	0.1	-0.04	+0.35
						N	0.1	0.1	-0.02	0.1	0.1	-0.01	-0.11
						SK	0.3	0.2	-0.04	0.2	0.2	-0.04	-0.03
						ALL							+0.24
				Proportion of prescriptions for oral corticosteroids for exacerbations		NL	0.4	0.4	+0.01	0.2	0.4	+0.17	+1.99*
						S	0.1	0.5	+0.05	0.2	0.2	+0.01	-0.34
						N	0.3	0.4	+0.07	0.3	0.4	+0.18	+0.87*
						SK	0.4	0.3	-0.1	0.4	0.5	+0.06	+0.79
						ALL							+0.71*

Table 48 (cont.) Audit and feedback - process outcomes

Physician knowledge and attitudes <sup>ab</sup>								
Variables	Country	Control group			Intervention group			Statistic
		Before	After	% change	Before	After	% change	Effect size <sup>c</sup>
Knowledge Overall	NL	0.7	0.7	-0.01	0.7	0.7	-0.02	-0.23
	S	0.7	0.7	+0.03	0.6	0.7	+0.02	-0.26
	N	0.7	0.7	0.0	0.7	0.7	+0.02	+0.35
	SK	0.6	0.7	+0.02	0.6	0.7	+0.05	+0.34
	ALL							+0.03
Knowledge: Maintenance treatment	NL	0.8	0.8	-0.01	0.8	0.8	-0.08	-0.67
	S	0.8	0.8	+0.05	0.8	0.8	0.0	-0.43
	N	0.7	0.7	0.0	0.8	0.7	-0.05	-0.45
	SK	0.7	0.7	+0.09	0.7	0.7	0.0	-0.55
	ALL							-0.51*
Knowledge: Exacerbations	NL	0.8	0.7	-0.04	0.8	0.8	-0.02	+0.13
	S	0.7	0.8	+0.06	0.7	0.8	+0.04	-0.15
	N	0.6	0.6	+0.05	0.6	0.7	+0.05	+0.01
	SK	0.5	0.5	+0.01	0.4	0.6	+0.15	+1.06*
	ALL							+0.17
Attitudes: Overall	NL	0.8	0.8	0.0	0.8	0.9	+0.05	+1.06*
	S	0.9	0.9	+0.02	0.9	0.9	+0.03	+0.29
	N	0.9	0.9	-0.01	0.9	0.9	+0.03	+0.87*
	SK	0.8	0.8	+0.01	0.8	0.9	+0.08	+0.92
	ALL							+0.75*

Table 48 (cont.) Audit and feedback - process outcomes

				Attitudes: Maintenance treatment	NL	0.9	0.9	+0.01	1.0	1.0	+0.03	+0.15
					S	1.0	1.0	-0.02	1.0	1.0	-0.02	-0.05
					N	1.0	1.0	-0.01	1.0	1.0	+0.01	+0.28
					SK	0.8	0.9	+0.09	0.9	0.9	+0.02	-0.43
					ALL							+0.02
				Attitudes: Exacerbations	NL	0.8	0.8	+0.02	0.8	1.0	+0.12	+0.97*
					S	0.7	0.8	+0.05	0.7	0.8	+0.1	+0.32
					N	0.8	0.8	0.0	0.6	0.8	+0.11	+0.63
					SK	0.5	0.6	+0.08	0.3	0.7	+0.41	+1.49*
					ALL							+0.76*

NL=The Netherlands; S=Sweden; N=Norway; SK=Slovakia. <sup>a</sup> weighted mean proportions of responses in agreement with guidelines per group of doctors; <sup>b</sup> data were rounded to one decimal place for raw data; <sup>c</sup> effect size = (mean change in outcome in intervention group) – (mean change in outcome in control group)/pooled standard deviation. Effect size>0.8=large, 0.4-0.8=moderate, <0.4=small; \* significant trend or intervention effect (0.05 level, 2-tailed).

### ***Critical success factors of audit and feedback***

The main critical success factor found in (Veninga et al. 1999) was the same as that found in the studies assessing educational tools, that is, interactive discussions. However it is also apparent that for this intervention, motivation may have had an impact on the success of the intervention. The intervention was most successful in The Netherlands, where general practitioners are involved in developing national guidelines for asthma treatment and management and as such may have been more motivated to change their behaviour.

Therefore the two critical success factors found in the better quality study assessing an audit and feedback tool are:

- Interactive interventions
- Physician motivation

### ***Critical success factors of tools for asthma***

The factors identified as critical to the success of asthma service improvement tools are, therefore:

- Interactive, small group teaching;
- Physician motivation;
- Combined educational interventions; and the
- Intensity of the educational program.

# Cancer

Cancer, or neoplasms, arise following genetic mutation or exposure to carcinogens. Malignant cancers involve the abnormal proliferation of cells and invasion into healthy tissues (metastasis). Cancers may develop in almost any part of the body and each type of cancer has a particular profile, including risk factors (smoking, genetic inheritance, exposure to carcinogens), pattern and rate of growth, degree of severity, survival rate, and treatment options (chemotherapy, surgery, radiotherapy).

In 2000, there were 85,231 new cases and 35,466 deaths attributed to cancer – approximately one in three males and one in four females aged  $\leq 75$  years were diagnosed with the disease (AIHW & AACR 2003) (Table 49). The most common cancers are colorectal, breast, prostate, melanoma and lung cancer, which account for approximately 60% of all cancers.

Table 49. Rates of the most common cancers in Australia in the year 2000 (AIHW & AACR 2003)

Cancer	Number of newly-diagnosed cases	Age-standardised incidence rate per 100,000	Number of cancer deaths	Age-standardised mortality rate per 100,000
<i>Males</i>				
Prostate	10,512	125	2,665	36
Colorectal	6,863	80	2,569	31
Lung	5,278	62	4,594	55
Melanoma	4,770	54	617	7
All cancers	45,935	536	20,038	245
<i>Females</i>				
Breast	11,314	115	2,521	25
Colorectal	5,542	54	2,149	20
Melanoma	3,761	38	354	4
Lung	2,782	27	2,317	23
All cancers	39,286	390	15,428	147
Total	85,231	451	35,466	188

Importantly, small changes in incidence and mortality trends in the most common cancers may have a substantial impact on the actual number of new cases or deaths. For example, a 1% increase in breast cancer incidence is equivalent to 113 new cases per year, whereas a similar increase in cervical cancer incidence equates with seven new cases. Some evidence suggests that population-based screening for certain cancers, particularly breast (mammogram), cervical (Pap smear), and bowel cancer (faecal occult blood test), in conjunction with timely effective treatment substantially reduces the illness and death associated with the disease (Cancer Council Australia 2003).

Tools that have been developed to improve health service delivery in the area of cancer fall primarily into the preventive, diagnostic, treatment and palliative areas of health care. Several of the tools that were evaluated in populations that included cancer patients, or health professionals treating cancer patients have been identified in systematic reviews in a previous section - *universally applicable tools* (Balas et al. 2000; Hunt et al. 1998; Jamtvedt et al. 2003; Thomson O'Brien et al. 2001; Thomson O'Brien et al. 2000a; Thomson O'Brien et al. 2000b).

## Educational Tools

The key messages in preventive medicine for cancer relate to regular screening tests and lifestyle changes - particularly smoking cessation. Educational tools are used to increase patients' understanding of risk factors and encourage lifestyle changes, increase knowledge about symptoms to aid diagnosis, and to improve communication skills and understanding of pain control for both physicians and patients. Table 50 lists the educational tools that were identified in 13 studies. One study (Fallowfield et al. 2002), which met the inclusion criteria, was excluded due to the lack of extractable data for the relevant process outcomes (Appendix F).

Table 50. Educational tools for cancer

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Cancer pain educational interventions: interventions targeting physicians and patients to improve control of cancer pain.	Treatment, management and palliation	(Allard et al. 2001; de Wit et al. 2001; de Wit & van Dam 2001; Grant et al. 2000; Trowbridge et al. 1997)*	N/E	N/E
Educational learner-centred course: 3-day small group-based course. Feedback: comprehensive written feedback. Educational course and feedback	Treatment	(Jenkins & Fallowfield 2002)	1. Physician participation • Change in communication skills	n/a
Educational intervention – providers: Algorithm-trained practitioners - expert role-model approach includes 5-hour training session, algorithm flow chart, guiding principles for prescribing drugs, pain flow sheet.  Educational intervention - providers: 3-session program including: 1x3-hour lecture on epidemiology, diagnosis and skin cancer management; interactive rounds at melanoma unit; skills training for excising skin lesions.	Treatment  Diagnosis, treatment, and management	(Du Pen et al. 2000)*  (Girgis et al. 1995)*	N/E  N/E	N/E  N/E
Educational intervention – patients: individual or group counselling and workshop on risky lifestyles.  Educational intervention – patients: telephone information service concerning mammography screening.	Prevention  Prevention	(Hollen et al. 1999; Shepherd et al. 2000)*  (Crane et al. 1998)*	N/E  N/E	N/E  N/E

Table 50 (cont.) Educational tools for cancer

Educational materials – patients: printed materials for cervical screening.	Prevention	(Eardley et al. 1988)*	N/E	N/E
Educational materials – patients: printed materials concerning genetic testing for BRCA1/BRCA2 among Askenazi Jewish women.	Prevention	(Schwartz et al. 2001)*	N/E	N/E
Educational training – radiologists: breast imaging reporting and data system.	Diagnosis	(Berg et al. 2002)*	N/E	N/E

N/E=not evaluated; n/a = not available. <sup>a</sup> more detailed description of intervention is provided in the study profile of the study that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### Effectiveness of educational tools for cancer

One average quality quasi-randomised controlled trial met the inclusion criteria. (Jenkins & Fallowfield 2002) conducted this trial in the UK and examined the impact of communication skills training on physicians’ attitudes to patients and on their communication behaviours. Physicians were ‘randomised’ to a control group (no intervention) or to attend a communication skills course. Prior to randomisation, a sample of 6-10 consecutive patient consultations for each physician was videotaped using the Medical Interaction Process System (MIPS), which classifies utterances during the consultation into categories. Participants in the course worked in small groups, led by a facilitator, with a team of simulator patients who provided feedback on the physicians’ communication performance. The course participants discussed the initial videotaped consultation and feedback, identified communication problems, and proposed solutions to the problems. Three months after the course, two patient consultations for each physician were filmed and analysed by MIPS. The primary process outcome was physician participation (change in attitude and behaviour). To measure change in attitude, physicians completed the Physician Psychosocial Belief (PPSB)<sup>§§§§</sup> questionnaire at baseline and three months after the course. Analysis of the MIPS videotape determined physicians’ change in behaviour.

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§§§§ Physician Psychosocial Belief (PPSB) scale = a 32-item self-report questionnaire that measures physicians’ beliefs about psychosocial aspects of patient care. Using a 5-point Likert scale, scores range from 32 to 160, with low scores reflecting positive attitudes to the psychosocial issues that are part of a physician’s role.

Results, shown in Table 51, indicate that the course improved physicians' attitudes, with significantly more positive attitudes (lower mean PPSB score,  $p=0.002$ ) in physicians who had attended the course compared to controls. Analysis of the MIPS videotaped consultations revealed that physicians who attended the course were more likely to show empathy, use open questions, make appropriate responses to patient cues, and engage in psychosocial probing, compared to their colleagues in the control group. Overall, attending the course significantly improved the attitudes and communication behaviour of physicians. The main limitation of this study is the lack of reliability and validity of the primary measures. Physician attitude was measured using a self-reported questionnaire (PPSB scale) and the MIPS videotape analysis of physician behaviour had a low inter-rater reliability (0.69 [0.49 to 0.81]). Although assessment was blinded, physicians and patients were aware that their communication was being filmed and their interactions may not reflect 'real' behaviour. In addition, it is not clear whether there was adequate protection against contamination between the groups or whether the randomisation procedure adequately protected against bias. The average response rate from physicians (77% returned baseline and follow-up questionnaires) makes it difficult to determine the generalisability of these results.

Table 51. Effectiveness of educational tools for cancer – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Assessment of participation (behavioural change)							
				<i>Physician communication behaviours, % of utterances per MIPS analysis</i>			<i>Physician attitude, mean PPSB scores±SD</i>		Effect measure		
(Jenkins & Fallowfield 2002)	Level III-1: quasi-RCT Quality: average	93 oncology physicians	Educational learner-centred course: 3-day small group-based course.	Behaviours	Control (no course) N=45			Intervention (Course) N=48			Relative change P value <sup>a</sup>
					Before	After	% change	Before	After	% change	Relative change P value <sup>a</sup>
				Use of open questions	77	71	-6.0	76	90	+14.0	2.3 <i>p</i> <0.01
				Use of empathy	49	38	-11.0	59	58	-1.0	0.1 <i>p</i> <0.05
				Appropriate responses to patient cues	46	32	-14.0	42	52	+10.0	0.7 <i>p</i> <0.01
				Psychosocial probing	11	16	+5.0	16	27	+11.0	2.2 <i>p</i> <0.05
											Relative change P value <sup>b</sup>
				PPSB score	82.6±8.6	83.7±8.7	+1.33	78.4±8.2	75.4±10.5	-3.8	2.9 <i>p</i> =0.002

MIPS=medical interaction process system that codes utterances by their content and mode (empathy, open/closed question); PPBS=physician psychosocial belief scale - low scores reflect more positive attitudes, indicating physicians agree that psychosocial issues are part of a physician's role; SD=standard deviation. <sup>a</sup> chi-square analysis – no differences at baseline; <sup>b</sup> ANCOVA used to control for baseline differences.

## Decision Support

Decision support in the area of cancer is usually designed to assist patients in assessing their risk of developing cancer (for preventive screening purposes) or to provide information and possible consequences of decisions concerning treatment options (e.g. surgery, pharmacology, or watchful waiting). An assortment of decision aids have been developed to assist both physicians and patients in making decisions about the most appropriate course of treatment (e.g. surgical, pharmacological, monitoring) – many of which have been assessed in a systematic review (O'Connor et al. 1999). Physician-oriented decision support tools focus on improving health care providers' skills in detecting potential malignancies and enhancing communication with their patients. Management of pain is a primary focus of most health service improvement tools in the areas of treatment, management and palliative care. The studies identified in the evidence base that described cancer decision support tools are listed in Table 52.

Table 52. Decision support tools for cancer

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Cancer nomograms: expert system that performs clinical predictions based on a set of input data	Treatment	(Ross et al. 2002; Schwartz & Albertsen 2002)*	N/E	N/E
Consultation Planning Template: structured outline that prompts patients to generate decision-focussed agendas for consultations Consultation Recording Template: recording written summaries of consultations	Treatment and management	(Sepucha et al. 2003; Sepucha et al. 2000)*	N/E	N/E
Computer-based decision aid – patients: touchscreen family cancer questionnaire to determine cancer risk	Prevention	(Campbell et al. 1997; Westman et al. 2000)*	N/E	N/E
Computer-based decision aid – patients: CHESS system – provides information, decision-support and social support	Treatment	(Davison & Degner 2002)*	N/E	N/E
Decision aid - patients: pamphlets, self-administered questionnaire	Prevention	(Bastian et al. 2002; Chelf et al. 2001; O'Connor et al. 1999; Schapira & VanRuiswyk 2000; Stacey et al. 2003)*	N/E	N/E
Decision aid – patients: audiotape or interactive multimedia decision aid	Treatment	(Goel et al. 2001; Murray et al. 2001a)*	N/E	N/E

Table 52 (cont.) Decision support tools for cancer

Decision support - physician: algorithm for the clinical management of patients with suspicious skin lesions, and a Polaroid camera to record the appearance of lesions for follow-up review	Diagnosis	(Del Mar & Green 1995) (Gerbert et al. 2000; Hanrahan et al. 2002)*	1. Physician participation <ul style="list-style-type: none"> <li>• Change in the number of benign lesions excised</li> <li>• Change in reasons for excising lesions</li> </ul> 2. Physician satisfaction	n/a
Decision support - physician: computer-based tumour marker advisory program	Treatment	(Leaning et al. 1992)*	N/E	N/E
Decision support – shared decision-making: interactive videodisk program about options and encouragement for active participation in decision-making process	Treatment	(Gramlich & Waitzfelder 1998; Maslin et al. 1998)*	N/E	N/E
Decision support – PAINReportIt: interactive touchscreen program assisting patients' assessment and reporting of pain and analgesic use	Treatment	(Huang et al. 2003)*	N/E	N/E

N/E=not evaluated; n/a = not available. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of decision support for cancer

One good quality randomised controlled trial that met the inclusion criteria examined the effectiveness of using a skin cancer diagnosis algorithm and a photographic record of skin lesions to reduce the number of excisions of benign lesions (Del Mar & Green 1995). Two Australian cities in Queensland were randomised to either the control or intervention group. Physicians in the intervention city received an algorithm for the clinical management of suspicious skin lesions. The algorithm, which comprised a series of assessments and decisions, was a simplified summary of “best practice” guidelines. Physicians also received a Polaroid camera, with instructions on its use, for keeping an objective photographic record of patients’ skin lesions, with a view to monitoring their changes over time. Process outcomes were physician participation (behavioural change), specifically the change in the number of benign lesions excised. Results (Table 53) indicate that physicians in the intervention city removed a significantly lower proportion of lesions that were neither invasive nor potentially malignant compared to physicians in the control city ( $p < 0.001$ ). Although promising, these results are provisional as only one city in each study arm substantially reduces the power of the study. A larger sample size in a well-designed randomised controlled trial would increase the power, validity and generalisability of the findings.

Table 53. Effectiveness of decision support tools for cancer – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Assessment of participation (behavioural change)							
				Control – over 6 months			Intervention – over 24 months		Effect measure <sup>a</sup>		
				Baseline	After (6 month average)	% change	Baseline	After (6 month average)	% change	Relative change	
(Del Mar & Green 1995)	Level III-1: quasi-RCT Quality: good	105 general practices	Decision support: physicians used an algorithm for the clinical management of patients with suspicious skin lesions, and a Polaroid camera to record the appearance of lesions for follow-up review	<i>Physicians' excision of skin lesions</i>							
				No. of lesions excised	752	2468 (617)	-18.0 <sup>b</sup>	606	1997 (499)	-17.7 <sup>b</sup>	1.0
				Total no. of potentially malignant lesions	45	153 (47)	+4.3 <sup>b</sup>	39	224 (68)	+74.4 <sup>b</sup>	17.3
				% of excised non-invasive lesions [95% CI]	96.1 [94.8, 97.5]	96.6 [95.9, 97.3]	+0.5	98.2 [97.1, 99.2]	95.8 [94.9, 96.7]	-2.4	4.8
				Non-invasive nor potentially malignant, % [95% CI]	94.0 [92.3, 95.7]	93.8 [92.8, 94.8]	-0.2	93.6 [91.6, 95.5]	88.8 [87.4, 90.2]	-4.8	24 <i>p</i> <0.001

<sup>a</sup> multivariate logistic regression analysis – adjusted for patient's gender, age, and site of lesion; <sup>b</sup> calculated using the post-intervention 6-month average.

## Prompts and Reminders

Prompts and reminders (patient- and physician-oriented) are used to improve rates of cancer screening and promote healthy lifestyles. Ten studies (Table 54) investigated the effects of using prompts and reminders to increase the uptake of cancer screening procedures, remind patients about appointments, or to improve communication between patients and physicians.

Table 54. Prompts and reminders for cancer prevention

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Combined reminders: combined mailed reminders (to patients) for Pap test and mammogram plus medical record prompt	Prevention	(Burack et al. 2003)*	N/E	N/E
Combined reminders and prompts: reminders for patients, prompts for physicians, and combined reminder plus prompt	Prevention	(Richards et al. 2001)	1. Physician participation <ul style="list-style-type: none"> <li>change in uptake of breast screening in eligible women patients</li> </ul>	n/a
Computer-generated reminders	Prevention	(Goldberg et al. 2000)*	N/E	N/E
Follow-up reminders	Prevention	(Jeffery et al. 2002)*	N/E	N/E
Patient-held records: patients retain a supplementary medical record and diary to keep appointments and assist communication with their provider	Management	(Drury et al. 2000; Williams et al. 2001)*	N/E	N/E
	Palliation	(Cornbleet et al. 2002)*	N/E	N/E
Patient-held question sheet: to assist patients in asking questions during consultations	Treatment	(Gattellari et al. 2001)*	N/E	N/E
Patient reminder: postcard or telephone reminders for Pap test or mammogram	Prevention	(Abood et al. 2002; Eilers & Swanson 1993)*	N/E	N/E

N/E=not evaluated; n/a=not available. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of prompts and reminders for cancer

One good quality cluster randomised controlled trial met the inclusion criteria. Richards et al (Richards et al. 2001) examined the effectiveness of using a combined intervention – reminder letters to patients and prompts for physicians – to increase the breast screening rates in eligible women aged between 50 and 64 years. Practices, with historically low rates of breast screening uptake, were stratified by geographical area (of 2) and by practice size within each area, and then randomised to one of four intervention groups: 1. Control (no intervention); 2. Reminder letter to patients, sent one month prior to their routine invitation for screening; 3. Flag in eligible patients' notes to prompt physician to discuss breast screening; and 4. Combined reminder letter to patient and flag in patient's notes. The process outcome was physician participation (behavioural change) concerning uptake of breast screening for eligible patients. Odds ratios (Table 55) indicate a statistically significant increase in the rate of uptake for breast screening in practices that sent reminder letters to patients (OR 1.3 [1.1, 1.6]) or used flags (OR 1.4 [1.1, 1.8]) to prompt physicians compared to control. However, there was no statistically significant interaction between reminder letters and prompting flags, indicating no increased benefit in practices using a combination of letters and reminders.

Table 55. Effectiveness of prompts and reminders for cancer – Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Assessment of physician participation (behavioural change)						
				<i>Uptake of breast screening</i> <sup>a</sup>						
				Control N=1621	Reminder letter N=1703	Prompt flag N=1151	Reminder and Prompt N=1257			
				% change	% change	Relative change <sup>b</sup> OR [95% CI]	% change	Relative change <sup>b</sup> OR [95% CI]		
(Richards et al. 2001)	Level II: cluster RCT, by practice, stratified by area and size Quality: good	99 General practices 6,133 women aged 50-64 years	Reminder letter Prompt Reminder and prompt	+9.3	+12.4	1.3 1.3 [1.1, 1.6]	+15.3	1.7 1.4 [1.1, 1.8]	+23.9	2.6 1.4 [0.9, 2.3]

OR=odds ratio. <sup>a</sup> pre- and post-intervention scores not included due to space restrictions - available on request; <sup>b</sup> random effects logistic regression model, adjusting for the effects of cluster randomisation and stratifying on practice size and area.

## Telemedicine

One brief report from Queensland Health and one study explored the effects of telemedicine on cancer. Both failed to meet the inclusion criteria for an assessment of effectiveness (Table 56).

Table 56. Telemedicine for cancer

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Telemedicine: telephone nursing intervention	Management	(Rawl et al. 2002)*	N/E	N/E
Telehealth technologies	All levels	QH*	N/E	N/E

N/E=not evaluated; QH=Queensland Health. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Alternative Care Approach

One study (Table 57) in the evidence base examined the use of an alternative care approach to cancer but failed to meet the inclusion criteria for an assessment of effectiveness.

Table 57. Alternative Care Approach

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Specialist nurse counsellor: advocacy approach to support patients diagnosed with breast cancer	Treatment	(Ambler et al. 1999)*	N/E	N/E

N/E=not evaluated. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Interdisciplinary Team Approach

One brief report from Queensland Health and one study described an interdisciplinary team approach to cancer. Both failed to meet the inclusion criteria for an assessment of the effectiveness of the interdisciplinary team approach (Table 58).

Table 58. Interdisciplinary Team Approach to cancer

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Clinical care pathways: interdisciplinary team develops a structured health care plan, which is continuously monitored, reviewed and evaluated for variances from the pathway	Treatment	(Gendron et al. 2002)*	N/E	N/E
Zonal clinical service improvement networks	All levels	QH*	N/E	N/E

N/E=not evaluated; QH=Queensland Health. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Multi-faceted Interventions

Eight studies, listed in Table 59, examined the effectiveness of multi-faceted interventions in the field of cancer. None of them met the inclusion criteria.

Table 59. Multi-faceted interventions for cancer

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
CME plus feedback	Diagnosis	(Gerbert et al. 1998)*	N/E	N/E
CME, educational materials, academic detailing, and financial incentives	Prevention	(Hermens et al. 1999)*	N/E	N/E
CME, pain documentation, policies and procedures: nurse-focussed multi-faceted intervention	Treatment and management	(Holzheimer 1999)*	N/E	N/E
Reminder letters, printed information plus telemedicine: reminder letters concerning Pap tests and mammograms plus motivational interview delivered by telephone or in clinics	Prevention	(Rimer et al. 2002; Valanis et al. 2003)*	N/E	N/E
Office system: CME, feedback on performance rates in mammogram screening, prompts, patient-held records, patient educational materials, flow sheets – tailored for individual practices	Prevention	(Kinsinger et al. 1998; McPhee & Detmer 1993)*	N/E	N/E
Zero acceptance of pain: pain education materials, pain management prompts, documentation tools, and nurse educator	Management and palliation	(Fortner et al. 2003)*	N/E	N/E

CME=continuing medical education; N/E=not evaluated. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### *Critical success factors of tools for cancer*

Three studies aiming to improve the delivery of health services in the area of cancer were evaluated for this review. Educational tools, decision support, or prompts and reminders, were each moderately successful in achieving targeted aims. The factors that appear to have contributed to their success are the:

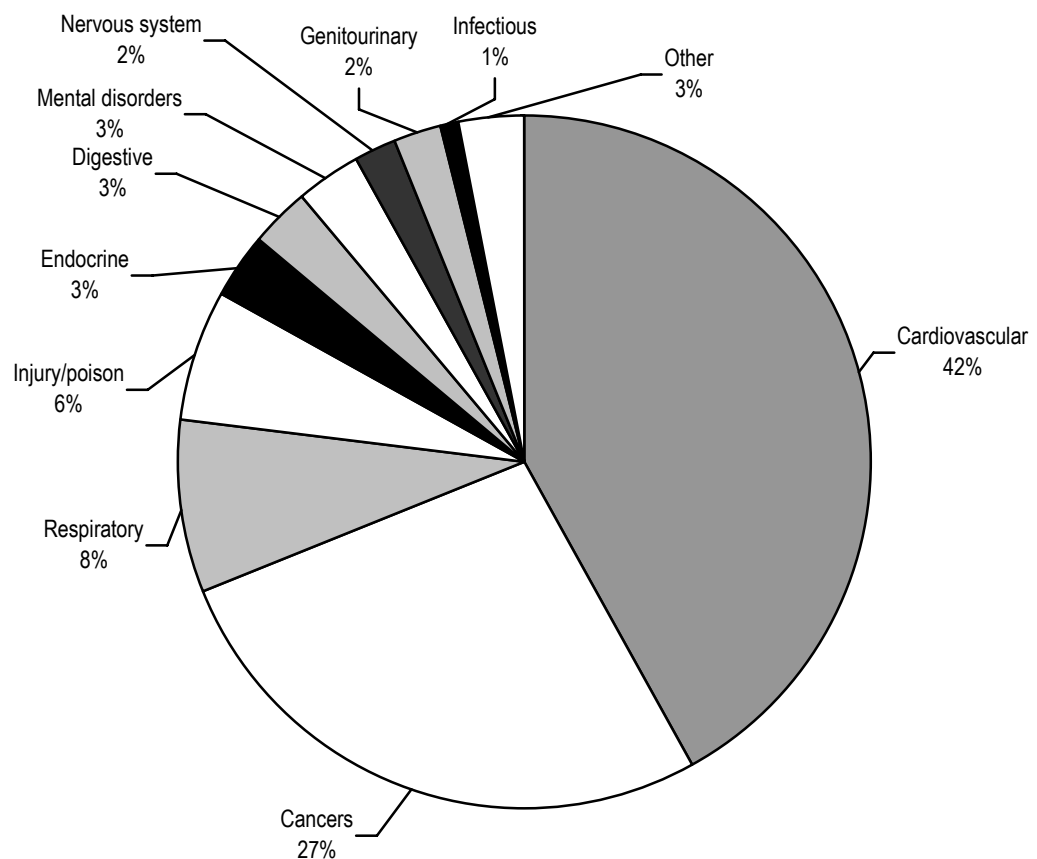
- Interactive nature of the intervention, including a focussed objective;
- Simple design – easily integrated into existing procedures and requiring relatively little input;
- Relevance to the target population; and
- Use of additional tools.

# Cardiovascular Disease and Stroke

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Cardiovascular disease encompasses all diseases of the circulatory system, including coronary and ischaemic heart disease, heart failure, angina, peripheral vascular disease, and stroke. Together, this syndrome of diseases is the leading cause of morbidity and premature death in Australia. In 2001, cardiovascular disease accounted for 49,381 deaths (or 38% of all deaths) and the health and economic burden exceeded that of any other disease in Australia (AIHW 2003a). Figure 3 illustrates the causes of death in Australia in 1996.

Figure 3. Causes of death in Australia, 1996 (AIHW 2001)



The prevalence of cardiovascular disease increases with age, from 4% in 18 to 24-year olds to 61% in those aged 75 years and over (NHPAC 1998). Although there has been a downward trend in mortality rates associated with cardiovascular disease, the burden of disease is rising due, primarily, to the aging population. Coronary heart disease is responsible for more than 50% of deaths due to cardiovascular diseases, whereas stroke is the leading cause of long-term disability in adults (AIHW 2003a). Stroke disability and morbidity places great demands on the health system as well as on family members and caregivers.

The key physiological process underlying cardiovascular disease is atherosclerosis, or narrowing of the blood vessels. This interferes with the blood supply to the heart, leading

to heart attack or angina, or to the brain, resulting in stroke. A number of major risk factors have been associated with atherosclerosis and, therefore, are common to diseases of the cardiovascular system. Physiological risk factors include hypertension, elevated serum lipids, obesity, and diabetes, whereas the behavioural risk factors include tobacco smoking, physical inactivity, poor nutrition, and high consumption of alcohol. Moreover, these risk factors are often linked – e.g. poor nutrition influences cholesterol level, body weight and blood pressure. Although risk factors such as age and family history are immutable, much of the burden caused by cardiovascular disease is preventable. This may be achieved by increasing exercise, reducing alcohol intake and cholesterol levels, ceasing to smoke, and controlling blood pressure, blood sugar, and body weight.

Various health service improvement tools have been used to reduce the risk factors associated with cardiovascular disease, both for primary prevention to reduce the incidence of cardiovascular disease in the whole population, and for secondary prevention to reduce further events in those already diagnosed with the disease. Tools aimed at patients and providers to raise awareness of the risk factors and promote healthy lifestyles are primarily educational tools, prompts and reminders, decision aids, and multi-faceted interventions. Decision aids are also used for determining the type of care needed for cardiovascular patients, and determining the proper balance of medication. This is especially important for anti-coagulant therapy, which may cause adverse side effects, such as haemorrhage. Alternative care approaches and interdisciplinary teams are used predominantly for rehabilitation (e.g. after stroke or heart failure), and secondary prevention after a cardiovascular event. Most of the identified tools and those evaluated for effectiveness fell into the multi-faceted category, using a combined approach to improve health services for cardiovascular patients across the continuum of care.

## **Continuous Quality Improvement**

Continuous quality improvement (CQI), rapid cycle improvement, critical care pathways, and health care quality improvement programs encompass an array of tools that use a dynamic, iterative format to improve the quality of health services. Similarly, Total Quality Management (TQM) refers to the overall management of all aspects of an organisation's quality of service (Isouard 1999). CQI tools were identified in nine studies and focussed on improvements in the diagnosis, treatment, and management of cardiovascular disease (Table 60).

Table 60. Continuous quality improvement (CQI) tools for cardiovascular disease and stroke

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Cooperative cardiovascular project: to improve care for acute myocardial infarction	Treatment	(CCPBP Working Group, 1998)*	N/E	N/E
CQI: to improve flow of patients with acute myocardial infarction attending the emergency department	Treatment	(Giltz et al. 1998; Markel & Marion 1996; Saturno et al. 2000; Snow et al. 2003)*	N/E	N/E
Critical pathway: preparation and development of a clinical plan, a process to implement the plan, monitoring and evaluation of clinical outcomes, and change plan as necessary	Treatment	(Turley et al. 1994)*	N/E	N/E
Health care quality improvement program: to improve delivery of imaging services	Diagnosis and management	(Grant et al. 1997)*	N/E	N/E
Rapid cycle improvement – breakthrough series: to reduce length of stay and improve care of adult cardiac surgery patients	Treatment	(Doran et al. 1998)*	N/E	N/E
Total quality management	Treatment	(Isouard 1999)	1. Provider participation • Change in laboratory test requests	n/a
Management to improve survival in congestive heart failure	Management	(Philbin et al. 1996)*	N/E	N/E

N/E=not evaluated; CQI=continuous quality improvement; n/a=not available. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### Effectiveness of CQI tools in cardiovascular disease and stroke

One good quality before-and-after controlled study, conducted at two teaching hospitals in Sydney, met the inclusion criteria. (Isouard 1999) examined the effect of using a total quality management (TQM) approach to improve the appropriateness of laboratory testing of patients with acute myocardial infarction. This study was undertaken over two 15-month periods – Phase I entailed collecting baseline data and the TQM intervention took place during Phase II. Investigators used the FOCUS-PCDA model of TQM involving the stages outlined in Box 5. The key process outcome was provider participation (behavioural change) in the ordering of appropriate laboratory tests. Tests were appropriate if they matched those listed in the guidelines devised by the team, or if they were justified according to a patient's medical record. In contrast, inappropriate tests were those not delineated in the recommendations, and not verified as appropriate after checking the patient's records.

Box 5. FOCUS-PDCA model of Total Quality Management (Isouard 1999)

• Find a process to improve	
• Organise a total quality management team	Select members Multi-disciplinary team building
• Clarify laboratory test-requesting process	Flow charts of test-requesting process Identify problems Customer requirements
• Uncover causes of poor quality test use	Causes of variation Collect data
• Select process improvement	Determine proposed improvements Prioritise
• Plan process improvement	Develop improvement strategies Education and training development
• Do the improvement	Pilot test Implement strategies Collect and analyse data
• Check results	Check lessons learned Determine how effort could be improved
• Act to hold the gain	Standardise procedures Establish monitoring and feedback processes Plan continuous improvement

After Phase II, physicians at the intervention hospital ordered more appropriate tests and fewer inappropriate tests, while the test ordering performance of physicians in the control hospital was relatively unchanged (Table 61). Although baseline differences between groups were not adjusted for in the analysis, the relative change from baseline for the intervention group is comparatively large (particularly for the reduction in inappropriate testing) and differences are unlikely to be altered significantly by regression to the mean. The main limitation of this study is in its design and lack of blinding in the assessment, which allows for potential observer bias.

Table 61. Effectiveness of Continuous Quality Improvement (CQI) – Process outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of participation (behavioural change)							
(Isouard 1999)	Level III-2: controlled before-and-after study Quality: good	Health professionals in two hospitals	TQM	<i>Ordering of laboratory tests</i>							
					Control		Intervention		Effect measure <sup>a</sup>		
				Laboratory tests	Before N=203	After N=211	% change	Before N=252	After N=253	% change	Relative change
				Appropriate tests, ratio of tests requested/tests indicated (%)	82.2	80.4	-1.8	77.5	88.2	+10.7	5.9
Inappropriate tests, number of tests per admission (%)	24.1	23.0	-1.1	38.4	7.0	-31.4	28.5				

CQI=continuous quality improvement; TQM=total quality management. <sup>a</sup> baseline data were not adjusted for in the analysis, therefore p values are not given.

## Educational Tools

Although the information about optimal health care in cardiovascular disease has been widely promulgated, it is now accepted that their mere existence and availability are insufficient to engender change.

Educational tools for cardiovascular disease in the available evidence-base were oriented mainly to changing the performance of health care providers. Table 62 lists the identified educational tools.

Table 62. Educational tools for cardiovascular disease and stroke

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
CME: conference and workbook (patient education manual, medical record tools, problem lists) for Health Education and Research Trial CME plus practice-profiling (feedback): discussions and reinforcement of quality improvement plans CME plus prevention coordinator: trained coordinators provided ongoing support for prevention activities	Prevention and management	(McBride et al. 2000)*	N/E	N/E
CME: audit of heart failure patients to improve prescribing	Treatment	(Cutts 2001)*	N/E	N/E
Use of simulated cardiopulmonary arrest to improve staff response	Treatment	(Adams et al. 2002)*	N/E	N/E
Rapid early action for coronary treatment - includes community, provider, and patient education about myocardial infarction	Prevention	(Raczynski et al. 1999)*	N/E	N/E
Educational materials – physician: dissemination of CPGs for hypertension	Management	(Chalmers 1999)*	N/E	N/E
Educational outreach	Prevention	(Lobo et al. 2002a) (Lobo et al. 2002b)*	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with preventive care tasks</li> <li>• Change in follow-up of patients</li> <li>• Change in record-keeping</li> </ul>	n/a
	Prevention	(Ornstein 2001)*	N/E	N/E

CME=continuing medical education; N/E=not evaluated; CPG=clinical practice guideline; n/a=not available. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of educational tools

A good quality randomised controlled trial investigated the effectiveness of an educational outreach program for the delivery of cardiovascular preventive care in general practice (Lobo et al. 2002a). General practices in The Netherlands were stratified by practice type (single-handed or partnership) and those randomised to the educational outreach intervention received 15 practice visits by an experienced practice assistant (facilitator). Outreach visits were structured to limit variation and facilitators allowed practice members to identify and prioritise problem areas within their practice and plan changes. Key messages from the cardiovascular and diabetes clinical practice guidelines were repeated in subsequent visits and feedback was provided on individual performance compared to ideal practice. The process outcome was physician participation (behavioural change) regarding adherence to preventive care tasks (e.g. measuring patient's blood pressure, documenting cardiovascular history, or giving advice on smoking cessation and diet), evidence of teamwork, and improved record-keeping (e.g. recording risk factors) and follow-up of patients. Data were collected by a questionnaire at baseline and 21 months after the intervention. A deficiency score<sup>\*\*\*\*</sup> was calculated to account for the "ceiling effect" in practices with higher baseline scores. Regression analysis was performed to adjust for differences in baseline deficiency scores.

Overall, practices exposed to the intervention demonstrated statistically significant improvements in all elements of preventive care compared to those in the control group ( $p < 0.001$ ) (Table 63). Multiple linear regression revealed that 37% of the variance in the change in record-keeping could be explained by practice size – i.e. practices with fewer practitioners and smaller list sizes made larger improvements in record-keeping. However, reporting bias may have affected results to some degree due to the reliance on self-report questionnaire. Also, since practices were recruited to the study via bulletins and letters, it is possible that the practices participating in the study were more motivated to change than non-participating practices. During the course of the study, there was nationwide publicity for preventive care and awareness of risk factors in cardiovascular disease. Although this publicity does not appear to have affected results, the marginal improvement in the control group underscores the limitations of promoting changes by the simple dissemination of information.

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\*\*\*\* Deficiency score = log (maximum possible score – actual score)

Table 63. Effectiveness of Educational tools – Process outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of participation (behavioural change)							
				Control N=62			Intervention N=62			Effect measure <sup>a</sup>	
(Lobo et al. 2002a)	Level II: RCT Quality: good	124 general practices	Educational outreach	<i>Adherence to preventive care guidelines, % of practices</i>					Relative change P value		
				Preventive tasks recorded	Before	After	% change	Before		After	% change
				BP	89	87	-2	77	94	+17	8.5 $p<0.01$
				Glucose	95	92	-3	87	95	+8	2.7 $p<0.05$
				Cholesterol	42	45	+3	34	42	+8	2.7 NS
				Height	26	27	+1	15	60	+45	45.0 $p<0.01$
				Weight	57	63	+6	40	77	+37	6.2 $p<0.01$
				BMI	19	23	+4	7	69	+62	15.5 $p<0.01$
				Cardiovascular history	31	24	-7	16	61	+45	6.4 $p<0.01$
				Cardiovascular family history	27	24	-3	15	61	+46	15.3 $p<0.01$
				Smoking habits	32	39	+7	27	77	+50	7.1 $p<0.01$
				Alcohol intake	8	24	+16	15	65	+50	3.1 $p<0.01$
				Diet advice	63	66	+3	52	76	+24	8.0 $p<0.05$
				Smoking cessation	29	39	+10	29	60	+31	3.1 $p<0.05$
				Losing weight	40	45	+5	32	61	+29	5.8 $p<0.05$
				Exercise	27	37	+10	24	58	+34	3.4 $p<0.05$
				Alcohol moderation	11	16	+5	11	37	+26	5.2 $p<0.05$
				<i>Deficiency scores for preventive tasks <sup>b</sup></i>	2.1	1.9	-9.5	2.2	1.2	-45.5	4.8 $p<0.001$
				<i>Record-keeping practices, % of practices</i>							
				Computerised patient records	79	81	+2	84	94	+10	5.0 NS
Systematic entries for risk factors	3	7	+4	8	27	+19	4.8 $p<0.05$				

Table 63 (cont.) Effectiveness of Educational tools – Process outcomes

			Separate record of risk factors	10	13	+3	10	57	+47	15.7 $p<0.01$
			Separate diagnosis from notes	68	77	+9	50	73	+23	2.6 NS
			Risk profile for cardiovascular patients	10	8	-2	3	40	+37	18.5 $p<0.01$
			Register preventive activities separately	39	34	-5	35	53	+18	3.6 NS
			<i>Deficiency scores for record-keeping<sup>b</sup></i>	1.3	1.3	0	1.4	0.8	-42.9	n/e $p<0.001$
<i>Teamwork activities, % of practices</i>										
			Written protocols for:							
			Diabetes mellitus	27	39	+12	27	71	+44	3.7 $p<0.01$
			Hypertension	26	34	+8	16	68	+52	6.5 $p<0.01$
			Detecting patients at risk	5	18	+13	3	31	+28	2.2 NS
			Regular scheduled meetings	52	61	+9	42	66	+23	2.6 NS
			<i>Deficiency scores for teamwork<sup>b</sup></i>	1.0	0.9	-10.0	0.9	2.3	+155.6	15.6 $p<0.001$
<i>Follow-up procedures, % of practices</i>										
			Make appointment after visit	87	81	-6	82	95	+13	2.2 $p<0.05$
			Make identifiable note	28	31	+3	20	68	+48	16.0 $p<0.01$
			Contact patients who miss appointment	63	68	+5	65	75	+10	2.0 NS

Table 63 (cont.) Effectiveness of Educational tools – Process outcomes

				Provide appointment cards for patients:								
				Diabetes mellitus	33	49	+16	39	75	+36	2.3	$p<0.01$
				Hypertension	28	44	+16	37	80	+43	2.7	$p<0.01$
				Cholesterol	11	24	+13	22	42	+20	1.5	NS
				Angina pectoris	17	18	+1	22	37	+15	15.0	$p<0.05$
				Peripheral arterial disease	17	16	-1	22	37	+15	15.0	$p<0.01$
				Heart failure	17	18	+1	22	34	+12	12.0	NS
				Deficiency scores for follow-up <sup>b</sup>	1.7	1.7	0	1.7	1.2	-29.4	n/e	$p<0.001$

BP=blood pressure; BMI=body mass index; NS=not significant; n/e=not estimable. <sup>a</sup> regression analysis was used to adjust for baseline differences; <sup>b</sup> deficiency score = log (maximum possible score – actual score). Decrease in deficiency score indicates improvement.

## Decision Support

Early computerised clinical decision support (CDS) systems were analogous to a “Greek oracle” whereby the physician entered patient-specific data into the system and passively waited for the “oracle” to provide a solution (van der Lei et al. 1991). In contrast, more recent computerised CDS systems use a “critiquing” model that requires the physician to also enter their proposed actions. The system then evaluates the decision and either concurs or offers an alternative, if appropriate. Primarily designed to assist physicians in providing optimal care for individual patients, computer-based CDS systems use algorithms as a means of operationalising clinical practice guidelines for provision of preventive care, monitoring control of symptoms, assessing risk, and selecting medication. Cardiovascular patients may also access decision aids, particularly regarding the use of anti-thrombotic therapy for stroke prevention.

CDS systems have been employed across all levels of care in cardiovascular disease and stroke. 26 studies have been identified and are described in Table 64.

**Table 64. Decision support tools for cardiovascular disease and stroke**

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Computer-based clinical decision support: bedside unit using algorithm for thrombolytic therapy	Treatment	(Kellett 1997)*	N/E	N/E
Computer protocol to predict presence of myocardial infarction	Diagnosis	(Goldman et al. 1988)*	N/E	N/E
To assess preoperative risk	Treatment	(Fox et al. 2003)*	N/E	N/E
For hypertension and lipid management	Management	(Hetlevik et al. 1999; Hobbs et al. 1996; Montgomery & Fahey 1998)*	N/E	N/E
Pharmacists assess patients' control of blood pressure and provide pharmaceutical care	Management	(Chabot et al. 2003)*	N/E	N/E
Critiquing model of decision support in patients with hypertension	Management	(van der Lei et al. 1991)*	N/E	N/E
System for hypertension management	Management	(Goldstein et al. 2001; Goldstein et al. 2000)*	N/E	N/E
An expert decision support system for supraventricular tachycardia in the elderly	Management	(Wang et al. 1998)*	N/E	N/E
Decision aid for therapy of angina	Management	(Hopkins & Maysuria 2000)*	N/E	N/E
Electronic record system with decision support for home care of stroke patients	Management	(Van Der Linden et al. 2003)*	N/E	N/E
Algorithm for oral anti-coagulant dosing	Treatment	(Manotti et al. 2001)*	N/E	N/E
Decision aid – physicians: for anti-thrombotic therapy after stroke	Treatment and management	(Weir et al. 2003)	1. Provider participation <ul style="list-style-type: none"> <li>change in prescribing behaviour</li> </ul>	n/a
Evidence-based clinical aid	Prevention	(Fulcher et al. 2003)*	N/E	N/E
Use of patient-specific, computerised coronary risk profiles	Prevention	(Lowensteyn et al. 1998)*	N/E	N/E
Use of triage “step-down” criteria to transfer low-risk patients with chest pain to intermediate care or unmonitored beds	Treatment	(Weingarten et al. 1990)	1. Change in productivity <ul style="list-style-type: none"> <li>Length of stay in intensive care unit</li> </ul>	1. Patient complications
Use of triage decision rule system for chest pain or suspected acute cardiac ischaemia	Treatment	(Colombet et al. 1999; Reilly et al. 2002)*	N/E	N/E
Predictive model for choosing the type of care needed for patients recovering from stroke	Rehabilitation	(Tilling et al. 2001; Unsworth 2001)*	N/E	N/E

Table 64 (cont.) Decision support tools for cardiovascular disease and stroke

Decision aid – patients: use of anti-thrombotic therapy for stroke prevention	Prevention	(Man-Son-Hing et al. 1999)*	N/E	N/E
Use of interactive videodisc for patients with ischaemic heart disease	Treatment	(Morgan et al. 2000)*	N/E	N/E
Decision analysis in routine treatment tool - use of warfarin for stroke prevention	Prevention	(Thomson et al. 2002)*	N/E	N/E
Nomogram: weight-based nomogram for use of intravenous heparin	Treatment	(Toth & Voll 2002)*	N/E	N/E

N/E=not evaluated; n/a=not available. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met all the criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### Effectiveness of decision support tools for cardiovascular disease and stroke

Despite the large number of studies that have used decision support tools to improve health service, only two of the available studies met the inclusion criteria.

A good quality cluster randomised controlled before-and after study used a computer-based clinical decision support (CDS) system to estimate the risk of recurrent ischaemic vascular events for patients diagnosed with acute ischaemic stroke or transient ischaemic attack within the previous four months (Weir et al. 2003). The computer-based CDS system incorporated a knowledge base of efficacy data from randomised controlled trials and meta-analyses, risk factor prevalence rates from acute stroke unit databases, and haemorrhagic event rates during anti-platelet and anticoagulant therapy from published studies. Using information from patient's medical history and clinical status, the CDS system drew on the knowledge base to estimate the annual risk of ischaemic vascular events associated with six potential therapeutic strategies: 1. long-term anticoagulation with warfarin; 2. anti-platelet therapy with aspirin; 3. anti-platelet therapy with dipyridamole; 4. aspirin and dipyridamole in combination; 5. warfarin and aspirin in combination; and 6. no anti-platelet or anticoagulant therapy. During a baseline six-month period (Phase I), data on routine prescribing practice were collected via an automated telephone data entry system in both control and intervention centres and the CDS system estimated event rates for each potential therapy. During the subsequent six-month period (Phase II), patient-specific information, generated by the CDS, was added to the intervention hospital patients' records, thereby providing medical staff with decision support on the most suitable therapy for individual patients. The key process outcome was provider participation (behavioural change). This was manifest as the change in relative risk reduction from Phase I to Phase II between control and intervention hospitals. Investigators also calculated the proportion of patients receiving optimal treatment<sup>††††</sup> in control and intervention groups. Results indicate that assistance from the CDS system did not significantly change prescribing behaviour as shown by the similar estimated relative risk reduction between groups (Table 65). There were two

†††† Optimal treatment = the treatment giving the lowest estimated event rate according to the CDS

potential confounding factors in this study. A new anti-thrombotic drug, clopidogrel, was registered for use after the study commenced and, therefore, was not included in the CDS system. Its introduction appeared to have little effect on the results in this study. More importantly, cost-effectiveness of the various therapies was not reported and it is possible that physicians' prescribing decisions, particularly where the differences in estimated event rates were small, were influenced by costs.

An average quality controlled study using an alternate month time series design evaluated the use of triage criteria for low-risk chest pain patients to enhance efficiency of bed use in the coronary care unit (Weingarten et al. 1990). During the three intervention months, the study nurse contacted the eligible patient's physician, advising them that their patient was at low-risk of complications according to certain triage criteria, and giving them the option to transfer the patient to an unmonitored bed or remain in the coronary care unit. During control months, the study nurse administered usual care to patients without informing physicians of the triage recommendations. The primary process outcome was productivity (change in efficiency) – particularly with respect to patient flow. Use of the triage criteria resulted in a significant decrease in the length of stay in the intermediate and coronary care units ( $p < 0.001$ , Table 65). There was no educational effect over time as the effect of the intervention was extinguished during control months, with the length of stay in the intermediate and coronary care units reverting to the baseline levels. This underscores the need for constant intervention to sustain improvements. The main impact outcome was patient complications (data not provided) and authors state that no decision to transfer patients to unmonitored beds was associated with increased patient complications.

Table 65. Effectiveness of decision support tools – Process outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of provider participation (behavioural change)							
							Effect measure <sup>a</sup>				
(Weir et al. 2003)	Level II: RCT Quality: good	16 hospitals	Decision aid – physicians: use of anti-thrombotic therapy after stroke	<i>Relative risk reduction, median [IQR]</i>							
				Control N=8			Intervention N=8				
					Before	After	% change	Before	After	% change	Relative change
				Estimated relative risk reduction	16.7 [13.2, 23.7]	16.3 [13.1, 23.8]	-2.4	16.3 [15.2, 21.2]	16.7 [13.5, 22.9]	+2.5	1.0
				<i>Therapy prescribed, % of patients</i>							
				None	3.0	3.0	0	2.0	3.0	+1.0	n/e
				Aspirin	58.0	54.0	-4.0	65.0	53.0	-12.0	3.0
				Dipyridamole	2.0	1.0	-1.0	3.0	2.0	-1.0	1.0
				Clopidogrel	1.0	4.0	+3.0	3.0	8.0	+5.0	1.7
				Aspirin and dipyridamole	24.0	24.0	0	17.0	21.0	+4.0	n/e
				Warfarin	9.0	12.0	+3.0	9.0	14.0	+5.0	1.7
Warfarin and aspirin	2.0	1.0	-1.0	1.0	1.0	0	0				
Optimal therapy prescribed	33.0	34.0	+1.0	23.0	30.0	+7.0	7.0				
(Weingarten et al. 1990)	Level III-3: interrupted time series Quality: average	404 low-risk chest pain patients	Decision aid: triage criteria for transferring patients to unmonitored beds	<i>Length of stay, mean days</i>							
				Control months		Intervention months		Effect measure <sup>b</sup>			
								% reduction	P value		
				Intermediate care unit	2.8		1.8		-35.7	p<0.001	
Coronary care unit	0.9		0.4		-55.6	p<0.001					
Total days	5.1		4.3		-15.7	p=0.17					

IQR=inter-quartile range; n/e=not estimable. <sup>a</sup> multi-level modelling was used to adjust for baseline differences and intra-class correlation within hospitals; <sup>b</sup> student's t-test.

## Prompts and reminders

In the area of cardiovascular disease and stroke, prompts and reminders are used mainly for the provision of preventive care, particularly in high-risk patients, or for patients already diagnosed with cardiovascular disease. Table 66 lists the studies identified as using prompts and reminders for cardiovascular disease and stroke.

Table 66. Prompts and reminder tools for cardiovascular disease and stroke

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Automatic prescriptions: automatic prescribing of lipid-lowering medications in patients with coronary or cerebrovascular disease	Prevention	(Siskind et al. 2000)*	N/E	N/E
Prompts: personalised message concerning risk information placed in progress notes	Prevention	(Weingarten et al. 1994a; Weingarten et al. 1994b)*	N/E	N/E
Leaflet to patient and letter to physician concerning preventive care	Prevention	(Feder et al. 1999)	1. Physician participation <ul style="list-style-type: none"> <li>• Compliance with guidelines (prescribing, recording risk factors, advice on lifestyle)</li> </ul>	1. Patient ability to manage disease <ul style="list-style-type: none"> <li>• Change in diet, exercise, and medication compliance</li> <li>• Smoking cessation</li> </ul>
Fixed-message reminders (checklists, chart tags, computer-generated reminders)	Management	(Frances et al. 2001)*	N/E	N/E

N/E=not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### Effectiveness of prompts and reminder tools for cardiovascular disease and stroke

One good quality randomised controlled trial met the inclusion criteria for the appraisal of effectiveness. The study examined the effectiveness of using prompts to both patients and health providers to improve preventive care following a coronary event (Feder et al. 1999). General practices were stratified by practice factors (list size, number of partners, presence/absence of a practice nurse, training status, and exposure to educational sessions on clinical practice guidelines for coronary heart disease) and then randomised to the intervention or control group. Consecutive patients who were registered with the practices and had been admitted to hospital with myocardial infarction or angina were recruited to the study. Eligible patients in practices randomised to the intervention group received leaflets containing recommendations for reducing their risk of another coronary event (e.g. lifestyle changes and medication compliance), and an invitation to attend the practice for further discussions with their general practitioner (GP). After patients were discharged from hospital, GPs in the intervention practices received a letter containing a summary of secondary prevention and a review card of the clinical practice guidelines (CPGs) for coronary heart disease for each patient's medical record. Control patients and

practices received no communications. The process outcome was physician participation (behavioural change) regarding changes in prescribing practice, provision of advice on diet, exercise, and smoking, and recording of risk factors (cholesterol, weight, blood pressure) (Table 67). Impact outcomes, which were collected by patient self-report questionnaire, were patients' ability to manage their disease – particularly improvements in diet, exercise, and smoking cessation (Table 68). Logistic regression analysis was used to adjust for baseline differences. Prompts to practitioners and leaflets to patients induced statistically significant increases in recording of some risk factors (cholesterol, weight, smoking status) and provision of advice on smoking cessation, exercise and weight loss. However, considering the intervention was implemented within three months of hospitalisation in a target population of patients at high risk for subsequent coronary events, prompts did not effect changes in prescribing practice or induce patients to make lifestyle changes. The potential for bias cannot be excluded as the authors state that a practice's allocation was evident in some patients' medical records during data extraction. A trend towards increased statin prescribing during the period of the study may have been a confounding factor, although it is likely to have affected both the intervention and control practices.

Table 67. Effectiveness of prompts and reminders – Process outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of participation (behavioural change)					
(Feder et al. 1999)	Level II: RCT Quality: good	59 general practices 328 patients with previous myocardial infarction or angina	Prompts	<i>Prescribed medications, % of patients</i>					
					Control N=156	Intervention N=172	Adjusted OR [95% CI] <sup>a</sup>	Effect measure <sup>b</sup>	
				Cholesterol-lowering drugs	19	28	1.7 [0.8, 3.4]	1.9	NS
				β-blockers	27	38	1.7 [0.9, 3.0]	0.9	NS
				Aspirin	91	90	0.9 [0.4, 1.9]	0.0	NS
				<i>Recorded risk factor measurement and advice, % of patients</i>					
				Cholesterol	39	67	4.0 [1.9, 8.2]	12.2	p<0.001
				Weight	21	44	3.0 [1.5, 5.8]	10.5	p<0.01
				Weight loss or diet advice	14	27	2.4 [1.2, 4.7]	6.2	p<0.05
				Exercise advice	7	30	5.7 [2.0, 16.3]	11.7	p<0.001
				Blood pressure	84	90	1.7 [0.9, 3.3]	2.6	NS
				Smoking habit	55	68	1.9 [1.0, 3.8]	3.9	p<0.05
				Smoking advice	44	69	2.8 [1.1, 6.8]	6.4	p<0.05
				<i>Consultation for coronary heart disease</i>					
Additional consultation with doctor or nurse	53	70	2.1 [1.1, 3.9]	5.3	p<0.05				

OR=odds ratio; NS=not significant (p>0.05). <sup>a</sup> there was statistical adjustment for the effect of clustering within practices and logistic regression analyses were used to adjust for differences in baseline values; <sup>b</sup> adjusted Chi-square statistic.

Table 68. Effectiveness of prompts and reminders – Impact outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of patient ability to manage disease				
					Control N=156	Intervention N=172	Adjusted OR [95% CI] <sup>a</sup>	Effect measure <sup>b</sup>
(Feder et al. 1999)	Level II: RCT  Quality: good	59 general practices  328 patients with previous myocardial infarction or angina	Prompts	<i>Patient self-report, % of patients</i>				
				Changed diet, medication, or exercise	83	83	1.0 [0.5, 2.1]	0.0 NS
				Able to reduce risk factors	58	60	1.1 [0.6, 1.9]	0.1 NS
			Gave up smoking since discharge	41	40	0.8 [0.3, 2.4]	0.1 NS	

OR=odds ratio; NS=not significant ( $p>0.05$ ). <sup>a</sup> there was statistical adjustment for the effect of clustering within practices and logistic regression analyses were used to adjust for differences in baseline values; <sup>b</sup> adjusted Chi-square statistic.

## Feedback

Feedback interventions in cardiovascular disease were used largely to provide health professionals with a ‘yardstick’ of their performance in relation to the evidence-base for a specific problem or to the performance of their peers. Eight studies were identified in the available literature (Table 69), none of which met the selection criteria for an evaluation of effectiveness.

Table 69. Feedback tools for cardiovascular disease and stroke

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
<b>Audit and feedback: summary feedback on promoting secondary prevention of coronary heart disease</b> <b>Audit and feedback plus recall to GP: set up disease register and systematic recall of patients to GP</b> <b>Audit and feedback plus nurse recall: set up disease register and systematic recall of patients to a nurse-led clinic</b>	Prevention	(Moher et al. 2001)*	N/E	N/E
<b>Audit and feedback</b>	Treatment	(Scott et al. 2001)*	N/E	N/E
<b>Feedback – written: CPGs, hospital-specific peer-comparison</b> <b>Enhanced feedback: written feedback plus training of local opinion leader on CPG recommendations for anti-thrombotic therapy</b>	Management	(Hayes et al. 2001; Hayes et al. 2002)*	NE	N/E
<b>Peer review feedback on quality indicators for acute myocardial infarction</b>	Treatment	(Ellerbeck et al. 2000; Marciniak et al. 1998; Scott et al. 2000)*	N/E	N/E
<b>Report card: publication of outcomes to motivate physicians’ performance in cardiac surgery</b>	Treatment	(Shahian et al. 2001)*	N/E	N/E

N/E=not evaluated; GP=general practitioner; CPG=clinical practice guidelines. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Financial Incentives

Only one study used financial incentives to improve the treatment of coronary artery disease (Table 70). This study did not meet the criteria for an assessment of the effectiveness of the intervention.

Table 70. Financial incentives for cardiovascular disease and stroke

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Fee-for-benefit: reimbursement directly proportional to the expected therapeutic benefit	Treatment	(Diamond et al. 1993)*	N/E	N/E

N/E=not evaluated. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Record Systems

Four studies used a variety of record systems, both electronic and paper-based, for the management of stroke and cardiovascular disease. Listed in Table 71, none of the identified studies were suitable for an assessment of record systems' effectiveness.

Table 71. Record systems for cardiovascular disease and stroke

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Clerking pro forma: for recording stroke patient details	Management	(Davenport et al. 1995)*	N/E	N/E
Combined prescription and monitoring charts	Management	(Phillips et al. 1997)*	N/E	N/E
Electronic compliance monitoring: to measure patient compliance with medication for hypertension	Management	(Burnier et al. 2001)*	N/E	N/E
Patient-held records	Management	(Ayana et al. 2001)*	N/E	N/E

N/E=not evaluated. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Telemedicine

Two studies used a telemedicine tool to improve the diagnosis of cardiovascular events and the management of stroke (Table 72). Neither of these studies met the pre-determined inclusion criteria for an assessment of effectiveness.

Table 72. Telemedicine for cardiovascular disease and stroke

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Telephone-linked computer system: interactive communication for monitoring control of hypertension	Management	(Friedman et al. 1996)*	N/E	N/E
Telecardiology: hand-held trans-telephonic electrocardiography	Diagnosis	(Molinari et al. 2002)*	N/E	N/E

N/E=not evaluated. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Alternative Care Approach

The alternative care approach was a commonly used tool to improve the care of cardiovascular patients, particularly for secondary prevention (reduction of risk factors), management of symptoms, and recovery of function after a cardiovascular event. Alternative care providers were predominantly trained nurses or specialists (e.g. dietitian) and alternative care settings focussed on specific disorders, such as angina, stroke, or heart failure clinics. A list of the emergent alternative care approaches is provided in Table 73.

### Effectiveness of the alternative care approach for cardiovascular disease and stroke

One good quality randomised controlled trial met the inclusion criteria. (Campbell et al. 1998) examined the effectiveness of providing preventive care via a nurse-run clinic to patients with coronary heart disease attending general practices. These patients were stratified by age, gender, and general practice, and randomised to the intervention or control groups. Patients assigned to the intervention group received the following attentions at the nurse-run clinics: 1. review of symptoms to identify poor control; 2. review of drug treatment to encourage aspirin use and identify possible side effects; 3. assessment of blood pressure and lipids according to clinical practice guidelines; and 4. assessment of behavioural risk factors and appropriate advice on lifestyle changes. Feedback, goal planning, and action plans were negotiated with patients, telephone support was provided, and appropriate referral to a physician occurred where necessary. Patients in the control group received usual care at the practice. The primary process outcome was provider participation (behavioural change) concerning compliance with guidelines for promoting aspirin use, and managing blood pressure and lipid levels. The key impact outcome was patients' ability to control disease by lifestyle modification – particularly diet, exercise, and smoking cessation. Blood pressure and lipid management data were collected through an audit of patients' medical records, whereas aspirin use, diet, smoking, and exercise data were collected by self-reported patient questionnaire. Appropriate secondary prevention was defined according to the criteria described in Box 6.

#### Box 6. Criteria for appropriate secondary prevention (Campbell et al. 1998)

- Aspirin taken (or contraindicated by allergy or peptic ulcer)
- Blood pressure managed according to the British Hypertension Society guidelines <sup>a</sup>
- Lipids managed according to the Grampian general practice lipid management guidelines <sup>b</sup>
- Moderate physical activity (index of physical activity >4) <sup>c</sup>
- Low fat diet (DINE score <30) <sup>d</sup>
- Not currently smoking <sup>c</sup>

<sup>a</sup> blood pressure was considered under control if the last measure was <160/90 mmHg or blood pressure had been treated, checked <3 months, or referred to a specialist clinic; <sup>b</sup> lipids were considered under control if the last cholesterol was ≤5.2 mmol/l or had been treated, checked <3 months, or referred to a specialist clinic; <sup>c</sup> smoking and exercise were measured by the health practices index – a validated measure; <sup>d</sup> DINE score is a validated instrument that measures dietary fat.

Table 73. Alternative care approach for cardiovascular disease and stroke

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Angina clinic: to optimise anti-anginal medication	Management	(Spertus et al. 2002)*	N/E	N/E
Anti-coagulation services: centralised, specialised, unit of trained nurses and pharmacists providing patient education, monitoring, and dosing decisions under supervision of physicians	Management	(Matchar et al. 2000)*	N/E	N/E
Dietitian services: medical nutrition therapy for cardiovascular patients delivered by dietitian	Prevention	(Rhodes et al. 1996)*	N/E	N/E
Facilitator: provides training, advice and support for practice staff in ascertaining risk factors for cardiovascular disease Practice prevention nurse: conducted health checks and recorded risk factors	Prevention	(Fullard et al. 1987)*	N/E	N/E
Heart failure clinic: patient educational material and education sessions, and personal diary	Management	(Doughty et al. 2002)*	N/E	N/E
Home-based care: exercise training for cardiac patients	Rehabilitation	(Arthur et al. 2002)*	N/E	N/E
Nurse-facilitated home program for patients recovering from myocardial infarction	Rehabilitation	(Jolly et al. 2003)*	N/E	N/E
Nurse-led clinic: to promote medical compliance and lifestyle changes	Prevention	(Campbell et al. 1998) (Allison et al. 2000)*	1. Provider participation • Compliance with CPGs (aspirin, blood pressure and lipid management)	1. Patient ability to control disease • Lifestyle changes (exercise, diet, smoking cessation)
Lipid centre - nurse-based, physician-supervised clinic for patients with coronary heart disease	Prevention	(Allen & Scott 2003; Allison et al. 1999; LaBresh et al. 2000)*	N/E	N/E
Public health nurse providing individual diet counselling (Food for Heart Program), referral to nutritionist, and follow-up reinforcement by telephone	Prevention	(Ammerman et al. 2003)*	N/E	N/E
Trained nurses providing a smoking cessation intervention to patients hospitalised for acute myocardial infarction	Prevention	(Taylor et al. 1990)*	N/E	N/E
Southampton heart integrated care project: led by specialist cardiac liaison nurses	Prevention	(Jolly et al. 1999)*	N/E	N/E

Table 73 (cont.) Alternative care approach for cardiovascular disease and stroke

<p>Stroke unit: specialised setting with interdisciplinary team providing standardised and routine care  <b>Stroke-team care:</b> interdisciplinary team care provided in general ward setting  <b>Domiciliary care:</b> interdisciplinary care provided to patients within their own home</p>	<p>Treatment and rehabilitation</p>	<p>(Kalra et al. 2000)*</p>	<p>N/E</p>	<p>N/E</p>
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N/E=not evaluated; CPGs=clinical practice guidelines. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

Data were analysed on an intention-to-treat basis and investigators’ statistically adjusted for baseline performance, age, gender, and practice. The salient findings from this study were the statistically significant improvements in all aspects of secondary preventive care, except smoking, for patients who attended the nurse-led clinics (Table 74 and Table 75). The main limitation of this study was the use of self-report questionnaires, which may overestimate compliant behaviours in patients. As shown by the increase from baseline in the control group, some contamination may also have occurred between control and intervention groups as both attended the same practice, although this was not substantial. The external validity of these results is good, as recruitment and follow-up of patients was relatively high (71% and 87%, respectively).

Table 74. Effectiveness of alternative care approaches – Process outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of provider participation (behavioural change)							
				Control			Intervention		Effect measure		
(Campbell et al. 1998)	Level II: RCT Quality: good	1173 patients diagnosed with coronary heart disease	Nurse-led clinic	<i>Appropriate secondary prevention, % patients</i>							
				Preventive care measure	Before	After	% change	Before	After	% change	Relative change OR [95% CI] <sup>a</sup>
				Aspirin management	63.2	66.4	+3.2	69.4	81.0	+11.7	3.7 3.2 [2.2, 4.8]
				Blood pressure management	87.8	87.9	+0.2	86.7	96.5	+9.8	49.0 5.3 [3.0, 9.4]
				Lipid management	13.8	21.6	+7.8	12.0	41.1	+29.2	3.7 3.2 [2.4, 4.3]

<sup>a</sup> logistic regression analysis was used to adjust for baseline performance, age, gender, and practice type.

Table 75. Effectiveness of alternative care approaches – Impact outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of patients' ability to control disease							
				Control			Intervention		Effect measure		
(Campbell et al. 1998)	Level II: RCT Quality: good	1173 patients diagnosed with coronary heart disease	Nurse-led clinic	<i>Appropriate secondary prevention, % of patients</i>							
				Preventive care measure	Before	After	% change	Before	After	% change	Relative change OR [95% CI] <sup>a</sup>
				Moderate physical activity	32.2	31.2	-1.1	37.6	42.1	+4.4	4.0 1.7 [1.2, 2.3]
				Low fat diet	48.6	48.6	0.0	49.0	56.5	+7.5	n/e 1.5 [1.1, 2.0]
				Non-smoking	82.7	84.7	+1.9	82.5	82.7	+0.2	0.1 0.8 [0.5, 1.3]

N/e=not estimable. <sup>a</sup> logistic regression analysis was used to adjust for baseline performance, age, gender, and practice type.

## Interdisciplinary Team Approach

By definition, an interdisciplinary approach to the care of cardiovascular patients involves the interaction of several disciplines working as a team and tailoring care to the specific needs of the individual patient. Thirteen studies using an interdisciplinary approach were identified from the literature search (Table 76). The clinical care pathway - which is also known as clinical pathway, critical pathway, critical path method, or care map - is the most commonly used interdisciplinary approach. It is a form of health service delivery that aims to encourage organised and efficient patient care based on the best available evidence regarding a particular condition (Kwan & Sandercock 2002). The pathway is incorporated into the patient's record, daily written care plans are used, important actions are highlighted, and each step of care is documented. Similarly, an outpatient management program uses an interdisciplinary team of nurses, cardiologists, and social workers or dietitians. This team works collaboratively, discussing each patient's status and developing a plan of care. Follow-up contact with patients is a common feature of the outpatient management program. None of the listed studies met the inclusion criteria for an assessment of effectiveness.

Table 76. Interdisciplinary approach to cardiovascular disease and stroke

Tools	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Clinical care pathway: interdisciplinary team, including nurses, physicians, nutritionists and occupational therapists, developing a clinical pathway for heart failure, stroke, and acute myocardial infarction	Treatment, management and rehabilitation	(Ahmed 2002; Akosah et al. 2003; Cardozo & Aherns 1999; Cheah 2000; Dancer 1996; Hainsworth et al. 1997; Hoskins et al. 2001; Kwan & Sandercock 2002; Philbin 1999; Sulch et al. 2000)*	N/E	N/E
Outpatient management program: interdisciplinary team of nurses and physicians following up patients with hypertension or those recovering heart failure using an automated telephone response system	Management and rehabilitation	(Hershberger et al. 2001; Kasper et al. 2002; Schultz & Sheps 1994)*	N/E	N/E

N/E=not evaluated. \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Multi-faceted Interventions

The largest volume of literature aimed at improving health service delivery in the area of cardiovascular disease and stroke (across all levels of care) utilised interventions that combined established tools. Most of these multi-faceted interventions, identified in the 34 studies in Table 77, contained elements of educational tools and used a highly interactive format.

Table 77. Multi-faceted tools for cardiovascular disease and stroke

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
<p>Alternative care approach: nurse-led clinic Computerised decision support: oral anti-coagulation therapy</p> <p>Alternative care approach: stroke unit Record system: Riks-Stroke national register for quality assessment Feedback: peer-comparison - each unit received performance feedback compared to the national performance</p>	<p>Management</p> <p>Treatment and rehabilitation</p>	<p>(Fitzmaurice et al. 2001)*</p> <p>(Stegmayr et al. 1999)*</p>	<p>N/E</p> <p>N/E</p>	<p>N/E</p> <p>N/E</p>
<p>CQI Education: opinion leader</p> <p>CQI Feedback Site visit</p>	<p>Treatment</p> <p>Treatment</p>	<p>(Berner et al. 2003)</p> <p>(O'Connor et al. 1996a)*</p>	<p>1. Provider participation</p> <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> </ul> <p>N/E</p>	<p>n/a</p> <p>N/E</p>
<p>Decision support Prompts and reminders</p> <p>Decision support Risk chart</p>	<p>Management</p> <p>Management</p>	<p>(Ellrodt et al. 1992; Lee et al. 1995)*</p> <p>(Montgomery et al. 2000)*</p>	<p>N/E</p> <p>N/E</p>	<p>N/E</p> <p>N/E</p>
<p>Disease management: inter-disciplinary team specialising in management of patients with heart failure at a specialty clinic or under specialty care in the home</p>	<p>Management and rehabilitation</p>	<p>(Costantini et al. 2001)</p> <p>(Akosah et al. 2002; DeBusk et al. 1994; Moser 2000; McAlister et al. 2001a; McAlister et al. 2001b; Ohldin 2001)*</p>	<p>1. Provider participation</p> <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> </ul>	<p>1. Hospital readmission and length of hospital stay</p> <p>2. Hospital mortality</p>
<p>Education: local opinion leader Feedback</p> <p>Education: outreach visits Feedback: compliance with CPGs</p> <p>Education: didactic lectures on cardiovascular disease CPGs: local adaptation of CPGs Feedback: audit and feedback of compliance with CPGs</p>	<p>Management</p> <p>Prevention and treatment</p> <p>Prevention</p>	<p>(Heller et al. 2001)</p> <p>(Maue et al. 2002)*</p> <p>(Frijling et al. 2003)</p> <p>(Ketola et al. 2000)</p>	<p>1. Physician participation</p> <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> </ul> <p>1. Physician participation</p> <ul style="list-style-type: none"> <li>• Compliance with CPGs</li> </ul> <p>1. Physician participation</p> <ul style="list-style-type: none"> <li>• Compliance with CPGs – documentation of actions</li> </ul>	<p>n/a</p> <p>n/a</p> <p>1. Patients' health status</p> <ul style="list-style-type: none"> <li>• Blood pressure</li> <li>• Weight</li> <li>• BMI</li> <li>• Cholesterol</li> <li>• Blood glucose</li> </ul>

Table 77 (cont.) Multi-faceted tools for cardiovascular disease and stroke

<p>Education: CME - three interactive case-based audio-conferences Prompts and reminders</p> <p>Education: academic detailing for control of hypertension Feedback: audit and feedback, behaviour reinforcement</p> <p>Education: practice-based CME including small-group discussions on management of hypertension and identification of barriers to change Feedback: audit and feedback</p>	<p>Prevention</p> <p>Management</p> <p>Management</p>	<p>(Casebeer et al. 1999)</p> <p>(Denton et al. 2001)*</p> <p>(Cranney et al. 1999)*</p>	<p>1. Provider participation</p> <ul style="list-style-type: none"> <li>• Compliance with CPGs for hypercholesterolemia</li> </ul> <p>N/E</p> <p>N/E</p>	<p>1. Patients' health status</p> <p>2. Patients' ability to manage disease</p> <ul style="list-style-type: none"> <li>• Cholesterol</li> <li>• Diet</li> </ul> <p>N/E</p> <p>N/E</p>
<p>Education – patients Interdisciplinary team approach Telemedicine: telephone follow-up and consultations</p> <p>Education – patients Interdisciplinary team approach Exercise program – patients</p> <p>Education – patients: exit interview Decision support: triaging by patient characteristics to assess needs</p>	<p>Management</p> <p>Rehabilitation</p> <p>Management</p>	<p>(Krumholz et al. 2002; Laramee et al. 2003; McDonald et al. 2002)*</p> <p>(Sledge et al. 2000)*</p> <p>(Hatcher et al. 1986)*</p>	<p>N/E</p> <p>N/E</p> <p>N/E</p>	<p>N/E</p> <p>N/E</p> <p>N/E</p>
<p>Education - provider: training and assistance in organisation of patient information; and/or training and assistance in accessing and interpreting evidence</p>	<p>Prevention</p>	<p>(Langham et al. 2002)</p>	<p>1. Physician participation</p> <ul style="list-style-type: none"> <li>• Change in recording risk factors</li> <li>• Change in prescribing performance</li> </ul>	<p>1. Patient ability to control disease</p>
<p>Integrated care pathway: interdisciplinary team developing short-term goals, and charting patient's progress. Prompts initiate investigation, treatment or referrals</p> <p>Interdisciplinary team approach: critical care pathway CME: medical grand rounds and lectures Educational – patients: information for patients and their families Feedback: hospital-specific feedback compared to benchmark practice</p>	<p>Treatment, management, and rehabilitation</p> <p>Treatment and management</p>	<p>(Barker et al. 1999; Sulch et al. 2002)*</p> <p>(Philbin et al. 2000)</p>	<p>N/E</p> <p>1. Provider participation</p> <ul style="list-style-type: none"> <li>• Compliance with CPGs for heart failure (prescribing behaviour, counselling)</li> </ul>	<p>N/E</p> <p>1. Length of hospital stay</p> <p>2. Patient quality of life</p> <p>3. Patient health status</p> <ul style="list-style-type: none"> <li>• Hospital mortality</li> </ul>

Table 77 (cont.) Multi-faceted tools for cardiovascular disease and stroke

Interdisciplinary team approach: developing practice guidelines for routine laboratory and radiographic testing Decision support: computerised test ordering template Education: educational sessions for staff to explain the guidelines and use of the template	Treatment	(Wang et al. 2002)	1. Provider participation • Compliance with CPGs	1. Length of hospital stay 2. Readmission within 30 days 3. Patient health status • Hospital mortality
Interdisciplinary team approach Decision support	Management	(Cannon et al. 2002)*	N/E	N/E
Patient-centred care: case management Interdisciplinary team: clinical pathways Feedback: report cards	Prevention	(Levknecht et al. 1997)*	N/E	N/E
Patient-centred care: transitional care between hospital and hospital-at-home Educational materials – patient Telemedicine: follow-up support	Rehabilitation	(Harrison et al. 2002)*	N/E	N/E

N/E=not evaluated; n/a=not available; CQI=continuous quality improvement; CPG=clinical practice guidelines; BMI=body mass index; CME=continuing medical education. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of multi-faceted tools for cardiovascular disease and stroke

Nine of the studies met the pre-defined inclusion criteria and were evaluated for effectiveness. One good quality cluster randomised controlled trial was aimed at improving secondary preventive care in patients with cardiovascular disease using a combined intervention (Langham et al. 2002). General practices were randomised to one of four study arms: 1. the *information systems* arm received training and assistance in organising patient information to set up a disease register; 2. the *evidence-based medicine* arm received training and assistance in accessing and critically appraising evidence from Medline and Internet searches. Summaries of treatment effectiveness and guidelines were discussed and consensus on treatment protocols was reached; 3. the *information and evidence* group could choose any aspect of the information systems and evidence-based medicine interventions; and 4. the *control* arm received training and assistance in tasks unrelated to cardiovascular disease (e.g. teamwork training, establishing asthma register, and giving advice on smoking cessation during pregnancy). Process outcomes centred on physician participation (behavioural change) – specifically concerning the recording of risk factors and the prescribing of appropriate drugs. Impact outcomes related to patients' ability to control disease – particularly control of blood pressure and total cholesterol level<sup>###</sup>. Results are presented in Table 78 (process outcomes) and Table 79 (impact outcomes). Results indicate overall improvements in the recording of all risk factors, with a statistically significant improvement occurring in the combined information plus evidence practices (mean = 19.9% [0.5, 39.3], p<0.001). Conversely, the

### Control = blood pressure <160/90 in hypertensives treated in the past 12 months; cholesterol < 5.5 mmol/l.

proportion of current smokers appeared to increase, particularly in the information plus evidence group (Table 79). This, however, is likely to be a consequence of the *recording* of smoking status in this group (Table 78), as opposed to worsening health practices. The information plus evidence practices also demonstrated increased recording of cholesterol, with a concomitant reduction in mean cholesterol level in their patients. Overall, increases in the recording of risk factors and improvements in prescribing behaviour were small and variable. There are several factors in this study that add weight to the results. In contrast to other studies, the practices in this study had little experience with auditing, developing guidelines, or participating in research and were recruited from deprived areas. Moreover, the negligible effect on patient health outcomes could not be attributed to a lack of participant motivation, as practices had considerable local involvement in tailoring the interventions to the specific practice needs. Similarly, practices received substantial human and financial resources over the study period and so were not under-resourced. Although the assessment of primary outcomes was not blinded, there was good protection against bias by concealment of allocation, protection from contamination, use of objective measures, and follow-up of patients (85%) and physicians (100%).

Another good quality randomised controlled trial evaluated the effectiveness of combining outreach visits with feedback reports to improve general practitioners' (GPs) compliance with selected recommendations from clinical practice guidelines (Frijling et al. 2003). In the intervention practices, GPs received outreach visits for each of several medical conditions – hypertension, hypercholesterolemia, diabetes, angina pectoris, heart failure, transient ischaemic attacks, and peripheral arterial disease. Prior to each outreach visit, GPs received feedback on their baseline clinical decision-making for the relevant condition, in terms of the key recommendations in the associated guidelines. The primary process outcome was provider participation (behavioural change) with respect to increasing compliance with clinical practice guidelines (CPGs) on cardiovascular care. Baseline measures were taken for each practice over a 2-month period prior to randomisation and again, at 21 months. The compliance rate for each indicator was calculated as follows:

**Compliance rate** = The number of decisions concordant with the CPG recommendations for an indicator divided by the total number of decisions made for that indicator.

Results, shown in Table 78, showed statistically significant improvements in five (of 12) indicators for physicians in the intervention group, assessed on an intention-to-treat basis. These included provision of information and advice to patients treated for hypertension or hypercholesterolemia, assessment of risk factors in patients with hypercholesterolemia or angina pectoris, and checking for clinical signs of deterioration in patients with heart failure. Baseline compliance rates were equivalent between groups and multi-level analysis showed that the greatest improvements occurred in single-handed practices, non-training practices, and practices with older physicians. Physicians in the intervention group, unblinded to the allocation of their practice, may have been more conscientious about recording patient encounters compared to the control group. This is unlikely to attenuate the results, however, as there was little difference between groups in the number of patient encounters recorded.

A good quality quasi-randomised controlled trial examined whether the addition of a local opinion leader to a continuous quality improvement intervention would increase

adherence to clinical practice guidelines for unstable angina (Berner et al. 2003). Twenty-two hospitals were assigned (randomisation method not provided) to one of three study arms: 1. Health Care Quality Improvement Project (HCQIP); 2. Opinion leader group; and 3. Control (no intervention). An assigned coordinator for each of the eight HCQIP hospitals attended a half-day orientation, consisting of a review of the unstable angina guidelines and feedback data on hospital-specific baseline performance for quality of care indicators (shown in Box 7). Coordinators also participated in interactive discussions on the collection, monitoring, and reporting of data, and development of a quality improvement plan.

**Box 7. Quality of care indicators for treatment of unstable angina (Berner et al. 2003)**

- Performance of an electrocardiogram within 20 minutes of arrival
- Receipt of aspirin or other anti-platelet therapy within 24 hours of admission
- Receipt of aspirin or other anti-platelet therapy at discharge
- Receipt of heparin during hospitalisation for patients at moderate to high risk of acute myocardial infarction or death
- Receipt of  $\beta$ -blockers during hospitalisation

In the opinion leader study arm seven opinion leaders were selected by consensus procedures, and also attended the half-day orientation session. Further information was provided on the role of opinion leaders in continuous quality improvement, and the use of strategies, such as academic detailing, audit and feedback, chart reminders, and other educational tools to tailor the intervention to meet the specific needs of individual hospitals. The primary process outcome was provider participation (behavioural change) regarding adherence to the five quality indicators (Box 7). Data were collected using a standardised electronic chart abstraction tool that gave high inter-rater reliability (>95%) and validity (>95%) on all variables. Analysis of variance was used to determine statistically significant differences in the mean change in the proportion of compliant hospitals between study arms. Although adjustments were made for hospital and patient characteristics, the authors reported unadjusted (crude) results when these adjustments had no effect on the result. Results indicated a significantly higher mean increase in anti-platelet medication within 24 hours in the opinion leader group (15.8%) compared to control (-0.4%,  $p=0.01$ ). No significant differences were apparent for other quality indicators across the study arms. Improvement within groups appeared greater when baseline performance was lower. For example, all hospitals showed large improvements in heparin therapy, and the opinion leader hospitals' baseline performance on anti-platelet medication within 24 hours was lower than their peers. Data were also analysed at the patient level, using generalised linear modelling to adjust for baseline differences (Table 78). Consistent with the results from hospital level analysis, patients in the opinion leader hospitals were more likely to receive anti-platelet medication within 24 hours compared to those in control hospitals ( $p<0.01$ ). Although a larger sample size may provide more power, the trend towards improvement in the quality indicators varied across the study arms, and the opinion leader intervention was not consistently superior. The existence of other quality improvement projects for cardiovascular disease within participating hospitals, and publicity surrounding the release of new guidelines for cardiovascular disease and stroke at the time of the study, may have affected the results, by raising physicians' awareness concerning the appropriate treatment of unstable angina. Overall, given the highly interactive and multi-faceted approach in the opinion leader intervention, the effectiveness of the combined intervention was relatively modest.

In a good quality quasi-randomised controlled trial, (Heller et al. 2001) implemented an educational program (with feedback) to improve management of unstable angina pectoris in hospital patients. Hospitals in the intervention group received educational sessions, which were run by a local opinion leader, to explain new clinical practice guidelines on unstable angina (Box 8). Baseline data on each hospital's current performance in management of unstable angina were collected from hospital records and presented to the intervention hospital for comparison to the "gold standard" clinical practice guidelines. Hospitals in the control group were offered a similar intervention that would commence after the study period (waiting-list control).

**Box 8. Guidelines on management of unstable angina pectoris <sup>a</sup>**

- The guidelines recommend use of:
- Aspirin, intravenous or low molecular weight heparin, and  $\beta$ -blockers
  - Calcium-channel blockers only for angina refractory to  $\beta$ -blockers or variant angina, or if systolic blood pressure is >150 mmHg
  - Intravenous nitroglycerine if pain persists
  - Cardiac catheterisation if patient is high risk, has persistent or recurrent pain, and is haemodynamically stable
  - Echocardiogram if catheterisation is not performed and there is a past history of ischaemia, conduction abnormalities or cardiomyopathy
  - A rehabilitation program

<sup>a</sup> (NHMRC 1999)

The primary process outcome was physician participation (behavioural change) assessed by documentation of compliance with guidelines (e.g. prescribing behaviour). Results, presented in Table 78, showed increased use of  $\beta$ -blockers and decreased use of calcium-channel blockers (consistent with guidelines) in both groups post-intervention. General release of the National Health and Medical Research Council guidelines for management of unstable angina during the study period may explain the slight improvement in both groups. However, there were no statistically significant differences between groups for any of the measured variables, although there was a trend towards decreased use of calcium channel blockers in the intervention group. Since the baseline rates for use of aspirin, heparin and combined aspirin/heparin were relatively high at intervention and control hospitals, a ceiling effect may have masked any potential improvements. Concealment of allocation to the intervention status and blinding of primary outcomes were not reported, indicating potential selection or assessment biases. However, the use of objective primary measures may, in part, counteract these methodological flaws.

A good quality quasi-randomised controlled study investigated the effects of introducing a multi-faceted quality improvement intervention for the care of heart failure patients (Philbin et al. 2000). A team of physicians, nurse leaders, and administrators at the intervention hospitals designed an in-patient critical pathway for heart failure management using a Gantt chart or time-task matrix. The pathway was based on published clinical trials, clinical practice guidelines, and well-established clinical standards. Other components included physician education, patient educational materials, feedback on hospital performance, use of a critical pathway in the emergency department, and a home care pathway to reduce hospital readmissions after hospital discharge. Control hospitals were able to use their own local quality improvement programs, but were restricted from accessing data or resources associated with the study. The primary process outcome was provider participation (behavioural change) regarding compliance with the recommended pathway (Table 78) Impact outcomes included length of hospital

stay, patients' health status (hospital mortality), and patients' quality of life (Table 79). Trained nurses abstracted data by reviewing the charts of all patients diagnosed with heart failure. Baseline data were collected on heart failure patients admitted to hospital between April and December 1995 and post-intervention data were collected between November 1996 and July 1997, after all aspects of the intervention had been implemented. Overall, the results showed that the intervention had no significant effect on either process or impact outcomes. Assessment bias is possible, as nurses conducting the chart abstraction were not blinded to hospital allocation. Furthermore, the potential for improvement in intervention hospitals may have been mitigated by the presence of local quality improvement practices at control hospitals. The confidence intervals were wide for most measures, indicating large variability across the hospitals, and lack of statistical power.

In the evidence base, studies of lower quality or of a lower level of evidence (Casebeer et al. 1999; Costantini et al. 2001; Ketola et al. 2000; Wang et al. 2002) that evaluated multi-faceted interventions for cardiovascular disease and stroke had mixed results. All of these interventions included some sort of educational approach but varied quite considerably in delivery, additional interventions, and the target audience (Table 78 and Table 79).

### ***Critical success factors of tools for cardiovascular disease and stroke***

For most of the categories of tools, less than two studies were available for an evaluation of effectiveness. Evidence from the higher quality studies indicated moderate improvement in the ordering of laboratory tests and the delivery of preventive care as a result of the continuous quality improvement and the alternative care approach, respectively. Marginal improvement in providing preventive care was shown through educational outreach, whereas physician prompts resulted in improved documentation, but no improvement in prescribing or patient outcomes. Of the two studies using decision support tools, one had no effect on prescribing behaviour while the other resulted in a better flow of patients following a triage system. Multi-faceted tools gave mixed results, probably reflecting the heterogeneity of the interventions as well as the diversity of targeted behaviours. Overall, there were small to modest improvements in physicians' compliance with guidelines and in the recording of risk factors, but benefits to patients were variable and largely negligible. The use of complex multi-faceted interventions that are flexible to the work environment and the context in which changes are to be made, may be more useful. Since there are multiple reasons underlying physicians' behaviour/performance, it follows that the more effective strategies for changing physicians' behaviour are likely to be multifactorial. That is, a combination of tools is more likely to influence a wider group of individuals with different learning styles, values, and motivation levels.

Although some tools appear more effective than others in influencing physician performance or patient health, no single strategy is always effective. In addition to the characteristics of the tool itself, other factors may influence the effectiveness of tools, including the clinical issue concerned (complexity, severity of illness), the particular setting (support, resources), and the target population (motivation).

The recurrent theme in the strategies that resulted in improvements (in process outcomes) were:

- Interactive or tailored interventions;
- Reinforcement – follow-up and repeated messages or reminders; and
- Multiple tools.

Table 78. Effectiveness of multi-faceted tools – Process outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of physician participation (behavioural change)										
(Langham et al. 2002)	Level II: cluster RCT Quality: good	17 general practices	Information: training and assistance in organisation of patient information	<i>Recording of risk factors, % of patients</i>										
					Control N=254	Information only N=257		Evidence only N=240		Information and evidence N=223				
					Mean % change [95% CI]	Mean % change [95% CI]	Relative change <sup>a</sup>	Mean % change [95% CI]	Relative change <sup>a</sup>	Mean % change [95% CI]	Relative change <sup>a</sup>			
				Smoking status	-5.4 [-25.7, 15.0]	-5.2 [-16, 5.6]	1.0	-1.2 [-14.4, 12.1]	0.2	+13.7 [-6.5, 34.0]	2.5			
				Blood pressure	-16.2 [-30.7, -1.7]	-1.1 [-23.1, 20.8]	14.7	-14.1 [-48.7, 20.5]	0.9	+0.7 [-33.0, 34.3]	0.0			
				Cholesterol	+12.3 [-9.1, 33.8]	+11.5 [5.3, 17.8]	1.1	+7.2 [-8.1, 22.4]	0.6	+22.5 [7.9, 37.2]	1.8			
			Evidence: training and assistance in accessing and interpreting evidence	All risk factors	+6.5 [-8.1, 21.3]	+6.6 [-14.5, 27.7]	1.0	+7.2 [-19.4, 33.9]	1.1	+19.9 [0.5, 39.3]	3.1			
				<i>Prescribing behaviour, % of patients</i>										
				Information and evidence	Aspirin	+3.4 [-0.5, 7.3]	-8.7 [-23.8, 6.4]	2.6	-2.2 [-10.5, 6.1]	0.6	+2.0 [-11.3, 15.3]	0.6		
			Anti-hypertensives		-16.7 [-61.0, 27.6]	-22.5 [-70.8, 25.8]	1.4	-9.3 [-24.6, 13.2]	0.6	-27.3 [-48.6, -5.9]	1.6			
			Lipid-lowering agents		+3.0 [-1.7, 7.7]	+6.0 [-0.5, 12.5]	2.0	+4.0 [-30.4, 11.8]	1.3	+4.4 [1.3, 7.5]	1.5			
			(Frijling et al. 2003)	Level II: RCT Quality: good	124 general practices	Education: outreach visits Feedback	<i>Change in compliance rates<sup>b</sup>, %</i>							
							Indicator	Control Mean % change [95% CI] <sup>c</sup>		Intervention Mean % change [95% CI] <sup>c</sup>		Effect measure Relative change OR [95% CI] <sup>d</sup>		
<i>Newly diagnosed hypertension</i>														
Assessment of risk factors	0.0 [-6, 6.0]						-2.0 [-9.0, 5.0]		n/e	1.1 [0.8, 1.5]				
Provision of information and advice	-1.0 [-10.0, 8.0]						5.0 [-6.0, 16.0]		5.0	1.3 [0.9, 1.9]				
<i>Treated hypertension</i>														
Provision of information and advice	-3.0 [-8.0, 2.0]						5.0 [-1.0, 10.0]		1.7	1.6 [1.4, 1.8]				
Increasing the anti-hypertensive medication	4.0 [-3.0, 11.0]						8.0 [-1.0, 16.0]		2.0	0.9 [0.6, 1.2]				
Scheduling a follow-up appointment	0 [-5.0, 5.0]		1.0 [-4.0, 6.0]		n/e	1.0 [0.8, 1.2]								

Table 78 (cont.) Effectiveness of multi-faceted tools – Process outcomes

				<i>Hypercholesterolemia</i>							
				Assessment of risk factors	2.0 [-2.0, 5.0]	5.0 [2.0, 8.0]	2.5 2.0 [1.4, 2.9]				
				Provision of information and advice	0.0 [-6.0, 6.0]	7.0 [1.0, 13.0]	n/e 1.6 [1.2, 2.1]				
				<i>Angina pectoris</i>							
				Assessment of risk factors	0.0 [-7.0, 6.0]	8.0 [2.0, 15.0]	n/e 3.1 [1.1, 8.8]				
				Provision of information and advice	-9.0 [-23.0, 4.0]	-7.0 [-18.0, 4.0]	0.8 1.0 [0.6, 1.7]				
				Prescribing aspirin and sublingual nitrate	1.0 [-14.0, 17.0]	10.0 [-1.0, 21.0]	10.0 1.4 [0.9, 2.4]				
				<i>Heart failure</i>							
				Checking for clinical signs of deterioration	-7.0 [-17.0, 2.0]	12.0 [0, 25.0]	1.7 4.1 [2.2, 7.8]				
				Provision of information and advice	6.0 [-2.0, 15.0]	0.0 [-8.0, 8.0]	0.0 0.9 [0.4, 1.7]				
(Berner et al. 2003)	Level III-1: cluster quasi-RCT Quality: good	21 hospitals	COI  Education: local opinion leader	<i>Treatment of unstable angina in intervention groups compared to control</i>							
				Quality of care indicators	COI OR [95% CI] <sup>e</sup>		COI plus opinion leader OR [95% CI] <sup>e</sup>				
				Echocardiography	1.0 [0.8, 1.6]		1.2 [0.8, 1.8]				
				Anti-platelet medication within 24 hours	1.1 [0.7, 1.7]		1.9 [1.2, 3.1], p<0.01				
				Anti-platelet medication at discharge	1.3 [0.8, 2.0]		1.3 [0.8, 2.0]				
				Heparin	0.9 [0.6, 1.3]		0.9 [0.6, 1.3]				
				β-blockers	0.9 [0.5, 1.5]		0.9 [0.5, 1.4]				
(Heller et al. 2001)	Level III-1: quasi-RCT Quality: good	36 hospitals  Patients admitted to hospital with unstable angina pectoris	Education: local opinion leader  Feedback	<i>Management of unstable angina pectoris, rates of use (% of patients)</i>							
					Control		Intervention	Effect measure <sup>f</sup>			
				CPG recommendations	Before	After	% change OR [95% CI]	Before	After	% change OR [95% CI]	Relative change OR [95% CI]
				Aspirin	84	83	-1.0 0.9 [0.6, 1.3]	82	85	+3.0 1.2 [0.9, 1.5]	3 1.1 [0.7, 1.8]
				Heparin	69	77	+8.0 1.6 [1.1, 2.4]	72	64	-8.0 0.7 [0.2, 2.0]	1 0.5 [0.3, 1.2]
				Aspirin and heparin	62	68	+6.0 1.3 [1.0, 1.8]	63	57	-6.0 0.8 [0.4, 1.6]	1 0.6 [0.3, 1.3]

Table 78 (cont.) Effectiveness of multi-faceted tools – Process outcomes

				β-blockers	49	51	+2.0 1.1 [0.9, 1.4]	46	57	+11.0 1.6 [1.1, 2.2]	5.5 1.3 [0.9, 2.0]
				Calcium-channel blockers	53	47	-6.0 0.7 [0.7, 0.9]	54	41	-13.0 0.6 [0.4, 0.8]	2.2 0.8 [0.6, 1.0]
				Nitrates	n/a	n/a	0.8 [0.6, 1.1]	n/a	n/a	0.6 [0.4, 0.9]	0.9 [0.6, 1.4]
				Coronary angiography	n/a	n/a	1.5 [0.8, 2.6]	n/a	n/a	1.2 [0.9, 1.6]	0.8 [0.3, 2.3]
				Echocardiography	n/a	n/a	1.0 [0.5, 1.9]	n/a	n/a	1.0 [0.7, 1.4]	0.7 [0.3, 1.5]
				Rehabilitation	n/a	n/a	0.8 [0.4, 1.4]	n/a	n/a	0.9 [0.5, 1.8]	1.3 [0.6, 2.6]
(Philbin et al. 2000)	Level III-1: quasi-RCT Quality: good	10 hospitals Patients diagnosed with heart failure	Inter-disciplinary team approach  CME  Patient educational material  Feedback	<i>Compliance with pathway - documentation of actions, % of patients</i>							
					Control			Intervention			Effect measure
				Actions	Before N=640	After N=664	% change	Before N=762	After N=840	% change	Relative change Intervention effect [95% CI] <sup>g</sup>
				Primary aetiology of heart failure	75.0	73.0	-2.0	69.0	76.0	+7.0	3.5 10.0 [-7.0, 26.0]
				Left ventricular systolic function	67.0	77.0	+10.0	65.0	63.0	-2.0	0.2 -12.0 [-27.0, 2.0]
				Dietary counselling	74.0	78.0	+4.0	68.0	73.0	+5.0	1.3 1.0 [-22.0, 23.0]
				ACE inhibitor prescribed (all patients)	64.0	66.0	+2.0	57.0	63.0	+6.0	3.0 4.0 [-14.0, 23.0]
				ACE inhibitor prescribed (ideal candidates)	79.0	83.0	+4.0	79.0	78.0	-1.0	0.3 -7.0 [-20.0, 5.0]

Table 78 (cont.) Effectiveness of multi-faceted tools – Process outcomes

(Casebeer et al. 1999)	Level III-1: quasi-RCT Quality: average	28 physicians	Education: CME - three interactive case-based audio-conferences  Reminders	<i>Number of physicians' adherence-enhancing behaviours, mean ±SD</i>							
					Control			Intervention			Effect measure
				Compliance-enhancing behaviours (No. of possible behaviours)	Before N=14	After N=12	% change	Before N=14	After N=14	% change	Relative change <sup>h</sup>
			Diet counselling (15)	4.1±4.7	5.5±4.8	+34.1	5.0±4.8	6.7±4.8	+34.0	1.0 NS	
			Exercise counselling (4)	1.1±1.5	1.6±2.0	+45.5	1.5±1.6	1.8±1.7	+20.0	0.4 NS	
			Interpersonal interaction (7)	5.8±1.5	6.2±1.7	+6.9	4.8±2.1	6.1±1.2	+27.1	3.9 NS	
			Medication assessment (3)	2.3±0.8	2.1±1.1	-8.7	1.8±0.9	2.4±0.8	+33.3	3.8 NS	
			Medication counselling (11)	3.9±3.0	5.3±3.9	+35.8	3.4±3.3	4.6±3.3	+35.3	1.0 NS	
			Risk-factor assessment (3)	2.3±1.1	2.6±0.8	+13.0	2.1±1.1	2.6±0.7	+23.8	1.8 NS	
			Understanding of hyper-cholesterolemia (9)	3.0±3.4	4.4±4.0	+46.7	2.4±3.1	5.8±2.9	+141.7	3.0 NS	
			Total compliance-enhancing behaviours (52)	22.4±12.0	27.7±14.2	+23.7	21.0±13.4	30.0±11.9	+42.9	1.8 NS	

Table 78 (cont.) Effectiveness of multi-faceted tools – Process outcomes

(Ketola et al. 2000)	Level III-2: controlled before-and-after study Quality: good	2 health centres	CME: didactic lectures on cardiovascular disease  CPGs: local adaptation of CPGs  Feedback: audit and feedback of compliance with CPGs	<i>Recording of risk factors, % of patients</i>				Effect measure <sup>i</sup>			
					Control			Intervention			Relative change
					Before	After	% change	Before	After	% change	
				Weight	11.0	17.0	+6.0	11.0	41.0	+30.0	5.0 $p<0.001$
				Height	11.0	16.0	+5.0	10.0	40.0	+30.0	6.0 $p<0.001$
				BMI	0.6	3.0	+2.4	0.8	20.0	+19.2	8.0 $p<0.001$
				Blood pressure	41.0	46.0	+5.0	43.0	60.0	+17.0	3.4 $p<0.001$
				Blood glucose	17.0	18.9	+1.9	13.0	30.7	+17.7	9.3 $p<0.001$
				Total cholesterol	9.7	12.4	+2.7	9.6	23.5	+13.9	5.1 $p<0.001$
				History of diabetes	1.2	32.0	+30.8	0.7	50.0	+49.3	1.6 $p<0.001$
				Smoking habits	12.0	23.0	+11.0	6.0	39.0	+33.0	3.0 $p<0.001$
				Alcohol consumption	5.0	6.0	+1.0	1.0	20.0	+19.0	19.0 $p<0.001$
				Exercise habits	0.1	2.0	+1.9	0.3	21.0	+20.7	10.9 $p<0.001$
				Family history of cardiovascular disease	6.1	9.0	+2.9	5.0	26.0	+21.0	7.2 $p<0.001$
<i>High levels of cardiovascular risk factors in patient records, % of patients</i>											
Total risk factors	22.0	29.0	+7.0	17.0	32.0	+15.0	2.1 $p<0.03$				

Table 78 (cont.) Effectiveness of multi-faceted tools – Process outcomes

(Wang et al. 2002)	Level III-2: controlled before-and-after study Quality: average	2 intensive care units	Inter-disciplinary team approach: developed practice guidelines for routine laboratory and radiographic testing  Decision support: computerised test ordering template Education: educational sessions for staff to explain the guidelines and use of the template	<i>Test utilisation per patient-day in the intensive care unit, mean</i>					Effect measure			
					Control (MICU)			Intervention (CCU)			Relative change P value <sup>9</sup>	
				Test	Before N=192	After N=165	% change	Before N=246	After N=225	% change		
				Sodium	2.6	2.6	0.0	1.9	1.6	-15.8	n/e NS	
				Potassium	3.8	3.8	0.0	3.2	2.4	-25.0	n/e $p<0.01$	
				Carbon dioxide	2.1	2.1	0.0	1.4	1.3	-7.1	n/e NS	
				Chloride	2.2	2.1	-4.5	1.4	1.3	-7.1	1.6 NS	
				Serum urea nitrogen	2.1	2.1	0.0	1.5	1.3	-13.3	n/e NS	
				Creatinine	2.1	2.1	0.0	1.5	1.4	-6.7	n/e NS	
				Glucose	3.4	3.6	+5.9	1.6	0.9	-43.8	7.4 $p<0.001$	
				Serum calcium	1.3	1.3	0.0	1.2	0.7	-41.7	n/e NS	
				Ionised calcium	1.2	1.5	+25.0	0.9	0.4	-55.6	2.2 $p<0.001$	
				Magnesium	1.3	1.3	0.0	1.2	0.9	-25.0	n/e $p<0.001$	
				Phosphorus	1.3	1.3	0.0	1.2	0.7	-41.7	n/e $p<0.001$	
				Complete blood cell count	1.8	1.9	+5.6	1.6	1.5	-6.3	1.1 NS	
				Chest radiograph	0.8	1.0	+25.0	1.0	0.9	-10.0	0.4 $p<0.001$	
				Arterial blood gases	3.1	3.4	+9.7	2.0	1.7	-15.0	1.5 $p=0.04$	

Table 78 (cont.) Effectiveness of multi-faceted tools – Process outcomes

(Costantini et al. 2001)	Level III-2: controlled before-and-after study Quality: average	409 patients diagnosed with cardiac failure	Disease management team	<i>Adherence to identified CPG activities, % of patients</i>						
					Baseline N=173	Control N=126		Intervention N=283		Effect measure <sup>j</sup>
				CPG activity	Before	After	% change	After	% change	Relative change
				60.0	75.0	+15.0	95.0	+35.0	2.3 $p<0.001$	
				52.0	53.0	+1.0	88.0	+36.0	36.0 $p<0.001$	
				40.0	50.0	+10.0	69.0	+29.0	2.9 $p<0.001$	
				60.0	58.0	-2.0	81.0	+21.0	10.5 $p<0.001$	

OR=odds ratio; n/e=not estimable; CQI=continuous quality improvement; CPG=clinical practice guidelines; n/a=not available; CME=continuous medical education; ACE=angiotensin-converting enzyme; SD=standard deviation; NS=not significant; BMI=body mass index. <sup>a</sup> pre- and post-intervention scores not included due to space restrictions - available on request. Two-sample weighted t-test – intra-cluster correlation coefficient = 0.03; <sup>b</sup> compliance rates = the number of decisions concordant with the CPG recommendations for an indicator/the total number of decisions made for that indicator; <sup>c</sup> mean change = mean % change from baseline values; <sup>d</sup> multilevel logistic regression analysis adjusted for baseline compliance rates and practice type; <sup>e</sup> general linear modelling was used to adjust for baseline differences; <sup>f</sup> a chi-square test, corrected for cluster sampling using 2<sup>nd</sup>-order correction of Rao and Scott, was used to determine differences between intervention and control and between baseline and follow-up patients. Significance of changes was assessed using multivariate logistic regression to adjust for hospital type and patient characteristics (e.g. age, gender, severity of illness). A 2-way interaction term between time (before – after) and group (intervention – control) was included and significance was determined by the Wald test; <sup>g</sup> linear regression model was used to adjust for baseline differences; <sup>h</sup> ANCOVA was used to adjust for baseline differences; <sup>i</sup> chi-square test or Fisher’s exact test was used to compare levels of risk factor recording. General linear modelling for continuous variables and modelling for categorical data were used to estimate time trends; <sup>j</sup> multivariate linear regression model.

Table 79. Effectiveness of multi-faceted tools – Impact outcomes

Study	Level and quality of evidence	Target population	Tool	Outcomes – Assessment of patient ability to control disease							
(Langham et al. 2002)	Level II: cluster RCT Quality: good	17 general practices	Information: training and assistance in organisation of patient information  Evidence: training and assistance in accessing and interpreting evidence  Information and evidence	<i>Control of risk, % of patients</i>							
					Control N=254	Information only N=257		Evidence only N=240		Information and evidence N=223	
					Mean % change [95% CI]	Mean % change [95% CI]	Relative change	Mean % change [95% CI]	Relative change	Mean % change [95% CI]	Relative change <sup>a</sup>
				Current smokers	+0.4 [-11.7, 12.6]	-1.0 [-9.3, 7.3]	2.5	+0.5 [-6.6, 7.6]	1.3	+6.5 [0.8, 12.2]	16.3
				BP: mean systolic (mmHg)	-1.7 [-3.1, -0.4]	-2.5 [-8.3, 3.3]	1.5	-0.1 [-13.6, 13.3]	0.1	+1.5 [-6.8, 9.7]	0.9
				BP: mean diastolic (mmHg)	-2.7 [-7.3, 1.8]	-2.0 [-5.6, 0]	0.7	+1.5 [-3.9, 6.9]	0.6	-0.3 [-3.5, 2.8]	0.1
				BP <160/95	-10.2 [-19.0, 1.4]	-6.8 [-21.9, 8.3]	0.7	-6.5 [-19.7, 6.7]	0.6	-3.2 [-19.6, 13.2]	0.3
				Total cholesterol (mmol/l), mean	-0.1 [-0.8, 0.6]	-0.2 [-0.5, 0]	2.0	-0.2 [-0.2, 0]	2.0	-0.7 [-1.3, 0]	7.0
Total cholesterol <5.5	+6.6 [-2.3, 15.4]	+1.2 [-6.2, 8.6]	0.2	-0.3 [-9.9, 9.4]	0.0	+0.9 [-7.9, 9.7]	0.1				
(Philbin et al. 2000)	Level III-1: quasi-RCT Quality: good	10 hospitals Patients diagnosed with heart failure	Inter-disciplinary team  CME  Patient educational material  Feedback	Length of hospital stay, mean days							
				Control			Intervention			Effect measure	
				Before N=640	After N=664	% change	Before N=762	After N=840	% change	Relative change Intervention effect [95% CI] <sup>b</sup>	
				7.7	7.0	-9.1	8.0	6.2	-22.5	2.5 -1.1 [-2.9, 0.7]	
				Mortality, % of patients							
				5.4	3.7	-1.7	5.9	5.2	-0.7	0.4 1.0 [-3.0, 5.0]	
				Patient quality of life, mean Ladder of Life score <sup>c</sup>							
				6.3	6.5	+3.2	6.6	6.5	-1.5	0.5 -0.3 [-1.6, 1.0]	

Table 79 (cont.) Effectiveness of multi-faceted tools – Impact outcomes

(Ketola et al. 2000)	Level III-2: controlled before-and-after study Quality: good	2 health centres	CME: didactic lectures on cardiovascular disease  CPGs: local adaptation of CPGs  Feedback: audit and feedback of compliance with CPGs	Assessment of patients' health status							
				<i>Mean±SD values of measured risk factors in the general population</i>							
					Control			Intervention			Effect measure <sup>d</sup>
					Before	After	% change	Before	After	% change	Relative change
				Systolic blood pressure (mmHg)	130.0±19.3	128.0±19.6	-1.5	128.0±19.9	128.0±17.3	0.0	0.0 $p=0.06$
				Diastolic blood pressure (mmHg)	82.0±12.6	81.0±11.3	-1.2	80.0±11.7	81.0±10.7	+1.3	1.1 $p=0.06$
				Weight (kg)	68.9±14.7	71.0±16.8	+3.0	70.5±14.2	73.0±15.6	+3.5	1.2 $p<0.001$
				BMI (kg/m <sup>2</sup> )	27.6±7.0	28.0±4.2	+1.4	23.6±9.0	27.0±5.0	+14.4	10.3 $p<0.001$
				Total cholesterol (mmol/l)	6.0±1.0	6.1±1.0	+1.7	6.2±1.4	5.8±1.0	-6.5	3.8 $p<0.01$
				Blood glucose (mmol/l)	5.5±1.2	5.3±1.3	-3.6	5.4±1.6	5.1±1.1	-5.6	1.6 $p<0.001$
				<i>Mean values of measured risk factors in patients taking cardiovascular disease medication</i>							
				Systolic blood pressure (mmHg)	145.0	145.0	0.0	147.0	138.0	-6.1	n/e
				Diastolic blood pressure (mmHg)	90.0	90.0	0.0	90.0	86.0	-4.4	n/e
				Weight (kg)	85.6	84.6	-1.2	80.7	78.8	-2.4	2.0
				BMI (kg/m <sup>2</sup> )	29.0	28.1	-3.1	n/a	28.2		n/e
				Total cholesterol (mmol/l)	6.3	6.4	+1.6	6.3	5.8	-7.9	4.9
Blood glucose (mmol/l)	5.4	5.8	+7.4	6.5	5.3	-18.5	2.5				

Table 79 (cont.) Effectiveness of multi-faceted tools – Impact outcomes

(Costantini et al. 2001)	Level III-2: controlled before-and-after study Quality: average	409 patients diagnosed with cardiac failure	Disease management team	<i>Patient hospitalisation and mortality</i>						
					Baseline N=173	Control N=126		Intervention N=2830		Effect measure
					Before	After	% change	After	% change	Relative change
				Length of hospital stay, median [IQR], day	4.0 [2.0, 5.0]	5.0 [3.0, 8.0]	+25.0	3.0 [2.0, 5.0]	-25.0	1.0
30-day readmission, %	6.4	4.8	-1.6	6.0	-0.4	0.3				
In-hospital mortality, %	5.8	5.6	-0.2	2.1	-3.7	18.5				

BP=blood pressure; CME=continuous medical education; CPG=clinical practice guidelines; BMI=body mass index; SD=standard deviation; IQR = inter-quartile range. <sup>a</sup> pre- and post-intervention scores not included due to space restrictions - available on request. Two-sample weighted t-test – intra-cluster correlation coefficient = 0.03; <sup>b</sup> linear regression modelling was used to adjust for baseline differences; <sup>c</sup> Ladder of Life is a patient self-report questionnaire that ranks quality of life from 1 (worst) to 10 (best); <sup>d</sup> chi-square test or Fisher’s exact test was used to compare levels of risk factor recording. General linear modelling for continuous variables and modelling for categorical data were used to estimate time trends.

# Diabetes Mellitus

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Diabetes mellitus is a complex metabolic disease that is characterised by poor regulation or production of the hormone insulin. It has three main types, commonly known as gestational diabetes, insulin dependent diabetes (or type 1 diabetes) and non-insulin dependent (or type 2 diabetes). There are estimated to be one million Australians with diabetes, with Type 2 diabetes by far the most common (AIHW 2002). Diabetes is a very serious disease that contributed to 7.9% of all deaths in 2000, and in 1996 was responsible for almost 70,000 years of life lost (AIHW 2002). In its most common form, diabetes results in high levels of glucose in the blood, which can lead to serious complications such as blindness, nerve damage and kidney damage. Diabetic retinopathy is the most common cause of blindness in people aged 30-69, and the rate of kidney disease in people with diabetes is four times that of people without the condition (AIHW 2002). About 64,000 Australians are disabled because of their diabetes (AIHW 2002). Diabetes is characterised not only by fluctuating blood glucose levels but also by various comorbidities, such as: hypertension, high cholesterol, obesity and inactivity. People with diabetes are four times more likely to develop cardiovascular disease (AIHW 2002). Improvements to metabolic control and associated comorbidities lessen the risks associated with diabetes and so management of these factors is crucial to the care of people with this condition. The heavy burden of disease associated with diabetes and its complications in Australia, and the fact that diabetes is a condition that can be prevented or effectively managed, clearly illustrate why it is a national health priority area.

All the studies found for this systematic review of diabetes mellitus focus on the management of the condition, with the primary goal usually being glycaemic control.

The tools identified for the improvement of management services for diabetes were:

- Continuous quality improvement;
- Clinical practice guidelines;
- Decision support tools;
- Prompts and reminders;
- Feedback;
- Record systems;
- Telemedicine and telecare;
- Alternative care approaches (providers and care settings)
- Interdisciplinary team approaches; and
- Multi-faceted interventions.

## Clinical Practice Guidelines

Only one study was found that described the use of clinical practice guidelines as a health service improvement tool, and it was not eligible for evaluation.

Table 80. Clinical practice guidelines for the management of diabetes

Tool	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Clinical practice guidelines	Management	(Benjamin et al. 1999)*	N/E	N/E

N/E=not evaluated. \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Continuous Quality Improvement

Four studies were identified that used continuous quality improvement (CQI) as a tool for improving diabetes care, however none of these studies fulfilled the eligibility criteria for a review of effectiveness.

Table 81. CQI for management of diabetes

Tool	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
CQI	Management	(Fox & Mahoney 1998; Goldberg et al. 2002; O'Connor et al. 1996b; Solberg et al. 1997)*	N/E	N/E

N/E=not evaluated. \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Decision Support

Decision support tools were identified in five studies relating to diabetes care, as shown in Table 82.

Table 82. Decision support tools for the management of diabetes

Tool <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Computerised decision support	Management	(Hetlevik et al. 2000; Meigs et al. 2003) (Ambrosiadou et al. 1996; Zahlmann et al. 1990)*	1. Assessment of participation <ul style="list-style-type: none"> <li>• Tests conducted according to guidelines</li> </ul> 2. Assessment of participant satisfaction	1. Patient health status <ul style="list-style-type: none"> <li>• HbA1c</li> <li>• Cholesterol</li> <li>• Blood pressure</li> <li>• BMI</li> </ul>
Paper-based decision support	Management	(Lobach & Hammond 1997)*	N/E	N/E

BMI=body mass index; N/E=not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### Effectiveness of decision support tools for diabetes management

Two of the five studies were eligible for a review of effectiveness (Meigs et al. 2003; Hetlevik et al. 2000). One of the studies was conducted in the USA, the other in Norway. Both studies used decision support tools that were accessible on a computer in the consulting room of the physician. These decision support tools remind physicians of the guidelines for diabetes care, particularly with regard to tests that should be completed as well as the test ranges, or cut-off values, to aid diagnosis and treatment.

The better quality of these studies was (Meigs et al. 2003). The unit of randomisation was the physician and the analysis was adjusted for clustering of patients, baseline differences and also weighted by the number of patients per physician. There was no loss to follow-up as measurements were conducted by chart audit at the completion of the study, thus every patient who was seen prior to and during the intervention year was included. The statistical testing was also appropriately performed on the difference in change from baseline to follow-up between the groups. The process outcome for this study was provider participation (behavioural change) and results indicate that there were no statistically significant improvements in testing behaviour as a consequence of decision support (Table 83), with the exception of improvement in the rates of foot examination ( $p=0.003$ ). Likewise, the impact or patient-relevant outcomes show little difference between the groups, except on the systolic blood pressure measurement; diastolic blood pressure also trended towards improvement for the intervention group.

The (Hetlevik et al. 2000) study randomised general practitioners to the intervention but analysed results at the level of the patient, thus resulting in a unit of analysis error. The study did not conduct statistical testing to compare the change in proportions of patients without recommended tests; rather it tested differences between the intervention and control patients at baseline and follow-up. As such, this analysis did not account for baseline differences, or clustering of patient data. However enough information was provided to assess the relative change in the proportion of patients receiving recommended tests. The results (Table 83) showed that the intervention group received increased testing for glycosylated haemoglobin (HbA<sub>1c</sub>) and cholesterol, but the control group received increased testing for blood pressure, although the difference between groups for this outcome was much smaller. No data for participant satisfaction were reported, however the authors found that user-friendliness of the system was not

satisfactory, with 92% of intervention general practitioners (GPs) finding the decision support tool too large. After 18 months the GPs in the intervention group had used the tool with only 14% of patients, although about half of all GPs, regardless of whether they had used the system or not, reported much or some benefit from the tool. The authors stated that there were no baseline differences for the patient impact outcomes, thus a direct comparison of the follow-up measures is provided in Table 84. The only significant difference between the intervention and control groups was a reduction in diastolic blood pressure in the intervention group patients; there was no difference for any other outcome.

Overall these studies do not show that decision support tools are effective. The studies report relatively poor uptake of the tools by clinicians, which was attributed both to the use of the computerized system (eg system too large, insufficient time to use the system, use of computers during consultation is a barrier to communication) and to the guidelines themselves (eg recommended procedures were too time consuming). So, although clinical practice has been shown to deviate from recommendations for evidence-based practice, more work needs to be done on decision support tools to improve their effectiveness at helping clinicians follow clinical practice guidelines in the area of diabetes management.

***Critical success factors of decision support tools in diabetes care:***

- The decision support system must be easily integrated into clinical practice;
- The ‘decisions’ must be evidence-based but also practical so that providers are willing to implement them; and
- Decision support systems must take into account the limitations faced by providers, such as time and demand, and the other conditions that must be dealt with during a consultation.

Table 83. Effectiveness of decision support tools: process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of participation (behavioural change)							
				<i>Test in last 12 months, % of patients receiving test</i>							
(Meigs et al. 2003)	Level II: RCT Quality: good	Physicians	Decision support: web-based, featuring patient-specific information	Control N=291			Intervention N=307			Effect measure	
					Before	After	% change	Before	After	% change	Relative change P value <sup>a</sup>
				HbA <sub>1c</sub>	88.0	87.0	-1.0	86.0	87.6	+1.6	1.6 $\rho=0.3$
				LDL cholesterol	57.4	60.8	+3.4	57.7	64.9	+7.2	2.1 $\rho=0.5$
				BP	98.6	97.2	-1.4	97.4	98.4	+1.0	0.7 $\rho=0.3$
				Eye exam	41.2	42.9	+1.7	29.3	34.8	+5.5	3.2 $\rho=0.5$
				Foot exam	82.1	81.4	-0.7	65.5	75.3	+9.8	14 $\rho=0.003$
(Hetlevik et al. 2000)	Level II: RCT Quality: poor	General practitioners	Decision support: computerised	<i>Recommended tests undertaken in 12 months, % of patients <sup>b</sup></i>							
				Control			Intervention				
					Before (N=535)	After (N=416)	% change	Before (N=499)	After (N=380)	% change	Relative change
				HbA <sub>1c</sub>	77.6	81.2	+3.6	72.5	79.5	+7.0	1.9
				BP	77.4	81.5	+4.1	78.2	81.3	+3.1	0.8
Cholesterol	29.0	37.3	+8.3	20.0	43.7	+23.7	2.9				

HbA<sub>1c</sub>=glycosylated haemoglobin; LDL=low density lipoprotein; BP=blood pressure. <sup>a</sup> test for difference in change in proportion; <sup>b</sup> results inverted to represent completion of tests rather than non-completion, for consistency with other studies.

Table 84. Effectiveness of decision support tools - Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of patients' health status							
				<i>Test result, mean</i>			Effect measure				
(Meigs et al. 2003)	Level II: RCT Quality: good	Physicians	Decision support: web-based, featuring patient-specific information	Control N=291			Intervention N=307			Relative change P value <sup>a</sup>	
				Before	After	% change	Before	After	% change		
				HbA <sub>1c</sub> (%)	8.1	8.2	+1.7	8.4	8.2	-2.7	1.6 $\rho=0.09$
				LDL cholesterol (mg/dl)	122.1	112.7	-7.7	126.7	112.0	-11.6	1.5 $\rho=0.3$
				BP (mmHg systolic)	136.9	134.7	-1.6	138.1	138.9	+0.6	0.4 $\rho=0.03$
				BP (mmHg diastolic)	76.4	75.6	-1.1	78.3	76.5	-2.3	2.1 $\rho=0.08$
(Hetlevik et al. 2000)	Level II: RCT Quality: poor	General practitioners	Decision support: computerised	<i>Test result at 18 months follow-up, mean</i>				Effect measure			
				Control			Intervention			Relative change Differences at follow-up [95% CI] <sup>b</sup>	
				Before N=535	After N=416	% change	Before N=499	After N=380	% change		
				HbA <sub>1c</sub> (%)	8.2	8.0	-2.4	8.2	7.9	-3.7	1.5 -0.1 [-0.4, 0.1]
				BP (mmHg systolic)	151.7	153.7	+1.3	152.5	151.4	-0.7	0.5 -2.3 [-5.6, 1.0]
				BP (mmHg diastolic)	85.3	85.3	0.0	84.5	82.8	-2.0	n/e -2.4 [-4.0, -0.9]
Serum cholesterol (mmol/L)	6.6	6.3	-4.5	6.6	6.2	-6.1	1.4 -0.1 [-0.3, 0.2]				

HbA<sub>1c</sub>=glycosylated haemoglobin; LDL=low density lipoprotein; BP=blood pressure; n/e=not estimable. <sup>a</sup> test for difference in change in mean; <sup>b</sup> negative indicates lower (better) values for intervention group.

## Prompts and Reminders

Prompts and reminders are aimed at encouraging both providers and patients to obtain regular review, testing and management of diabetes and associated risk factors such as hypertension and hyperlipidaemia. Four studies were identified that used this tool, as shown in Table 85.

Table 85. Prompts and reminders for management of diabetes

Tool <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Patient reminder	Management	(Lafata et al. 2002) (Halbert et al. 1999)*	1. Assessment of participation • Recommended tests undertaken	1. Patient health status • HbA1c controlled • Lipids controlled
Physician prompt: patient specific recommendations	Management	(Grant et al. 2003)	1. Assessment of participation • Recommendations of prompt followed	n/a
Physician prompt: generalised recommendations	Management	(Sanders & Satyvavolu 2002)	1. Assessment of participation • Medication change	1. Patient health status • Blood pressure

HbA<sub>1c</sub> = glycosylated haemoglobin; n/a = not available. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### Effectiveness of prompts and reminders

There were three studies included in this review of effectiveness that used prompts or reminders to improve diabetes care (Lafata et al. 2002; Grant et al. 2003; Sanders & Satyvavolu 2002). One of these studies used reminders to patients about visiting their health professional, while the other two studies used prompts to the physicians to ensure appropriate care procedures were undertaken. These two different types of study will be discussed separately.

The study that used patient reminders was conducted in the USA and was set in a large group practice of 195 primary care physicians (Lafata et al. 2002). This study used the patient's birthday as the date for reminding of requirements for routine testing and screening. The reminder also included patient self-care information. The primary outcome was completion of recommended testing and examination. This study was of good quality (Lafata et al. 2002). It was a large study involving 3,309 patients who were randomised to intervention and control arms using a random number generator, and outcomes were measured using automated clinical and administrative systems. The authors state that there were no baseline differences between intervention and control patients on the outcomes of interest. Thus they compared odds ratios for follow-up measures alone. The study found that patient prompting was effective for increasing the proportion of patients who received the eye exam, although acknowledged that the differences were small. The study also showed a trend for the intervention group on the

process and impact measures concerning improved glycaemic testing and control, although again, the differences were small.

The two studies that prompted physicians to perform the recommended tests and examinations were both conducted in the USA. In one study of practitioners at a primary care clinic (Grant et al. 2003), evidence-based guidelines for the management of individual patients were generated and then emailed to the patient's physician and entered onto the electronic medical record. The primary process outcome measure was provider participation (behavioural change), specifically percentage of recommendations followed. This was an average quality non-randomised controlled trial. The intervention was implemented at one site, while a different site provided the control cohort. The authors deliberately matched the control patients to the intervention patients based on demographic and clinical variables so that the control cohort would be similar in terms of recommendations for testing and therapy, although the physicians at the control site would not receive these recommendations. The study was adjusted to account for possible effects of physician clustering. Baseline figures were presented, but not in a way that was comparable to the outcome measures; thus the study is not reported in Table 86. This study found that overall, there was a statistically significant increase in the number of recommendations followed, although differences for testing rates and therapy changes were not significant.

The other study was primarily concerned with the management of hypertension in diabetes (Sanders & Satyvavolu 2002). Guidelines about medication for hypertension were generated and the information was attached to the patient's notes before the consultation. As all the patients included in this study were hypertensive, the primary process outcome was a change in prescribing of anti-hypertensive medication. This poor quality study was described as a randomised controlled trial although there was no evidence that randomisation occurred appropriately. Patients who fit the eligibility criteria were selected from the patient populations of the intervention and control practices. The primary outcome measure was medication change, a physician indicator, although the trial was randomised by practice, thus resulting in a unit of analysis error. This is further compounded by the use of patient measures in the impact outcomes. The study found one statistically significant difference on baseline measures between intervention and control patients for systolic blood pressure but concluded the groups were comparable, and thus directly compared follow-up measures. The results could therefore not be included in Table 86.

Overall the evidence for patient and physician prompting is not convincing. These studies were not of particularly good quality and did not show any conclusive evidence for the effectiveness of patient reminders or physician prompting on diabetes management. At most, any improvements were small and not clinically important.

***Critical success factors of prompts and reminders in diabetes care:***

- Physicians may not follow prompts to comply with guidelines even when provided with good evidence for the need for treatment;
- There are other barriers to physicians following guidelines beyond the need for simple prompting;
- Study follow-up should be long enough to assess the impact of physician and patient prompts on metabolic control; and
- Tools with technology components such as computerised reminders, need to take into account hardware limitations and the information technology knowledge of the user.

Table 86. Effectiveness of prompts and reminders for diabetes care - Process and impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Process Outcomes – Assessment of physician participation (behavioural change)							
				<i>Test in last 12 months (6 months for HbA<sub>1c</sub>), % of patients</i>							
(Lafata et al. 2002)	Level II: RCT Quality: good	Patients of large group practice in USA	Prompts and reminders: mailed reminder about tests and scheduled appointments	Control N=1668			Intervention N=1641			Effect measure	
				Before	After	% change	Before	After	% change	Relative change Odds ratio [95% CI] <sup>a</sup>	
				HbA <sub>1c</sub>	59.8	58.9	-0.9	62.2	61.6	-0.6	0.7 1.1 [1.0, 1.3]
				LDL cholesterol	44.7	51.1	+6.4	48.0	54.3	+6.3	1.0 1.1 [1.0, 1.3]
				Eye exam	47.1	38.8	-8.3	49.9	43.8	-6.1	0.7 1.2 [1.1, 1.4]
				Impact Outcomes – Assessment of patients' health status, % of patients							
				HbA <sub>1c</sub> < 8%	30.6	42.1	+11.5	32.2	45.3	+13.1	1.1 1.1 [1.0, 1.3]
LDL < 100mg/dL	12.8	15.8	+3.0	12.8	17.0	+4.2	1.4 1.1 [0.9, 1.3]				

USA=United States of America; HbA<sub>1c</sub>=glycosylated haemoglobin; LDL=low density lipoprotein. <sup>a</sup> calculated on post-intervention measurements as there were no baseline differences between intervention and control patients.

## Feedback

Only one study was identified that use audit and feedback alone, and this study did not fulfil the eligibility criteria.

Table 87. Feedback for management of diabetes

Tool	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Feedback	Management	(Gilmet et al. 1998)*	N/E	N/E

N/E=not evaluated. \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Record Systems

There was were two studies identified that used a recording system to improve diabetes management; again these studies did not meet the inclusion criteria for an assessment of effectiveness in this review.

Table 88. Record systems for management of diabetes

Tool	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Record system	Management	(Sonksen & Williams 1996; Smith et al. 1998)*	N/E	N/E

N/E=not evaluated. \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Telemedicine

There were eleven studies identified that used telemanagement or telecare as a tool for improving diabetes services. Most of these studies were descriptive and did not fulfil the criteria for inclusion in the review. These studies are listed in Table 89.

## Alternative Care Approach

There has been a considerable amount of research into what type of care provider or care setting is most effective at delivering continuity of diabetes care. This is important as diabetes patients require ongoing management by health practitioners for regular testing and screening for complications, and they also need to maintain a high degree of self-management, highlighting the need for patient education. The evidence-base included 20 studies that compared the setting of care or the care provider for the management of diabetes, as shown in Table 90.

**Table 89. Telemedicine for the management of diabetes**

Tool	Level of care	Studies	Effect on service delivery	
			Process outcomes	Impact outcomes
Telemanagement	Management	(Bellazzi et al. 2002; Biermann et al. 2002; Edmonds et al. 1998; Gomez et al. 1996; Gomez et al. 2002; Lahtela & Lamminen 2002; Marrero et al. 1995; Piette et al. 2001; Piette et al. 2000a; Piette et al. 2000b; Whitlock et al. 2001)*	N/E	N/E

N/E=not evaluated. \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

**Table 90. Alternative care providers and care settings for the management of diabetes**

Tool <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Alternative care setting and provider: any studies comparing diabetes care provided by primary health professionals to that provided by hospital clinics.	Management	(Griffin & Kinmonth 2003)	1. Assessment of participation <ul style="list-style-type: none"> <li>• Patients receiving regular review and routine surveillance</li> </ul>	1. Patient health status <ul style="list-style-type: none"> <li>• Mortality</li> <li>• Metabolic control</li> <li>• Cardiovascular risk</li> </ul>
Alternative care setting and provider: general practice vs hospital clinic.	Management	(DICE 1994; Hayes & Harries 1984; Ho et al. 1997; Hurwitz et al. 1993; Van Loon et al. 2000)*	N/E	N/E
Alternative care provider: specialist diabetes nurse.	Management	(Aubert et al. 1998; Cavan et al. 2001; Davies et al. 2001; Day et al. 1992; Gary et al. 2003; Lenz et al. 2002; Loveman et al. 2003; Mazzuca et al. 1997; Taylor et al. 2003; Yong et al. 2002)*	N/E	N/E
Alternative care provider: other health provider	Management	(Cranor & Christensen 2003; Laffel et al. 1999)*	N/E	N/E
Alternative care setting: hospital vs outpatient clinic	Management	(Charron-Prochownik et al. 1997; Clar et al. 2003; Hoskins et al. 1985; Spaulding & Spaulding 1976)*	N/E	N/E

N/E=not evaluated. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## **Effectiveness of alternative care approach**

The sole available study that met the review inclusion criteria was a systematic review that compared provision of diabetes care by general practitioners as compared to hospital clinics (Griffin & Kinmonth 2003). The study participants were health professionals involved in the routine care of people with diabetes and included general practitioners, hospital specialists, nurses, optometrists, dietitians and chiropractors. The inclusion criteria for this review included outcome measures related to process of care, in particular completeness of screening, that is people having regular review and routine surveillance such as glycosylated haemoglobin and retinal exams. It also included a range of impact outcomes such as mortality, metabolic control, cardiovascular risk factors, and development of complications.

This systematic review produced by the Cochrane Collaboration was well designed and of good quality. The review identified five studies that fulfilled the eligibility criteria, and only two of these reported on process outcomes. The review found that there was considerable heterogeneity in the results from the trials, but concluded that this was due to the presence or absence of prompted recall in the general practice arm of the trials. The trials with prompting tended to favour general practice care. Results from the two studies that reported on process outcomes were combined to show that patients in prompted general practice were more likely to be reviewed and tested than those in hospital clinics (see Table 91). For the impact outcomes, mortality was significantly higher in the general practice group (Peto Odds Ratio (OR) 1.75, 95% CI 1.11, 2.74), although this was mostly accounted for by the trials that did not feature prompting in the general practice arm. When the prompted trials were considered separately, there was no difference in mortality between trial arms (Peto OR 1.06, 95% CI 0.53, 2.11). Overall the review found no differences between hospital clinics and general practitioners for metabolic control (weighted mean difference (WMD)  $-0.005\%$ , 95% CI  $-0.26, 0.25$ ) or for control of blood pressure (systolic- WMD 2.24, 95% CI  $-2.04, 6.53$ ; diastolic – WMD 0.52, 95% CI  $-1.64, 2.68$ ).

### ***Critical success factors for alternative care providers in diabetes care:***

- Care of diabetes patients in general practice without adequate prompting is possibly harmful;
- Regular prompted recall and review for patients with diabetes in general practice is effective for improving diabetes management, particularly ongoing patient review and testing; and
- General practice, overall, is no more effective at maintaining the metabolic or blood pressure control of diabetes patients than hospital clinics.

Table 91. Effectiveness of alternative care providers or care settings - Process and impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Process Outcomes – Assessment of provider participation (behavioural change)				
(Griffin & Kinmonth 2003)	Level I: systematic review  Quality: good	General practitioners	Alternative care approach: comparison of care by hospital clinics to care by general practitioners for people with diabetes.	<i>Mean number of diabetes patient reviews, WMD, 95% CI<sup>a</sup></i>				
				0.3 [0.1, 0.5]				
				<i>Mean number of HbA<sub>1c</sub> measurements, WMD, 95% CI<sup>a</sup></i>				
				1.6 [1.4, 1.8]				
				Impact Outcomes – Assessment of patient health status				
				Outcome	Number of studies contributing data	Statistical method <sup>b</sup>	Result [95% CI]	
				Mortality	4	Peto odds ratio	1.8 [1.1, 2.7]	
				HbA <sub>1c</sub>	4	WMD	0.0 [-0.3, 0.3]	
BP systolic	2	WMD	2.2 [-20.4, 6.5]					
BP diastolic	2	WMD	0.5 [-1.6, 2.7]					

WMD=weighted mean difference; HbA<sub>1c</sub>=glycosylated haemoglobin; BP=blood pressure. <sup>a</sup> meta-analysis combining two studies; <sup>b</sup> meta-analysis.

## Interdisciplinary Team Approach

Five studies were identified that used an interdisciplinary team approach to improve the management of diabetes.

Table 92. Interdisciplinary care for management of diabetes

Tool <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Interdisciplinary team approach	Management	(Wagner et al. 2001b) (Courtney et al. 1997; Glasgow et al. 2002; Graber et al. 2002; Grey et al. 2002; Ovhed et al. 2000; Wagner et al. 2001a)*	1. Assessment of participation • Tests completed	1. Patient health status • HbA1c • Total cholesterol • SF-36

HbA<sub>1c</sub>=glycosylated haemoglobin; SF-36=short form – 36 item questionnaire. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

### Effectiveness of interdisciplinary team approach

The only study evaluated in this category (Wagner et al. 2001b) assessed a chronic care clinic in the USA, in which patients had visits with the physician, nurse and pharmacist, as well as group education. This was compared to usual care given by primary care providers. The process outcome measure was provider participation (behavioural change) as determined by completion of recommended procedures and tests. The impact outcomes concentrated on patient health status, through the measurement of metabolic control, cholesterol levels and functional status. The study was classified as a quasi-randomised controlled trial as no details of randomisation are given, and it was of average quality. The study randomised physician practices and controlled for within-practice correlations in the statistical analyses. In addition, baseline measures were adjusted where they were available, and so follow-up measures are directly compared. The study found few statistically significant differences in the proportion of intervention and control patients receiving recommended procedures, although there was an overall trend towards better completion in the intervention group, as shown in Table 93. The impact outcomes showed no difference in glycosylated haemoglobin or cholesterol levels between the two groups, or for the physical function or limitation of physical role impact measures. However, there was a benefit to the intervention group on the measure of general health and a reduction in the proportion of patients experiencing bed disability days (Table 93).

It is difficult to assess the effectiveness of the interdisciplinary team approach from a single study, however the evidence suggests that interdisciplinary care may be beneficial in ensuring completion of recommended procedures, and it does not appear to cause harm for those impact outcomes studied.

***Critical success factors of interdisciplinary team approach:***

- Interdisciplinary care requires substantial administrative support and coordination of services;
- Training for health personnel and communication between personnel are imperative; and
- In this trial, extra personnel associated with the study helped to provide the service, rather than existing staff being re-organised. This will have an impact on the sustainability of the program when study funding comes to an end and study personnel are no longer available.

Table 93. Effectiveness of interdisciplinary team approach - Process and impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Assessment of participation (behavioural change)							
				<i>Recommended procedures undertaken, % of patients</i>							
(Wagner et al. 2001b)	Level III-1: quasi-RCT Quality: average	Physicians, nurses, pharmacists	Interdisciplinary team approach: chronic care clinics	Control			Intervention			Effect measure	
				Before N=429	After N=339	% change	Before N=278	After N=242	% change	Relative change P value <sup>a</sup>	
				Medication review	57.1	60.5	+3.4	61.2	68.8	+7.6	2.2 $p=0.13$
				Retinal eye exam	62.2	63.5	+1.3	60.6	67.9	+7.3	5.6 $p=0.27$
(Wagner et al. 2001b)	Level III-1: quasi RCT Quality: average	Physicians, nurses, pharmacists	Interdisciplinary team approach: chronic care clinics	Outcomes - Assessment of patient health status				Effect measure			
				Control N=429			Intervention N=278			Relative change P value <sup>a</sup>	
				Before	After	% change	Before	After	% change		
				HbA <sub>1c</sub> (%)	7.4	7.9	+0.5	7.5	7.9	+0.4	0.8 $p=0.99$
				Total cholesterol (md/dl)	217.5	204.6	-5.9	215.1	202.8	-5.7	1.0 $p=0.58$
				General health (SF-36, mean)	44.5	44.0	-1.1	45.7	46.8	+2.4	2.2 $p=0.03$
				Physical function (SF-36, mean)	68.3	58.5	-14.3	67.0	59.3	-11.5	0.8 $p=0.69$
				Physical role limitation (SF-36, mean)	55.8	57.1	+2.3	55.0	56.4	+2.5	1.1 $p=0.82$
				Bed disability days (%≥1)	34.9	39.4	+4.5	34.2	31.5	-2.7	0.6 $p=0.02$
Restricted activity days (%≥1)	40.6	42.9	+2.3	45.1	40.7	-4.4	1.9 $p=0.59$				

HbA<sub>1c</sub>=glycosylated haemoglobin; SF-36=short form 36 health status questionnaire item, 0=worst 100= best. <sup>a</sup> comparison of post-intervention outcomes, with statistical analysis controlling for baseline differences.

## **Multi-faceted Interventions**

Studies that implemented multi-faceted interventions to manage diabetes are numerous. They characteristically utilise at least two of the tools previously outlined, often in many and varied combinations. As shown in

Table 94, 21 studies were identified that used a multi-faceted intervention to address diabetes management.

Table 94. Multi-faceted interventions for the management of diabetes

Tools <sup>a</sup>	Level of care	Studies	Effect on service delivery <sup>b</sup>	
			Process outcomes	Impact outcomes
Patient-centred care: disease and/or case management	Management	(Norris et al. 2002) (Sadur et al. 1999)*	1. Assessment of participation • Recommended procedures and tests completed	1. Patient health status • HbA1c • Total cholesterol • Function • BMI • Blood pressure 2. Patient satisfaction
Organisational interventions Professional interventions Financial incentives	Management	(Renders et al. 2004)  (Carlson & Rosenqvist 1991; Deeb et al. 1988; de Sonnaville et al. 1997; Joshi & Bernard 1999; McCullough et al. 1998; Sperl-Hillen et al. 2000)*	1. Assessment of participation • Recommended tests and procedures completed	1. Patient health status • Mortality • HbA1c • Cardiovascular risk factors • Complications • Functional status
Education Feedback	Management	(Frijling et al. 2002) (Hirsch et al. 2002)*	1. Assessment of participation • Recommended tests and procedures completed	1. Patient health status • HbA1c
Clinical practice guidelines Education Feedback: audit and feedback Prompts and reminders: registry and recall system	Management	(Renders et al. 2001a)	1. Assessment of participation • Recommended tests and procedures completed	1. Patient health status • HbA1c • Blood pressure • Lipids • BMI
Feedback: audit and feedback Prompts and reminders: prompts	Management	(Schmidt et al. 2003) (White 2001)*	1. Assessment of participation • Recommended tests and procedures completed	1. Patient health status • HbA1c • Blood pressure • Lipids

Table 94 (cont.) Multi-faceted interventions for the management of diabetes

Education Prompts and reminders: recall and reminder system	Management	(McDermott et al. 2001)	1. Assessment of participation • Recommended tests and procedures completed	1. Patient health status • Complications requiring hospitalisation
Clinical practice guidelines Education Prompts and reminders: registry for prompting providers and patients	Management	(Boucher et al. 1987; Clark et al. 2001; Montori et al. 2002; Nuckolls 2003; Roman & Chassin 2001)*	Duplicated in review by Renders, 2001 (above)	
Feedback: audit and feedback, benchmarking	Management	(Kiefe et al. 2001)*	N/E	N/E
Education Prompts and reminders	Management	(Stroebel et al. 2002)*	N/E	N/E
Education Feedback: audit Prompts and reminders: prompts Alternative care approaches: alternative care providers	Management	(Sutherland et al. 2001)*	N/E	N/E
Clinical practice guidelines Audit and feedback: audit	Management	(Varroud-Vial et al. 1999; Varroud-Vial et al. 2001)*	N/E	N/E
Clinical practice guidelines Education	Management	(Wilczynski et al. 1999)*	N/E	N/E
CQI Prompts and reminders: registry for recalls	Management	(Harwell et al. 2002)*	N/E	N/E

HbA<sub>1c</sub>=glycosylated haemoglobin; BMI=body mass index; N/E=not evaluated; CQI=continuous quality improvement. <sup>a</sup> more detailed description of intervention is provided in the study profiles of those studies that met the inclusion criteria (Appendix E); <sup>b</sup> more detailed information on the impact of the service improvement tool is provided in the Effectiveness section; \* studies were not evaluated for effectiveness due to failure to satisfy the inclusion criteria.

## Effectiveness of multi-faceted interventions

There was one large systematic review that evaluated disease management and case management (Norris et al. 2002). Disease management aims to ‘improve care, outcomes and costs for individuals and populations with diabetes’, and is ‘organised, proactive, population-based (and) integrated’ (Norris et al. 2002). The review by Norris focussed on interventions in community settings, those involving populations, and those aimed at improving health care systems. Thus it is highly relevant to this review. The essential components of disease management were defined as:

1. The identification of the population with diabetes or a subset with specific characteristics;
2. Guidelines or performance standards for care;
3. Management of identified people; and

4. Information systems for tracking and monitoring (Norris et al. 2002).

Case management was also considered in this review and was defined as ‘the assignment of authority to a professional (the case manager) who is not the provider of direct health care but who oversees and is responsible for coordinating and implementing care’ (Norris et al. 2002). The essential components of case management were:

1. Identification of eligible patients;
2. Assessment;
3. Development of an individual care plan;
4. Implementation of the care plan; and
5. Monitoring of outcomes.

This systematic review included only studies that were conducted in established market economies and that used comparative study designs. It was of good quality and comprehensively reported. The authors used quality criteria to assess eligibility for the review, as well as other criteria such as those given for disease or case management. The review identified 27 eligible studies for disease management and 15 for case management. The authors reported the mean changes found in all the relevant studies and they are reproduced in Table 95. Meta-analysis was not undertaken. For both disease management and case management, the evidence appears to be strongly in favour of the intervention. The authors conclude that for disease management, strong evidence existed for improvement of provider compliance with annual monitoring of glycosylated haemoglobin and retinopathy, and that sufficient evidence existed for the effectiveness of disease management with regard to screening for foot lesions, peripheral nephropathy, lipid concentrations and proteinuria (results on absolute differences were unable to be extracted from graph) (Norris et al. 2002). The evidence for the effectiveness of case management was not as strong, with the authors stating that there was sufficient evidence for effectiveness with regard to monitoring of glycosylated haemoglobin, but insufficient evidence for the other outcomes.

A second systematic review of multi-faceted interventions evaluated the effectiveness of components of the chronic care model (Bodenheimer et al. 2002). This review was an update of a Cochrane review completed the previous year (Renders et al. 2001a) but did not report results in sufficient detail for data extraction. The original review has therefore only been included for assessment (Renders et al. 2001a). The interventions that qualified for this review included:

1. Professional interventions (such as education, audit and feedback);
2. Organisational interventions (such as revision of professional roles, changes in medical record systems and arrangements for follow-up);
3. Financial interventions (such as fee-for-service and grants); and
4. Combinations of these (Renders et al. 2001a).

The systematic review was of good quality (Renders et al. 2004). The selection criteria were similar to this review and methodological quality was assessed using Cochrane

Effective Practice and Organisation of Care methods. The authors identified 27 relevant randomised controlled trials, 12 relevant controlled before-and-after studies, and two interrupted time series studies. In all included studies the targeted behaviour was the general management of people with diabetes, and different studies focused on more regular review, clinical prevention services, referrals, record keeping, professional-patient communication, patient education/advice, patient outcomes or combinations of these. The authors decided *a priori* not to conduct a meta-analysis as they expected considerable heterogeneity in study interventions, settings and patient populations. As would be expected in a review of this nature, methodological quality varied considerably on all aspects assessed. The authors specifically identified high dropout rates among patients and unit of analysis errors as limitations (Renders et al. 2004).

Results indicate that professional interventions, including postgraduate education in combination with reminders, audit and feedback, educational outreach visits, or combinations of these, improved diabetes care provided that the diabetes care was not of a good standard at baseline. The effect on impact outcomes was less clear. For organisational interventions, changes to medical record systems improved process outcomes, as did the combination of a multidisciplinary team with case management and patient education. However other outcomes were difficult to interpret due to methodological limitations. Studies that evaluated a combination of professional and organisational interventions consisted of complex interventions. The authors found that computerised reminders for care providers, audit and feedback, or a combination of these, improved process outcomes, as did a centrally organised, computerised database. However these complex interventions did not have any impact on patient outcomes. In studies where patient outcomes were assessed, greater involvement of nurses in diabetes management was beneficial to the patient. Studies with positive effects on patient outcomes tended to include patient education.

Overall the reviewers concluded that postgraduate education in combination with other professional interventions, and increased structured recall, improves the process of diabetes care, but the effect on impact outcomes is less clear. Patient education or the addition of an enhanced nurses role to a complex intervention improves impact outcomes as well as process outcomes (Renders et al. 2004).

There were also four comparative studies that considered multi-faceted interventions. The first of these was a randomised controlled trial of good quality, conducted with general practitioners in The Netherlands, and involving feedback and support from a facilitator (Frijling et al. 2002). The facilitator visited practices and discussed the feedback reports with general practitioners, and provided guidance, support and educational materials. Baseline and follow-up measures were taken during 2 month sample periods before the intervention and after 21 months of the intervention (Table 95). The study found compliance improved significantly for the outcomes relating to foot (OR 1.7, 95% CI 1.2, 2.4,  $p=0.004$ ) and eye exam (OR 1.5, 95% CI 1.1, 2.2,  $p=0.02$ ), and approached significance on the medication review measure (OR 1.5, 95% CI 1.0, 2.3,  $p=0.057$ ). No other statistically significant differences were found, although the overall trend was for better compliance in the intervention group. The study found no significant difference on the proportion of patients with uncontrolled blood glucose – the impact outcome ( $p>0.3$  using multi-level analysis - no further details provided).

The second of these comparative studies was a cluster randomised trial of average quality conducted in remote indigenous communities in the Torres Strait Islands and on the tip of Cape York, Australia (McDermott et al. 2001). The intervention involved setting up a

recall system at the intervention primary health centres, along with education, project support and a workshop. Health centres were randomly allocated to intervention and control groups by selection out of a hat. An extensive audit of patient records in relation to diabetes practices provided the baseline and follow up measures; this also resulted in differing numbers of patients at baseline and follow-up as the diabetes registers were updated after the baseline audit. The authors stated that there was little difference at baseline in diabetes indicators between control and intervention sites, thus statistical testing was performed on the compliance rates at follow-up between the two groups. However, outcomes were measured on patients rather than health centres resulting in a unit of analysis error. No adjustments were made for the effects of clustering in the results and thus there is likely to have been an over-estimation of the statistical significance of any differences between the groups. Precision estimates (i.e. p values) are therefore not provided with the results in Table 95 and Table 96. The intervention was found to improve nearly all diabetes indicators (Table 95), however it should be noted that the proportion of patients with a blood pressure measurement in the last six months decreased in both the control and intervention groups. The impact outcome of admission to hospital for diabetes complications showed that the intervention group had a four-fold decrease in the proportion of patients admitted to hospital when compared to the control group (Table 96).

The third comparative study was Dutch, non-randomised study and of poor quality (Renders et al. 2001a). The tool was implemented with general practitioners, and involved clinical practice guidelines, education sessions (through meetings), diabetes templates for registration of care and a central recall system. Because the participants in this study were volunteers, results are likely to be affected by selection bias - volunteer GPs were likely to be more motivated to implement the tool than if they had been randomly allocated to a trial arm. Although the tool was implemented by GPs, the unit of analysis was the patient. The authors used multi-level analysis to adjust for clustering of patients in practices, and also adjusted their analyses for baseline measures. Limitations of the study included the small sample sizes and substantial losses to follow-up at the final measurement time of 42 months. The study found considerable improvement on process measures for both intervention and control groups (Table 95), although the authors do not discuss why such improvements would be made with the group not receiving any support. The intervention group's patients did receive care more in accordance with guidelines, and the difference was particularly noticeable for the measurement of blood pressure (OR 12.1, 95% CI 4.7, 31.0). The authors note that most of the gain for the intervention group was made in the first 18 months of the study. The impact outcomes reflected no differences between the intervention and control groups, despite the improvements in recommended care (Table 96).

The fourth comparative study was of poor quality and conducted with outpatient clinics of a university family practice department in the USA (Schmidt et al. 2003). Physicians were the target group for this intervention and the trial had two experimental arms. Both groups were provided with a diabetes flow sheet to remind physicians of the guidelines for diabetes management. One of the experimental arms was also provided with feedback from the results of chart audits. Six outpatient clinics were chosen, based on clinic characteristics, to receive either intervention 1, intervention 2 or to the control condition. Baseline and follow-up measures were taken using a random sample of diabetes patients' charts at each clinic. Sample sizes were small with only 35 charts reviewed in each of the intervention clinics and 140 from the control clinic. A unit of analysis error occurred as allocation was by clinic but statistical analysis was at the level

of the patient. Results are therefore likely to over-estimate the statistical significance of any differences between the groups, and as such precision estimates (p values or confidence intervals) are not provided in Table 95 and Table 96. The study found considerable differences in baseline measures between the clinics, possibly reflecting their rural or urban status. Table 95 shows that the intervention arm receiving both guidelines and feedback improved more than the other two arms and the guidelines-only arm also fared better than the control group. The results for the impact outcomes can be seen in Table 96 and appear to be in the right direction, although the level of the change may not be clinically important.

***Critical success factors of multi-faceted interventions in diabetes care:***

- The strongest evidence for the use of multi-faceted interventions comes from the two systematic reviews in this category;
- Both reviews found that these types of interventions were successful in improving the relevant process outcomes, but the evidence for effect on impact outcomes was less convincing;
- In multi-faceted interventions, it is impossible to isolate the effects of the individual interventions. This means that complex strategies may be implementing some interventions that have no evidence of effectiveness; and
- The addition of patient education to a complex intervention strategy improves impact outcomes.

Table 95. Effectiveness of multi-faceted interventions - Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of provider participation (behavioural change)						
				<i>Provider monitoring and screening</i>	Number of studies contributing data	Mean % change, [inter-quartile range] <sup>a</sup>				
(Norris et al. 2002)	Level I: systematic review Quality: good	Providers of diabetes care (not specified)	Patient-centred care: diabetes disease management	<i>Provider monitoring and screening</i>						
				Glycosylated haemoglobin	15	15.6 [4.0, 39.0]				
				Lipid concentrations	9	24.0 [21.0, 26.0]				
				Dilated eye exams	15	9.0 [3.0, 20.0]				
				Foot exams	9	26.5 [10.9, 54.0]				
				Proteinuria	7	9.7 [0, 44.0]				
			Patient-centred care: diabetes case management	Glycosylated haemoglobin	5	33.0 [13.0, 42.0]				
				Lipid concentrations	4	30.0 [24.0, 44.0]				
				Dilated eye exams	4	35.0 [4.0, 76.0]				
				Foot exams	2	Results not pooled: study results 54% and 84%				
Proteinuria	3	Results not pooled: study results 44%, 63% and OR 1.65								
(Frijling et al. 2002)	Level II: RCT Quality: good	General practitioners in The Netherlands	Education	<i>GP compliance with recommendations, compliance rate % (based on number of decisions)<sup>b</sup></i>						
			Feedback	Control			Intervention		Effect measure <sup>c</sup>	
			Feedback and support, including guidance and education, from a facilitator	Before N=62	After N=60	% change	Before N=62	After N=61	% change	Relative change OR [95% CI], P value
			Foot exam	39	48	+8.0	43	62	+19.0	2.4 1.7 [1.2, 2.4], p=.004
			Eye exam	67	65	-2.0	70	79	+9.0	4.5 1.5 [1.1, 2.2], p=0.02
			Medication review	61	66	+5.0	65	73	+8.0	1.6 1.5 [1.0, 2.3], p<0.05
			BP measurement	92	95	+3.0	94	97	+3.0	1.0 1.3 [0.7-2.5], p=0.37
			Medication change	37	47	+10.0	33	44	+11.0	1.1 1.1 [0.7, 1.9], p=0.61

Table 95 (cont.) Effectiveness of multi-faceted interventions - Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of provider participation (behavioural change)							
Cont. (Frijling et al. 2002)	Level II: RCT Quality: good	General practitioners in The Netherlands	Education Feedback	<i>GP compliance with recommendations, compliance rate % (based on number of decisions)<sup>b</sup></i>				Effect measure <sup>c</sup>			
				Control			Intervention			Relative change	
				Before N=62	After N=60	% change	Before N=62	After N=61	% change	OR [95% CI], P value	
				Schedule follow-up	70	65	-5.0	70	66	-4.0	0.8 1.0 [0.7, 1.5], <i>p</i> =0.81
BMI review	59	64	+5.0	62	66	+4.0	0.8 1.0 [0.7, 1.5], <i>p</i> =0.96				
(McDermott et al. 2001)	Level II: RCT Quality: average	Primary care providers in primary health care centres in remote northern Australia and islands.	Education Prompts and reminders: recall and reminder system, education, support from project officer	<i>Health care provider compliance with recommendations, % patients with recommendation followed<sup>b</sup></i>				Effect measure			
				Control N=305			Intervention N=250			Relative change	
				Before	After	% Change	Before	After	% Change		
				Weight check	56	63	+7.0	54	74	+20.0	2.9
				BP check	64	57	-7.0	76	65	-9.0	1.3
				Foot check	52	55	+3.0	60	72	+12.0	4
				Podiatrist check	17	12	-5.0	8	45	+37.0	7.4
				Eye check	30	46	+16.0	30	59	+29.0	1.8
				Ophthalmologist check	18	22	+4.0	21	25	+4.0	1
				Lipids checked	54	70	+16.0	57	88	+31.0	1.9
				HbA1c checked	60	62	+2.0	70	73	+3.0	1.5
				Urinary albumin/ creatinine ratio checked	47	72	+25.0	48	83	+35.0	1.4
				Serum creatinine checked	66	73	+7.0	68	86	+18.0	2.6
Flu vaccination	54	49	-5.0	55	57	+2.0	0.4				

Table 95 (cont.) Effectiveness of multi-faceted interventions - Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of provider participation (behavioural change)							
				<i>Physician completion of recommended tests and procedures, % of patients tested</i>							
				Control			Effect measure				
				Before N=77	After N=41	% change	Before N=312	After N=229	% change	Relative change OR [95% CI] <sup>d</sup>	
(Renders et al. 2001a)	Level III-2: non randomised trial Quality: poor	General practitioners in The Netherlands	Clinical practice guidelines Education Feedback: audit and feedback Prompts and reminders: template to register diabetes care and a recall system.	≥ 4 diabetes visits	32.5	43.9	+11.4	48.7	72.1	+23.4	2.1 3.6 [1.7, 7.7]
				≥1 HbA1c measure	15.6	29.3	+13.7	34.9	75.5	+40.6	3.0 3.6 [1.6, 8.1]
				≥1 BP measure	41.6	34.1	-7.5	68.3	82.3	+14.0	1.9 12.1 [4.7, 31.0]
				≥ 1 total cholesterol measure	10.4	29.3	+18.9	35.3	73.4	+38.1	2.0 4.4 [1.8, 10.5]
				≥1 HDL measure	5.2	24.4	+19.2	16.0	60.7	+44.7	2.3 3.1 [1.4, 7.1]
				≥ 1 triglyceride measure	5.2	26.8	+21.6	17.6	59.4	+41.8	1.9 3.0 [1.3, 6.8]
				≥ 1 creatinine measure	11.7	26.8	+15.1	36.5	74.7	+38.2	2.6 3.8 [1.6, 9.1]
				≥ 1 albumin measure	3.9	14.4	+10.5	17.9	53.7	+35.8	3.4 2.5 [1.0, 5.8]
				≥ 4 weight reviews	2.6	12.2	+9.6	14.4	37.1	+22.7	2.4 3.8 [1.0, 13.8]

Table 95 (cont.) Effectiveness of multi-faceted interventions - Process outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Assessment of provider participation (behavioural change)					
				<i>Physician compliance with recommendations, % of patients assessed<sup>e</sup></i>					
				Control N=161	Intervention 1 N=35		Intervention 2 N=35		
				% change <sup>f</sup>	% change <sup>f</sup>	Relative change	% change <sup>f</sup>	Relative change	
(Schmidt et al. 2003)	Level III-2: non randomised trial Quality: poor	Physicians in outpatients departments of a university department of family medicine in the USA	Prompts and reminders: diabetes flowsheet to prompt recommended care (intervention 1) Feedback: received provider feedback from chart audit. (intervention 2)	HbA1c	-3.0	-0.1	0.0	+6.1	2.0
				Eye exam	-7.7	-1.8	0.2	-0.3	0.0
				Foot exam	+1.3	+23.0	17.7	+60.4	46.5
				Nephropathy test	-11.9	0.4	0.0	+2.7	0.2

OR=odds ratio; BP=blood pressure; BMI=body mass index; HbA<sub>1c</sub>=glycosylated haemoglobin; HDL=high density lipoproteins. <sup>a</sup> positive change equates to better performance in the intervention group; <sup>b</sup> data are rounded to whole number; <sup>c</sup> odds ratio adjusted in multilevel analysis for baseline compliance, practice characteristics, patients' age and gender; <sup>d</sup> adjusted for sex, age, duration of diabetes, region, treatment and baseline value; <sup>e</sup> data are rounded to one decimal place; <sup>f</sup> pre- and post-intervention scores not included due to space restrictions - available on request.

Table 96. Effectiveness of multi-faceted interventions - Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes - Patient health status			
				Outcome	Number of studies contributing data	Mean change, [inter-quartile range] <sup>a</sup>	
(Norris et al. 2002)	Level I: systematic review Quality: good	Unspecified-providers of diabetes care	Patient-centred care: diabetes disease management	Glycosylated haemoglobin (%)	19	-0.5 [-1.25, -0.10]	
				Lipid concentrations (mg/dL)	4	Results not pooled: Total cholesterol: -4.7 and -12.0 LDL: -4.3 and 4.2	
				BMI	4	0.45 [-0.9, 1.5]	
				Blood pressure	5	Systolic: 0.9 [-10.0, 3.1] Diastolic: -1.6 [-4.0, 0.1]	
				Quality of life	1	Improvement $p < 0.03$	
				Glycosylated haemoglobin %	11	-0.5 [-0.65, -0.46]	
			Patient-centred care: diabetes case management	Patient-centred care: diabetes case management	Glycosylated haemoglobin %	3	-0.4 [-0.6, -0.16]
					Lipid concentrations	3	Results not pooled: Total cholesterol: -4.7 and 0.0 LDL: +4.2
					BMI	1	0.3
					Blood pressure	2	Results not pooled Systolic: -20.5 and -4.2 Diastolic: -6.1 and -2.3
					Quality of life	2	Improved in both studies ( $p = 0.07$ and $p < 0.03$ )

Table 96 (cont.) Effectiveness of multi-faceted interventions - Impact outcomes

Study	Level and quality of evidence	Target population	Intervention	Outcomes – Patient health status							
							Effect measure <sup>a</sup>				
(Frijling et al. 2002)	Level II: RCT Quality: good	General practitioners in The Netherlands	Education Feedback Feedback and support, including guidance and education, from a facilitator	<i>% of patients with uncontrolled blood glucose (patient numbers not provided)</i>							
				Control			Intervention				
				Before	After	% change	Before	After	% change	Relative change P value	
				37.1	33.8	-3.3	39.0	35.6	-3.4	1.1 <i>p</i> >0.3	
(McDermott et al. 2001)	Level II: RCT Quality: average	Primary care providers in primary health care centres in remote northern Australia and islands.	Education Prompts and reminders: recall and reminder system, education, support from project officer	Outcomes – Patient complications							
				<i>% of patients admitted to hospital with diabetes related complications</i>							
				Control			Intervention			Effect measure	
				Before N=305	After N=396	% change	Before N=250	After N=282	% change	Relative change	
22.0	20.0	-2.0	20.0	12.0	-8.0	4.0					
(Renders et al. 2001a)	Level III-2: non randomised trial Quality: poor	General practitioners in The Netherlands	Clinical practice guidelines Education Feedback: audit and feedback Prompts and reminders: template to register diabetes care and a recall system.	Outcomes – Patient health status							
				<i>Physiological outcomes at 42 months follow-up, proportion of patients</i>							
					Control			Intervention			Effect measure
					Before N=77	After N=34	% change	Before N=312	After N=197	% change	Relative change OR [95% CI] <sup>b</sup>
				HbA1c <7%	45.8	35.7	-10.1	41.0	44.7	+3.7	0.4 1.1 [0.5, 2.3]
				HbA1c ≤ 8.5	72.2	78.6	+6.4	67.8	83.0	+15.2	2.4 1.2 [0.6, 2.2]
				BP systolic ≤140	31.1	47.8	+16.7	31.0	43.4	+12.4	0.7 1.0 [0.6, 1.6]
BP systolic ≤160	63.5	82.6	+19.1	69.0	78.0	+9.0	0.5 1.3 [0.7, 2.1]				

Table 97. Effectiveness of multi-faceted interventions - Impact outcomes

				BP diastolic $\leq$ 90	59.5	91.3	+31.8	79.7	83.6	+3.9	0.1 0.7 [0.4, 1.4]
				BP diastolic $\leq$ 95	68.9	91.3	+22.4	86.1	92.5	+6.4	0.3 0.4 [0.2, 1.0]
				Total cholesterol <5.2 mmol/l	22.2	33.3	+11.1	21.0	27.9	+6.9	0.6 1.1 [0.6, 2.1]
				Total cholesterol <6.5 mmol/l	77.8	66.7	-11.1	68.3	72.1	+3.8	0.3 1.0 [0.5, 1.9]
				HDL >1.1 mmol/l	47.2	61.9	+14.7	44.1	54.2	+10.1	0.7 0.9 [0.5, 1.7]
				HDL $\geq$ 0.9 mmol/l	83.3	85.7	+2.4	85.0	88.2	+3.2	1.3 1.6 [0.7, 3.4]
				Triglycerides <1.7 mmol/l	47.9	52.4	+4.5	46.1	44.8	-1.3	0.3 0.8 [0.4, 1.5]
				Triglycerides <2.2 mmol/l	74.6	57.1	-17.5	69.0	73.8	+4.8	0.3 1.1 [0.6, 2.2]
				BMI <25	29.9	31.8	+1.9	32.1	24.2	-7.9	4.2 0.8 [0.4, 1.7]
				BMI <27	55.8	54.5	-1.3	52.6	43.6	-9.0	6.9 1.3 [0.5, 3.3]
(Schmidt et al. 2003)	Level III-2: non randomised trial Quality: poor	Physicians in outpatients departments of a university department of family medicine in the USA	Prompts and reminders: diabetes flowsheet to prompt recommended care (intervention 1) Feedback: received provider feedback from chart audit. (intervention 2)	Outcomes – Patient health status							
				% of patients	Control	Intervention 1		Intervention 2			
					% change <sup>c</sup>	% change <sup>c</sup>	Relative change	% change <sup>c</sup>	Relative change		
				HbA <sub>1c</sub> <8%	-5.1	6.4	1.3	-1.0	0.2		
				HbA <sub>1c</sub> >9.5%	-8.6	-39.9	4.6	-14.3	1.7		
				LDL<130 mg/dl	21.3	-1.4	0.1	-11.7	0.5		
BP< 140/90	-1.3	17.3	13.3	5.9	4.5						

LDL=low density lipoprotein; BMI=body mass index; HbA<sub>1c</sub>=glycosylated haemoglobin; BP=blood pressure; HDL=high density lipoprotein. <sup>a</sup> multilevel analysis used to test the difference between intervention and control groups; <sup>b</sup> adjusted for age, sex, duration of diabetes, region, treatment and baseline value; <sup>c</sup> pre- and post-intervention scores not included due to space restrictions - available on request.

## ***Critical success factors of tools for diabetes***

This assessment of service improvement tools for the management of diabetes indicates that decision support tools are not effective. The studies report relatively poor uptake of the tools by clinicians, which is attributed to barriers in both the use of a computerised system and to the content of the clinical practice guidelines.

Overall the evidence for patient and physician prompting is not convincing. These studies were not of particularly good quality and did not show any conclusive evidence for the effectiveness of patient reminders or physician prompting on diabetes management. At most, any improvements were small and not clinically important.

Similar results were found in the assessment of alternative care approaches (providers or settings). Management of diabetes patients in general practice was no more effective than management in hospital clinics.

Limited evidence regarding the interdisciplinary team approach suggests that interdisciplinary care may be beneficial in ensuring completion of recommended procedures, and it does not appear to cause harm for those impact outcomes studied.

Multi-faceted interventions were successful in improving the relevant process or service-related outcomes, but evidence of an effect on the patient-relevant (impact) outcomes was less convincing. In multi-faceted interventions, it is impossible to isolate the effects of the individual interventions. This means that complex strategies may be implementing some interventions that have no evidence of effectiveness.

Factors that appear critical to the success of service improvement tools for the management of diabetes, include:

- The tool should be practical and easily integrated into clinical practice;
- The health care provider should be motivated to comply with or utilise the tool;
- The tool should be implemented for long enough to assess the impact on provider compliance and patient health status;
- Tools with technology components such as computerised reminders, need to take into account hardware limitations and the information technology knowledge of the user.
- Interdisciplinary care requires substantial administrative support, coordination of services, and communication between personnel; and
- The addition of patient education to a complex intervention strategy improves impact outcomes.

# Conclusions

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A multiplicity of tools have been used to improve health service delivery in and across the different National Health Priority Areas and across the continuum of care. Tools have been identified that are universally applicable, while others have only been tested or utilised in a specific disease area such as arthritis and musculoskeletal conditions, asthma, cancer, cardiovascular diseases and stroke, and diabetes.

## Research question 1:

*What tools (international, national and jurisdictional) have been used to improve health service delivery in the National Health Priority Areas?*

Thirteen categories of health service improvement tools have been identified in the 455 studies found in the international, national and jurisdictional literature. They include:

- **Clinical Practice Guidelines** - systematically developed statements (either consensus or evidence-based) to assist health care providers make decisions about appropriate health care for specific clinical circumstances.
- **Continuous Quality Improvement** - an iterative process of problem-solving and group decision-making that centres on the analysis of organisational systems and work processes, and is designed to deliver improvements in health outcomes.
- **Educational tools** - any replicable educational activity or program intended to improve the performance of health care providers and the health status of patients through increased knowledge. For example, educational materials, continuing medical education, educational outreach (academic detailing), and opinion leaders.
- **Decision support** – computerised or written protocols that are aimed at assisting the patient or health care provider make health care decisions.
- **Prompts and reminders** - any intervention (computerised or written) that prompts the health care provider or patient to perform a clinical action, particularly in the promotion of well-established and effective clinical practices.
- **Feedback** - involves evaluating the performance and consequences of health care decisions or actions after they have been made. This includes audit and feedback, which summarises clinical performance over a specified period, and according to specified benchmarks, with or without recommendations for clinical action.
- **Financial incentives** - involve some form of payment system, whereby individual health care providers receive remuneration that directly affects their personal disposable income.
- **Record systems** – any system developed for the storage and exchange of information. Record systems vary considerably and include manual or

computerised versions, centrally-held or patient-held records, and structured or unstructured systems.

- **Telemedicine** - involves the use of telecommunications as a medium to deliver medical services to sites distant from the health care provider. It utilises conventional telephone services, computer modems, satellites, and other equipment or software to transmit and receive data.
- **Patient-centred approach** - involves shared decision-making between patients and health care providers concerning interventions or management of patients' illnesses, as well as an holistic approach to treatment with the focus on the patient as a person, rather than the illness.
- **Alternative care approaches** – use an alternative setting for health care or a different health care provider than that traditionally utilised.
- **Interdisciplinary approaches** – involve representatives of different health disciplines working collaboratively to tailor treatment and management options and strategies to a particular patient.
- **Multi-faceted interventions** - employ two or more tools (such as those described above) to address several aspects of health care from a variety of perspectives.

## Research question 2:

*How have these tools been implemented across the continuum of care – prevention, detection, treatment, management (primary and acute settings), rehabilitation and palliation?*

Service improvement tools were found to address the health care continuum as depicted in Table 98.

Table 98. Application of health service improvement tools across the continuum of care

Tool Area	Prevention	Detection	Treatment	Management	Rehabilitation	Palliation
Universally applicable	✓	✓	✓	✓	✗	✓
Arthritis and musculoskeletal conditions	✗	✓	✓	✓	✓	✗
Asthma	✗	✓	✓	✓	✗	✗
Cancer	✓	✓	✓	✓	✗	✓
Cardiovascular diseases	✓	✓	✓	✓	✓	✗
Diabetes	✗	✗	✗	✓	✗	✗

### Research question 3:

*Have these tools been successful in improving health care? If so, what factors have contributed to their success?*

Although thirteen categories of tools were identified for this systematic review, information on the effectiveness of these tools at improving health care was limited. Overall, seventy-eight studies were included in this assessment of the effectiveness of universally applicable tools, as well as of tools addressing each of the National Health Priority Areas. From these studies it is clear that only a sub-set of these tools are effective at improving the delivery of health care by health professionals (process) and/or the health status of patients (impact).

Table 99 summarises those tools that were apparently effective at improving process or impact outcomes. The degree of effectiveness and credibility of the evidence associated with these tools cannot be represented in this small table. It is suggested that readers consult the appropriate sections of the report and review the tool and the evidence-base in more detail. However, from this overview it appears that, of all thirteen tools, the interactive educational tools (interactive continuing medical education; and academic detailing) were the most effective at improving aspects of health service delivery (process). Prompts and reminders, decision support, and multi-faceted interventions also appeared to have considerable impact. Continuous quality improvement, feedback, and alternative care approaches all successfully improved the process of care in one disease area.

**Table 99. Tools found to be effective at improving health service delivery (level and quality of evidence is variable)**

Tool Area	Effective Tool	Process outcomes	Impact outcomes
Universally applicable	Educational tools – interactive CME	✓	✗
	Educational tools - academic detailing	✓	✗
	Prompts and reminders	✓	NM
	Multi-faceted interventions	✓	NM
Arthritis and musculoskeletal conditions	Educational tools – interactive CME	✓	NM
	Educational tools - academic detailing	✓	✗
	Decision support	✓	NM
Asthma	Educational tools – interactive CME	✓	✓
	Feedback	✓	✗
Cancer	Decision support	✓	NM
	Prompts and reminders	✓	NM
Cardiovascular diseases	Continuous quality improvement	✓	NM
	Educational tools – academic detailing	✓	NM
	Decision support	✓	NM
	Prompts and reminders	✓	✗
	Alternative care approach	✓	✓
	Multi-faceted interventions	✓	✓
Diabetes	Multi-faceted interventions	✓	✗

CME = continuing medical education; NM = not measured

In studies where patient health was also an outcome that was assessed, service improvement tools appeared to have limited impact. Interactive educational tools were found to impact slightly on the health of asthma patients, and patients with cardiovascular disease appeared to receive marginal benefit from alternative care approaches and some multi-faceted interventions. There are several possibilities as to why service improvement tools appeared to have little impact on patient health: (1) chronic disease management is multi-factorial, with considerable responsibility (e.g. compliance, lifestyle modification) resting with the patient as opposed to the health provider, (2) impact (patient-relevant) outcome measures are often not measured or are measured inadequately (e.g. unvalidated tools) or (3) follow-up may be of insufficient duration to capture a change in health status.

Common factors that appear to be critical for these tools to improve health service delivery, include:

- Clear and focussed objectives
- Simple interventions – concise, convenient and accessible interventions, requiring relatively little input and easily integrated into existing procedures
- Credible/ trustworthy information sources
- Repetition and reinforcement of messages
- Relevance to the targeted health provider or patient – including the disease or problem, patient characteristics and setting
- Interaction and personalised contact – requiring active participation rather than the passive dissemination/receipt of information
- Use of pre-disposing strategies – consultation with health care professionals to enhance motivation to comply; tailoring strategies on the basis of needs-based assessments
- Use of enabling strategies – removal of barriers to change, such as procedural or equipment limitations and perceived threats to providers' autonomy or competence; and
- Combining effective strategies – addressing a focussed issue using a variety of well-chosen tools that are appropriate for the specific objective.

In conclusion, although some tools appear to be more effective than others in bringing about changes in health providers' performance, most notably the interactive educational tools - no single tool is always effective. The targeted behaviour, context, culture, setting, and available support influence the extent to which improvements are likely to occur. There are, however, certain critical success factors that appear to facilitate the impact of a health service improvement tool.

Few studies have assessed health service improvement tools that provided significant benefit to patients' health – either because the impact of the tool on the patient was not measured, or because it had no effect. In the cases where the impact was measured, only three tools - an interactive continuing medical education program for asthma, and an alternative care or multi-faceted approach for cardiovascular disease - appeared to have some effect on the patient, although this was negligible. Longer follow-up and constant reinforcement may be necessary to detect sustainable improvements at the level of the patient.

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# Appendix A HTA Websites

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## Websites of Health Technology Assessment Groups

### AUSTRALIA

- Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP-S) <http://www.surgeons.org/open/asernip-s.htm>
- Centre for Clinical Effectiveness (Monash University, Australia) <http://www.med.monash.edu.au/healthservices/cce/evidence/>
- Health Economics Unit, Monash University <http://chpe.buseco.monash.edu.au>

### AUSTRIA

- Institute of Technology Assessment / HTA unit <http://www.oecaw.ac.at/ita/e1-3.htm>

### CANADA

- Agence d'Évaluation des Technologies et des Modes d'Intervention en Santé (AETMIS) <http://www.aetmis.gouv.qc.ca/en/index.htm>
- Alberta Heritage Foundation for Medical Research (AHFMR) <http://www.ahfmr.ab.ca/publications.html>
- Canadian Coordinating Office for Health Technology Assessment (CCHOTA) <http://www.ccohta.ca/newweb/pubapp/pubs.asp>
- Canadian Health Economics Research Association (CHERA/ACRES) – Cabot database <http://www.mycabot.ca>
- Centre for Health Economics and Policy Analysis (CHEPA), McMaster University <http://www.chepa.org>
- Centre for Health Services and Policy Research (CHSPR), University of British Columbia <http://www.chspr.ubc.ca>
- Health Utilities Index (HUI) <http://www.fhs.mcmaster.ca/hug/index.htm>
- Institute for Clinical and Evaluative Studies (ICES) <http://www.ices.on.ca>

### DENMARK

- Danish Institute for Health Technology Assessment (DIHTA) [http://www.dihta.dk/publikationer/index\\_uk.asp](http://www.dihta.dk/publikationer/index_uk.asp)

### FINLAND

- FINOHTA <http://www.stakes.fi/finohta/e/>

## **FRANCE**

- L'Agence Nationale d'Accréditation et d'Evaluation en Santé (ANAES)  
<http://www.anaes.fr/>

## **GERMANY**

- German Institute for Medical Documentation and Information (DIMDI) / HTA  
<http://www.dahta.dimdi.de/>
- German Scientific Working Group of Technology Assessment  
[http://www.epi.mh-hannover.de/\(eng\)/hta.html](http://www.epi.mh-hannover.de/(eng)/hta.html)

## **THE NETHERLANDS**

- Health Council of the Netherlands Gezondheidsraad  
<http://www.gr.nl/engels/welcome/frameset.htm>

## **NEW ZEALAND**

- New Zealand Health Technology Assessment (NZHTA)  
<http://nzhta.chmeds.ac.nz/>

## **NORWAY**

- Norwegian Centre for Health Technology Assessment (SMM)  
<http://www.oslo.sintef.no/smm/Publications/Engsmdrag/FramesetPublications.htm>

## **SPAIN**

- Agencia de Evaluación de Tecnologías Sanitarias, Instituto de Salud “Carlos III”/Health Technology Assessment Agency (AETS)  
<http://www.isciii.es/aets/cdoc.htm>
- Catalan Agency for Health Technology Assessment (CAHTA)  
<http://www.aatm.es/cgi-bin/frame.pl/ang/pu.html>

## **SWEDEN**

- Swedish Council on Technology Assessment in Health Care (SBU)  
<http://www.sbu.se/admin/index.asp>

## **SWITZERLAND**

- Swiss Network on Health Technology Assessment (SNHTA)  
<http://www.snhta.ch/>

## **UNITED KINGDOM**

- Health Technology Board for Scotland <http://www.htbs.org.uk/>

- National Health Service Health Technology Assessment (UK) / National Coordinating Centre for Health Technology Assessment (NCCHTA)  
<http://www.hta.nhsweb.nhs.uk/>
- University of York NHS Centre for Reviews and Dissemination (NHS CRD)  
<http://www.york.ac.uk/inst/crd/>
- National Institute for Clinical Excellence (NICE)  
<http://www.nice.org.uk/index.htm>

#### **UNITED STATES**

- Agency for Healthcare Research and Quality (AHRQ)  
<http://www.ahrq.gov/clinic/techix.htm>
- Harvard Center for Risk Analysis – Cost-Utility Analysis Database Project [comprehensive league table] <http://www.hcra.harvard.edu/tablesdata.html>
- U.S. Dept. of Veterans Affairs Technology Assessment Program (VATAP)  
[http://www.va.gov/resdev/prt/pubs\\_individual.cfm?webpage=pubs\\_ta\\_reports.htm](http://www.va.gov/resdev/prt/pubs_individual.cfm?webpage=pubs_ta_reports.htm)

## Appendix B Specialty Websites

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### Health Service Improvement Websites

BioMed Central (BMC) Health Services Research

<http://www.biomedcentral.com/bmchealthservres/>

Agency for Healthcare Research and Quality <http://www.ahrq.gov/>

The International Society for Quality in Health Care <http://www.isqua.org.au/>

National Health Service <http://www.modern.nhs.uk/>

Healthy People 2010 <http://www.healthypeople.gov/LHI/>

The National Committee for Quality Assurance <http://www.ncqa.org>

Consumer Coalition for Quality Health Care <http://www.consumers.org>

The American Health Quality Association <http://www.ahqa.org>

The National Quality Forum <http://www.qualityforum.org>

The National Association for Healthcare Quality <http://www.nahq.org>

International Society for Quality in Health Care <http://www.isqua.org.au>

Australian Council for Safety and Quality in Health Care

<http://www.safetyandquality.org>

National Center for Chronic Disease Prevention and Health Promotion

<http://www.cdc.gov>

## Appendix C Search Terms

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The following search strategy has been developed for Medline/Pre-Medline on a SilverPlatter platform. Similar strategies will be used for the different bibliographic databases, with the same text words being used along with the relevant alternatives to Medical Subject Headings (MeSH) ie EmTree headings.

- #1 Search (continuous quality improvement) OR CQI Field: Text word
- #2 Search (clinical quality improvement) Field: Text word
- #3 Search (root cause analysis) Field: Text word
- #4 Search (total quality management) Field: Text word
- #5 Search (patient care management) Field: Text word
- #6 Search (change management) Field: Text word
- #7 Search (clinical process management) Field: Text word
- #8 Search (decision support) or (decision aid) Field: Text word
- #9 Search (diagnostic tool\*) Field: Text word
- #10 #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9
- #11 Search (quality of health care) Field: MeSH Terms
- #12 Search #10 AND #11
- #13 Search controlled clinical trials Field: MeSH Terms
- #14 Search randomized controlled trials Field: MeSH Terms
- #15 Search comparative study Field: MeSH Terms
- #16 Search cohort studies Field: MeSH Terms
- #17 Search (controlled stud\*) OR (controlled trial\*) OR (comparative stud\*) OR (evaluation stud\*) OR (intervention stud\*) OR (follow-up stud\*) OR (randomized trial\*) OR (retrospective stud\*) OR (prospective stud\*) Field: Title/Abstract
- #18 Search #13 OR #14 OR #15 OR #16 OR #17
- #19 Search #12 AND #18 Limits: Human

## Appendix D EPOC Checklist

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### Assessment of Methodological Quality

Source: Bero LA, Grilli R, Grimshaw JM, Mowatt G, Oxman AD, Zwarenstein M (eds). Cochrane Effective Practice and Organisation of Care Group. In: *The Cochrane Library*, Issue 2, 2002. Oxford: Update Software.

Standard criteria are used to assess the methodological quality of studies included in EPOC reviews (protection against bias). Each criterion is scored as DONE, NOT CLEAR, or NOT DONE.

#### **Seven standard criteria are used to assess the methodological quality of randomised controlled trials and clinical controlled trials:**

1. Concealment of allocation (protection against selection bias). This is scored as DONE if the unit of allocation was by institution, team or professional and any random process was described explicitly; or if the unit of allocation was by patient or episode of care and there was some form of centralised randomisation scheme, an on-site computer system or sealed opaque envelopes were used.
2. Follow-up of professionals (protection against exclusion bias). This is scored as DONE if outcome measures were obtained for 80-100% of subjects randomised.
3. Follow-up of patients. This is scored as DONE if outcome measures were obtained for 80-100% of patients randomised, or for patients who entered the trial.
4. Blinded assessment of primary outcome(s) (protection against detection bias). This is scored as DONE if the authors state explicitly that the primary outcome variables were assessed blindly, or the outcome variables are objective, e.g. length of hospital stay, drug levels as assessed by a standardised test. Primary outcome(s) are those variables that correspond to the primary hypothesis or question as defined by the authors. In the event that some of the primary outcome variables were assessed in a blind fashion and others were not, each is scored separately.
5. Baseline measurement. This is scored as DONE if performance or patient outcomes were measured prior to the intervention, and no substantial differences were present across study groups.
6. Reliable primary outcome measure(s). This is scored as DONE if there were two or more raters with at least 90% agreement or kappa greater than or equal to 0.8 OR the outcome data were obtained from some automated system, e.g. length of hospital stay, drug levels as assessed by a standardised test.
7. Protection against contamination. This is scored as DONE if allocation was by community, institution or practice and it is unlikely that the control group received the intervention.

**Seven standard criteria are used to assess the methodological quality of controlled before-and-after studies:**

1. Baseline measurement. This is scored as DONE if performance or patient outcomes were measured prior to the intervention and no substantial differences were present across study groups.
2. Baseline characteristics for studies using second site as control. This is scored as DONE if the baseline characteristics of the study and control providers are reported and similar.
3. Blinded assessment of primary outcome(s) (protection against detection bias). This is scored as DONE if the authors state explicitly that the primary outcome variables were assessed blindly OR the outcome variables are objective, e.g. length of hospital stay, drug levels as assessed by a standardised test. Primary outcome(s) are those variables that correspond to the primary hypothesis or question as defined by the authors. In the event that some of the primary outcome variables were assessed in a blind fashion and others were not, each is scored separately.
4. Protection against contamination. For studies using second site as control, this is scored as DONE if allocation was by community, institution or practice and it is unlikely that the control group received the intervention.
5. Reliable primary outcome measure(s). This is scored as DONE if there were two or more raters with at least 90% agreement or kappa greater than or equal to 0.8 OR the outcome data were obtained from some automated system, e.g. length of hospital stay, drug levels as assessed by a standardised test.
6. Follow-up of professionals (protection against exclusion bias). This is scored as DONE if outcome measures were obtained for 80-100% of subjects allocated to groups.
7. Follow-up of patients. This is scored as DONE if outcome measures were obtained for 80-100% of patients allocated to groups or for patients who entered the study.

**Seven standard criteria are used to assess the methodological quality of Interrupted Time Series studies:**

1. The intervention is independent of other changes. This is scored as DONE if the intervention occurred independently of other changes.
2. There are sufficient data points to enable reliable statistical inference. This is scored as DONE if at least 20 data points are recorded before the intervention AND the authors have done a traditional time series analysis (ARIMA model), OR if at least 3 data points are recorded pre and post intervention AND the authors have done a repeated measures analysis, OR if at least 3 data points are recorded pre and post intervention AND the authors have used ANOVA or multiple t-tests AND there are at least 30 observations per data point.
3. Formal test for trend. This is scored as DONE if a formal test for trend is reported.

4. Intervention unlikely to affect data collection. This is scored as DONE if it is reported that the intervention was unlikely to affect data collection, e.g. sources and methods of data collection were the same before and after the intervention.
5. Blinded assessment of primary outcome(s). This is scored as DONE if the authors state explicitly that the primary outcome variables were assessed blindly or the outcome variables are objective, e.g. length of hospital stay, drug levels as assessed by a standardised test. Primary outcome(s) are those variables that correspond to the primary hypothesis or question as defined by the authors. In the event that some of the primary outcome variables were assessed in a blind fashion and others were not, each is scored separately.
6. Completeness of data set. This is scored as DONE if data set covers 80-100% of total number of participants or episodes of care in the study.
7. Reliable primary outcome measure(s). This is scored as DONE if there were two or more raters with at least 90% agreement or kappa greater than or equal to 0.8 OR the outcome data were obtained from some automated system, e.g. length of hospital stay, drug levels as assessed by a standardised test.

## Appendix E Inclusions

### Study profiles of included studies

Study	National Health Priority Area	Level and quality of evidence	Study Design	Setting	Population	Type of Intervention	Comparator	Outcome(s) assessed	Length of follow-up
(SUPPORT Investigators, 1995)	Universally applicable	Level II Quality: good	Phase 1: prospective observational study Phase 2: RCT, randomised by physician specialty	5 teaching hospitals, USA	4804 (Phase 2) adult patients hospitalised with one or more of 9 life-threatening diagnoses	Patient-centred approach - SUPPORT (Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments): physicians received estimates of the likelihood of 6-month survival for every day up to 6 months; outcomes of cardiopulmonary resuscitation, and functional disability at 2 months. A specially trained nurse had multiple contacts with the patient, family, physician, and hospital staff to elicit preferences, improve understanding of outcomes, encourage attention to pain control, and facilitate advance care planning and patient-physician communication.	Usual care	Process outcomes: Assessment of participation: no. of days until DNR order was written; agreement between patient and provider on DNR  Impact outcomes: Patient pain No. of days in "undesirable state"	6 months
(Almond et al. 2002)	Universally applicable	Level III-2 Quality: average	Prospective controlled before-and-after study	General medical ward, Southend hospital, London, UK	Health care professionals	Electronic prescribing medicines administration (EPMA) and clinical decision support: conducted in Renal ward - data storage and retrieval, clinical decision support, and computerised stock control.	Usual care in Respiratory ward	Process outcomes: Assessment of participation: % correctly administered prescriptions	3 months
(Balas et al. 2000)	Universally applicable	Level 1 Quality:	Systematic review and	Primary care settings	33 studies involving 1547 clinicians and	Physician prompts: including computerised and non-	Usual care	Process outcomes: Assessment of	≥ 3 months

		good	meta-analysis		54,693 patients	computerised methods, notes attached to patient's chart		participation: compliance with CPGs for preventive care (Vaccination, immunization, cardiac care, blood pressure management, cholesterol management, smoking cessation)	
(Baker et al. 2003a)	Universally applicable	Level II Quality: good	Cluster RCT, randomised by practice	General practices in northern England	81 general practices	Review criteria: prioritised criteria of CPGs presented in concise format with emphasis on key recommendations for majority of patients. 10 criteria for asthma and 14 criteria for angina  Review criteria plus feedback: prioritised review criteria plus feedback on actual practice performance compared to other practices	Full version of CPGs	Process outcomes: Assessment of participation: compliance with CPGs  Impact outcomes: Patient health status Patient satisfaction	12 months
(Baker et al. 2003b)	Universally applicable	Level II Quality: average	Cluster RCT, randomised by practice	General practices, Leicestershire, UK	33 general practices	Feedback: Practice received feedback on ordering of specific tests compared to recommended guidelines	Practices received feedback and CPGs on different set of diagnostic tests –each acted as control for the other	Process outcomes: Assessment of participation: physician change in ordering diagnostic tests	12 months
(Bennett & Glasziou 2003)	Universally applicable	Level I Quality: good	Systematic review of RCTs	General medicine and specialist clinics	26 studies patients physicians nurse practitioners	Reminders: computerised or paper-based reminders to health care providers (or patients) to improve adherence to CPGs, specifically to switch to more appropriate medication; decrease use of antibiotics; increase use of preventive medications; monitor and assess	Usual care	Process outcomes: Assessment of participation: rate of prescribing; compliance with recommended guidelines  Impact outcomes: Compliance with	≥ 3 months

						medications <b>Feedback:</b> peer-comparison feedback on prescribing costs; letter identifying patients on long-term medications; audit feedback on prophylactic aspirin		medication	
(Berner et al. 2003)	CVD & stroke	Level: III-1 Quality: Good	Cluster quasi-RCT	21 hospitals in Alabama	7 opinion leader (OL) group hospitals, 8 Health Care Quality Improvement Project Group Hospitals and 6 no intervention hospitals	<b>Educational:</b> <b>HCIP group:</b> Half-day orientation session-overview of unstable angina guidelines and presentation of aggregate and blinded hospital-specific feedback. Also, discussions on various educational aspects took place. <b>OL group:</b> In addition to the HCIP intervention, this group received a presentation of quality improvement strategies. The main difference was the role of the opinion leader.	No intervention	<b>Process outcomes:</b> Assessment of participation: change in compliance	3-9 months
(Campbell et al. 1998)	CVD & stroke	Level: II Quality: Good	RCT	19 general practices in northeast Scotland	1173 patients under 80 years of age with working diagnoses of coronary heart disease	<b>Alternative care approach (setting)</b> Nurse-led clinic to promote medical compliance and lifestyle changes	Usual care	<b>Process outcomes:</b> Assessment of participation: compliance with CPGs <b>Impact outcomes:</b> Patient's ability to manage their disease	12 months
(Casebeer et al. 1999)	CVD & stroke	Level: III-1 Quality: Average	Quasi-RCT	Community physicians setting throughout Alabama	28 community physicians and 222 of their hypercholesterolemic outpatients	<b>Multi-faceted intervention:</b> <b>Continuing medical education:</b> series of three interactive audio- conferences <b>Reminder:</b> designed chart reminders	No intervention	<b>Process outcomes:</b> Assessment of participation: compliance with new strategy <b>Impact outcomes:</b> Patient health status Patient's ability to manage their disease	3 months

(Clark et al. 1998)	Asthma	III-1 Quality: good	Quasi-RCT	New York	Pediatricians working in Ann Arbor, Michigan and New York.  Children 1-12 yrs old, diagnosed with asthma & at least one emergency medical visit in previous year	Continuing medical education: brief lectures, a video, case studies, a protocol. In the form of two face-to-face group meetings held over 2-3 weeks.	Control physicians randomly assigned a date for follow-up of patients	Process outcomes: Assessment of participation  Impact outcomes: Changes in parent's view of physician performance  Changes in child's symptom (health) status  Changes in child's health care use	5 & 22 months
(Costantini et al. 2001)	CVD & stroke	Level: III-2 Quality: Average	Controlled before & after study	University hospitals at Cleveland, Ohio	582 patients at the hospital	Interdisciplinary team approach  Management of heart failure patients at a specialty clinic or under specialty care in the home	No intervention	Process outcomes Assessment of participation: adherence to guidelines  Impact outcomes Length of stay Hospital readmission Mortality	9 months
(Curley et al. 1998)	Universally applicable	Level II Quality: average	RCT firm system, randomised by ward	6 wards in County hospital medical centre, Ohio, USA	1102 patients randomised to firms 2 wards per firm	CQI: interdisciplinary daily rounds (clinicians, pharmacist, nutritionist, nurses); writing orders during rounds so ancillary work loads were more predictable	Traditional work rounds with clinicians only; work orders written ad hoc through the day	Process outcomes: Provider satisfaction  Impact outcomes: Length of hospital stay Hospital death	6 months
(Currell & Urquhart 2003)	Universally applicable	Level I Quality: good	Systematic review	Hospital, community or primary care settings	8 trials nurses or health care practitioners patients receiving care	Nursing record system: record of care planned and/or given to individual patients. Includes multidisciplinary care records, patient held records, or systems designed to record specific aspects of nursing care (pain control, wound management).	Centrally held records, conventional paper-based documentation	Process outcomes: Nurses satisfaction with system  Assessment of participation: quality of documentation, discharge planning, nursing workload  Impact outcomes: Quality of life (ADL)	3-12 months

								Patient's health status: perception of pain	
(Davis et al. 1999)	Universally applicable	Level I Quality: good	Systematic review of RCTs	GPs, clinicians	14 studies targeting GPs and clinicians	Continuing medical information: planned educational activities, including <i>didactic interventions</i> (seminars, lectures, symposia, meetings, conferences), <i>interactive interventions</i> (workshops, group discussions), and <i>mixed interventions</i> (didactic and interactive)	Usual care	<p>Process outcomes: Assessment of participation: no. of patients recommended preventive care services (cancer screening – mammograms, cervical smears), management of chronic disease (blood pressure control); counselling (lifestyle factors – smoking, exercise)</p> <p>Impact outcomes: Patients' self-management of disease: number of screening tests completed, smoking behaviour</p> <p>Patient health status: distress scores</p>	1-24 months
(Dexter et al. 2001)	Universally applicable	Level II Quality: good	Cluster RCT, randomised by general medicine team	Indiana University Medical Centre, USA	6371 patients (10,065 admissions) 202 physicians (96 intervention group; 78 control; 28 either group)	Computer-based order-entry workstations: medical staff wrote all orders into computer, which provided clinical-decision support by means of rule-based reminders (Care rules). Care rules generated reminders for pneumococcal vaccination, influenza vaccination, prophylactic aspirin for cardiovascular disease, prophylactic heparin for certain vascular disorders	Computer logged reminders but did not display them	<p>Process outcomes: Assessment of participation: preventive therapies - % of hospitalizations (vaccinations, heparin treatment, aspirin therapy)</p>	18 months

						when patients' medical record indicated the need			
(Del Mar & Green 1995)	Cancer	Level III-1 Quality: good	Quasi-RCT	General practices in 2 cities, Queensland, Australia	105 general practices	Decision support: physicians used an algorithm for the clinical management of patients with suspicious skin lesions, and a Polaroid camera to record the appearance of lesions for follow-up review	Usual care	Process outcomes: Assessment of participation: no. and characteristics of lesions excised, reasons for excising lesions  Physicians' satisfaction with use of photographs to record lesion characteristics	24 months
(Eccles et al. 2001)	Universally applicable	Level III-1: Quality: good	Pragmatic cluster quasi-RCT, randomised by practice, stratified by radiology department and practice size	6 radiology departments in NE England and Scotland	GPs in 247 practices	Multi-faceted intervention:  <b>Audit and feedback:</b> Feedback contained the number of requests for lumbar and spine and knee radiographs made by the whole practice compared with requests made by all GPs in the study.  <b>Educational reminder:</b> messages were attached to reports of knee or lumbar spine radiographs requested.  Knee message: "in adults with knee pain, without serious locking or restriction in movement, radiograph is not routinely indicated"  Lumbar spine message: "in either acute (<6 weeks) or chronic back pain, without adverse features, radiograph is not routinely indicated"  <b>Audit and feedback plus educational reminder:</b>	Assigned CPG alone	Process outcomes: Assessment of participation: number of radiographs requested per 1000 patients registered with every practice per year; no of radiographs concordant with CPGs	12 months

(Eccles et al. 2002)	Universally applicable	Level II Quality: good	Pragmatic cluster RCT	60 GPs in NE England	GPs and practice nurses Patients ≥18 years	Computerised decision support system (CDSS): computerised CPGs for angina and asthma patients. Computer system used patients' information to trigger guideline and present patient scenarios, offered suggestions for management.	Usual care	Process outcomes: Assessment of participation: compliance with CPGs; drug prescribing  Impact outcomes: Patient health status: disease-specific measures (BP, smoking status, ECG, cholesterol level, blood glucose, lung function, medication compliance)  Patient satisfaction	12 months
(Evans et al. 1997)	Asthma	III-2 Quality: good	Concurrently controlled study	Bureau of Child Health Clinics (BCH) in New York	Medical staff of BCH clinics and African-American or Latino asthmatic children attending these clinics.	Continuing medical education: 1. A series of five 3-hour sessions for staff of the BCH clinics 2. Tutorial session for BCH physicians 3. Monthly visits to BCH clinics by a nurse educator	Staff did not receive training. Control group physicians did not receive training about new medications.	Process outcomes: Assessment of participation: degree of asthma health education by physician; degree which physicians adopted the recommended treatment plans  Impact outcomes: Readmission to hospital  Patient self-management of disease: use of new medications and delivery devices	2 years
(Feder et al. 1999)	CVD & stroke	Level: II Quality: Good	RCT	52 general practices in east London	328 patients admitted to hospital for myocardial infarction or unstable angina and general practitioners of the	Prompts & reminders: Postal prompts for patients including secondary prevention advice.  Letters to the patient's general	No intervention	Process outcomes: Assessment of participation: change in physician's prescribing behaviour,	6 months-1 year

					general practices	practitioners reminding them about effective interventions and the existence of local guidelines for coronary heart disease		recording risk factors, advice on lifestyle <b>Impact outcomes</b> Patient's ability to manage their disease: change in diet, exercise, and medication compliance, smoking cessation	
(Flottorp et al. 2002)	Universally applicable	Level III-1 Quality: poor	Cluster quasi-RCT, randomised by practice	142 GP practices, Norway	Health care practitioners (physicians and practice assistants)  Patients: consultations for sore throat (>3 years old); urinary tract infection (non-pregnant women aged 16-55 years)	Electronic and printed materials: CPGs for GPs and information on urinary tract infections or sore throat for patients to facilitate discussions.  Computer-based CDS system and reminders: during consultations  Interactive course: for GPs and practice assistants  Financial incentive: increased fee for telephone consultations for the two diagnoses	Practices receiving one set of CPGs served as control for practices receiving the other.	Process outcomes:  Assessment of participation: rate of use of antibiotics, laboratory tests and telephone consultations	8 months
(Frijling et al. 2002)	Diabetes	Level II Quality: good	Cluster-RCT	General practices in The Netherlands	General practitioners	Multi-faceted intervention:  Feedback and support, including guidance and education, from a facilitator	General practitioners not receiving intervention	Process outcomes  Assessment of participation: recommended tests and procedures completed  <b>Impact outcomes</b> Patient health status: HbA1c	21 months
(Frijling et al. 2003)	CVD & stroke	Level: II Quality: Good	Cluster-RCT	124 general practices in The Netherlands	185 general practitioners	Multi-faceted intervention:  Feedback  Outreach visits	Usual care	Process outcomes:  Assessment of participation: physician compliance	2 years
(Gardner	Universally	Level III-2	Non-	8 medical units	Sample of	Patient-centred intervention:	Team nursing	Process outcomes:	1, 2 3 years

1991)	applicable	Quality: poor	randomised controlled study	in an urban tertiary care teaching hospital, New York, USA	convenience: Patients (different sample size for each measure) who were on the medical unit >2 days, understood English, fit into 1 of 3 DRGs (myocardial infarction with complications; myocardial infarction without complications, congestive heart failure) or in same room as patients with DRGs	Primary nursing Pre-intervention phase: all units had comparable staffing and patient mix and used a functional/team nursing model Intervention: Primary nursing Slater Nurse Competency Scale: used as control variable to measure nursing competency		Provider satisfaction: nursing stress measurement (386 nurses) Impact outcomes: Patient health status: Hospital Stress Rating Scale (HSRS) (637 patients): patients ranked stressful events Nursing Support Scale (NSS) (489 patients): 52 item scale rates frequency of supportive behaviour	
(Goldberg et al. 1998)	Universally applicable	Level II Quality: average	RCT Pretest-posttest design 12 month baseline – 6 months 'wash-in' – 12 months study period	15 small group practices at 4 primary care clinics, Seattle, USA	95 providers 4995 patients, aged 18-75, diagnosed with hypertension or depression	Academic detailing (AD): brief one-on-one education and feedback sessions to promote compliance with CPGs. Academic detailing (AD) plus CQI teams: combined approach multidisciplinary team uses problem-solving techniques to develop improvements in procedures and monitor compliance with CPGs. 2 physician opinion leaders conducted 15-minute AD training sessions – "detailing sheets" mimicked pharmaceutical advertisements, pocket cards outlined drug indications and costs, marker pens imprinted with educational message. CQI teams formed for hypertension and depression. Trained CQI facilitator instructed teams in use of	Usual care	Process outcomes: Assessment of participation: use of chart flow sheet, follow-up system, pamphlet distribution, post-it notes, computerised reminders Impact outcomes: Patient health status: BP control, depression Depression: Hopkins Symptom checklist	12 months

						"plan, do, study, act" cycle of activities.			
(Gonzales et al. 1999)	Universally applicable	Level: III-2 Quality: good	Non-RCT	Primary care practices in the Denver, Colo, metropolitan area	2462 adults with uncomplicated bronchitis and 93 clinicians	<b>Multi-faceted</b> <b>Full intervention site:</b> Education: household and office-based patient educational materials clinician education, feedback and academic detailing <b>Limited intervention site:</b> Office based educational materials only	Usual care	<b>Process outcomes:</b> Assessment of participation: change in treatment and prescribing for uncomplicated acute bronchitis	3 months
(Grant et al. 2003)	Diabetes	Level III-2 Quality: poor	Non-RCT	Primary care clinic, Massachusetts, USA	149 poorly controlled adult diabetic patients	<b>Prompt:</b> Patient- specific recommendations regarding testing and treatment guidelines emailed to providers	Usual care	<b>Process outcomes</b> Assessment of participation: compliance with recommendations	3 months
(Griffin & Kinmonth 2003)	Diabetes	Level I Quality: good	Systematic review	Primary care settings	Providers of diabetes care in primary care settings	<b>Alternative care approach:</b> Comparison of care for patients with diabetes by general practitioners.	Care for patients with diabetes in hospital clinics.	<b>Process outcomes</b> Assessment of participation: patients receiving regular review and routine surveillance <b>Impact outcomes</b> Patient health status: mortality, metabolic control, cardiovascular risk	Varies
(Grimshaw & Russell 1993)	Universally applicable	Level 1 Quality: average	Systematic review	Health care professionals	59 studies RCTs, CBAs, time series studies	<b>Educational intervention:</b> implementation of CPGs by a variety of means, including computer-generated reminders, educational meetings, feedback, mail-outs, prompts in patients' records, financial incentives	Usual care	<b>Process outcomes:</b> Assessment of participation: compliance with CPGs; change in physicians' knowledge <b>Impact outcomes:</b> Patient complications Number of admissions	9-24 months

								Patient ability to manage disease (e.g. stop smoking)	
(Gutierrez et al. 1994)	Universally applicable	Level III-2 Quality: poor	Non-randomised controlled study	2 Family medicine units, Mexico City	69 family practice physicians	<b>Multi-faceted intervention:</b> Training workshop involved information on recommended prescribing treatment for diarrhoea; feedback on prior prescribing practices; development of an algorithm for use in subsequent consultations; dissemination of printed algorithm of recommendations; formation of a peer-review committee to reinforce objectives	Usual care	<b>Process outcomes:</b> Assessment of participation: changes in physician prescribing behaviour	2, 6, 12, 18 months
(Heller et al. 2001)	CVD & stroke	Level: III-1 Quality: Good	Quasi-RCT	37 public hospitals across NSW	1872 patients admitted with a diagnosis of unstable angina pectoris	<b>Multi-faceted intervention:</b> <b>Education:</b> educational session run by a local opinion leader <b>Feedback:</b> baseline survey data was presented to staff at the hospitals	Waiting list control	<b>Process outcomes:</b> Assessment of participation: change in physician practice i.e. use of evidence based practice identified by hospital records	2 years
(Hetlevik et al. 2000)	Diabetes	Level II- Quality: poor	RCT	General practices in Norway	General practitioners and their patients with diabetes	<b>Decision support:</b> Accessible from the main computerised record system that guided doctors in diagnostics, history taking, physical examination, tests and treatment.	Practices not receiving the intervention	<b>Process outcomes</b> Assessment of participation: recommended tests undertaken Assessment of participant satisfaction <b>Impact outcomes</b> Patient health status: HbA1c, blood pressure, cholesterol, BMI	18 months
(Hunt et al. 1998)	Universally applicable	Level I Quality: good	Systematic review of RCTs	Clinical setting	68 controlled trials drug dosing	<b>Decision support (CDSS):</b> computer software using a knowledge base designed for	Usual care	<b>Process outcomes:</b> Assessment of participation: drug	≥ 3 months

					diagnosis preventive care	use by a clinician involved in patient care as a direct aid to clinical decision making		prescribing (% patients within therapeutic range; anticoagulation control); % patients with blood pressure assessed; adherence to protocol; errors in lab test ordering; rate of unnecessary admissions  <b>Impact outcomes:</b> Patient complications  % Patients discharged  Patient self- management of disease: blood pressure control; weight control;  Frequency of hospitalisations  Quality of life	
(Irvine et al. 2002)	Universally applicable	Level III-1 Quality: poor	Quasi-RCT	2 tertiary care hospitals and 2 community hospitals, Ontario, Canada	150 health care professionals from 25 CQI Multidisciplinary health care teams	<b>Continuous quality improvement team:</b> Cognitive component – instruction in methods and principles of quality improvement; systems knowledge relating to patient care; conflict management strategies  Behavioural component – application of quality improvement methods to real- life problems in clinical practice (e.g. MI); identify balanced set or outcome measures reflecting clinical, functional health, satisfaction; examine process of care; identify	Delayed intervention: comparison group received intervention 3 months later	<b>Process outcomes:</b>  Assessment of participation: physicians' CQI knowledge; physicians' functional / dysfunctional group interaction; physicians' problem- solving effectiveness	3, 6, 9 months

						change ideas based on process knowledge and benchmarking.			
(Isouard 1999)	CVD & stroke	Level: III-2 Quality: Good	Non-randomised controlled cohort study	2 metropolitan teaching hospitals in Sydney, Australia	All patients with a confirmed diagnosis of AMI admitted to the 2 teaching hospitals	Continuous quality improvement: multidisciplinary weekly meetings; guideline development and strategies for education and training programs as well as ongoing monitoring of performance	No intervention	Process outcomes: Assessment of participation: total number of clinically and non-clinically indicated tests requested	15 months
(Jamtvedt et al. 2003)	Universally applicable	Level I Quality: good	Systematic review of RCTs Preventive care Treatment Drug dosing	Primary care settings	85 studies Healthcare professionals responsible for patient care	Audit and Feedback: any summary of clinical performance of health care over a specified period of time. Includes compliance with CPGs scores, peer-comparison feedback, numbers or costs of diagnostic tests, patient-related information (BP, test results)	Usual care	Process outcomes: Assessment of participation: no. of prescriptions, tests ordered; compliance with guidelines Impact outcomes: Length of stay Patient self-management of disease: hypertension, depression	1-12 months
(Jenkins & Fallowfield 2002)	Cancer	Level III-1 Quality: average	Quasi-RCT	Cancer centres, UK	93 oncology physicians	Educational learner-centred course: 3-day small group-based course, incorporating cognitive, experiential, and behavioural components (discussion, role-play), led by experienced facilitator with a team of patient simulators. Feedback: comprehensive written feedback on physicians' communication skills during videotaped consultation.	Usual care	Process outcomes: Assessment of participation: change in physicians' communication skills – using the Physician Psychosocial Belief Scale (PPBS) to measure physicians' psychosocial beliefs.	3 months
(Karuza et al. 1995)	Universally applicable	Level III-1 Quality: good	Cluster quasi-RCT, randomised by group practice	13 group practices, New York, USA	51 primary care physicians	Small group consensus process: 1. physicians received a 10-minute CPG lecture on influenza vaccinations for the elderly; 2.	"placebo" intervention – control physicians received	Process outcomes: Assessment of participation: influenza vaccination rates	12 months

						a 7-step group discussion (40-50 minutes) was lead by a facilitator, to achieve commitment to and development of a practice-specific program to improve adherence guidelines to influenza vaccination for the elderly	information on a preventive health care topic, including chart review of patient records	Physician attitudes and knowledge of influenza	
(Ketola et al. 2000)	CVD & stroke	Level: III-2 Quality: Good	Controlled before and after study	2 primary care health centres in Northern Helsinki	Patients attending these two health care centres	Multi-faceted intervention: Record systems- personnel were trained to detect high risk patients using a structured CVD risk factor form CME- personnel participated in four lectures Local CPGs: personnel developed guidelines after the CME Interdisciplinary approach- the programme was implemented by a team of health care professionals Feedback: personnel were given feedback after every audit	No intervention	Process outcomes: Assessment of participation: change in physician behaviour- documentation of risk factors in patient records Impact outcomes Patient's health status	2 years
(Kogan et al. 2003)	Universally applicable	Level III-1 Quality: good	Quasi-RCT	5 outpatient general medicine practices, Pennsylvania, USA	44 resident 497 patient charts abstracted from medical records	Report card: summary of personal and group performance (documentation of lab reports, immunization records, ordering or recommending tests) Feedback: individualised 10-15 minute feedback session	Usual feedback via faculty practice preceptor	Process outcomes: Assessment of participation: physician compliance with CPGs - scores derived from actions taken in screening, immunizations, counselling, diabetes and hypertension management, total preventive health	12 months

(Kouides et al. 1998)	Universally applicable	Level II Quality: good	RCT	Primary care practices, New York, USA	54 primary care practices	Performance-based reimbursement: physicians used a target-based poster to track influenza immunisation rates in elderly patients aged ≥65 years. In addition to a regular \$US8 administration fee, they also received \$US0.80 or \$US1.60 per influenza shot if immunisation rates reached 70% or 85%.	Usual care with no financial incentive	Process outcomes: Patient self-management: influenza immunisation rates (total number of immunisations reported by a practice/total number of non-institutionalised patients aged ≥65 years visiting the practice in the past year)	12 months
(Lafata et al. 2002)	Diabetes	Level II- Quality: good	RCT	Large primary care group practice, Michigan USA	Adult patients with diabetes	Reminder: Mailed reminder to patients about tests and appointments due	Patients of same providers receiving no reminder	Process outcomes Assessment of participation: recommended tests undertaken  Impact outcomes Patient health status: HbA1c controlled, Lipids controlled	12 months
(Lagerlov et al. 2000)	Asthma	III-1 Quality: poor	Prospective controlled before and after study	Several geographical locations in Norway	GPs from south-west Norway	Audit & Feedback: 2 evening meetings. The first looked at diagnosis and behaviour underlying reasons for treatment. The second focused on national and international guidelines.	Same intervention but looking at urinary tract infection rather than asthma	Process outcomes: Assessment of participation: change in prescribing behaviour	1 year
(Langham et al. 2002)	CVD & stroke	Level: II Quality: Good	Cluster-RCT	Primary care practices in a defined area in inner London	All patients with CVD from the 17 recruited practices in the area	Intervention group 1- Information arm- training and assistance for set up of a disease register  Evidence arm-training and assistance in accessing and critical interpretation of evidence	Received training and assistance in practice-identified priorities that were not related to CVD	Process outcomes: Assessment of participation: changes in prescribing behaviour and changes in physician practice-recording of risk factors	3 months

						Information and evidence arm-received both interventions		Impact outcomes: Patient health status: control of blood pressure and total cholesterol	
(Lemelin et al. 2001)	Universally applicable	Level III-1 Quality: good	Quasi-RCT, randomised by primary care practice	Health service organisations, Ontario, Canada	46 Health Service Organisation practices	Facilitation intervention: facilitators visited practices 21-50 times over 18 months, using 7 intervention strategies (audit and feedback, consensus building, opinion leaders, academic detailing and educational materials, reminder systems, patient-mediated activities) to improve adoption of preventive care strategies	Usual care	Process outcomes: Assessment of participation: <i>Preventive performance index</i> : % of eligible patients who received recommended preventive care less the % who received inappropriate preventive measures. <i>Up-to-datedness index</i> : % of recommended measures done <i>Inappropriateness index</i> : % of inappropriate measures done	12 months
(Lobo et al. 2002a)	CVD & stroke	Level: II Quality: Average	RCT	General practices in southern half of The Netherlands	General practitioners at 124 general practices	Educational outreach 15 outreach visits were conducted per practice. The visitors provided training, educational materials, advice and guidance during these visits. The focus was practice organization and clinical decision-making.	No intervention	Process outcomes: Assessment of participation: change in physician behaviour, GP adherence to each aspect of the intervention, change in teamwork & record-keeping	21 months
(Markey & Schattner 2001)	Universally applicable	Level II Quality: poor	RCT	Primary practices, Melbourne,	64/132 GPs in the Monash Division of General Practice	Academic detailing: physicians receive a practice visit, consisting of 30-45	Academic detailing intervention	Process outcomes: Assessment of participation: GPs'	3 months

				Australia		minute discussion on evidence-based medicine and barriers to its practice	was delayed for 3 months	attitudes and knowledge of EBM	
(Mazzuca et al. 1987)	Arthritis	Level III-1 Quality: poor	Quasi-RCT	7 older-adult clinics in an urban mid-western county (Marion County Indiana), USA	29 public health nurses on staff at older-adult clinics	Continuing medical education: 5-component in-service education program on arthritis screening and management in older adults. This included required readings, a formal in-service program of 3 contact hours, a laminated "arthritis screening and management" index card, telephone number of an arthritis telephone consultation service, and practical sessions with an arthritis centre nurse (audit and feedback).	Usual care: data collected at baseline and at six months	Process outcomes: Assessment of participation: screening for joint pain, screening for joint swelling, screening for joint-related limitations of activity	6 months
(McDermott et al. 2001)	Diabetes	Level II Quality: average	Cluster RCT	Primary health care centres in remote northern Australia and islands.	Primary care providers in these settings and their indigenous populations with diabetes	Multi-faceted intervention: Recall and reminder system, education, support from project officer	Clinics not receiving intervention	Process outcomes Assessment of participation: recommended tests and procedures completed Impact outcomes Patient complications requiring hospitalisation	12 months
(Meigs et al. 2003)	Diabetes	Level II Quality: good	RCT	Hospital based internal medicine clinic in Massachusetts, USA	Physicians providing care to patients with diabetes	Decision support: Web-based decision support featuring patient-specific information	Physicians not receiving decision support	Process outcomes Assessment of participation: tests conducted according to guidelines Assessment of participant satisfaction Impact outcomes Patient health status: HbA1c, cholesterol, blood pressure, BMI	13 months

(Nilsson et al. 2001)	Universally applicable	Level III-2 Quality: poor	Non-RCT	3 CME groups and 6 health care centres, Stockholm, Sweden	40 GPs in health care centres with electronic patient record systems	Multi-faceted intervention: Feedback on individual prescribing rates; educational outreach visits, educational material; local opinion leaders.  An inter-professional pharmacotherapy education group, including a local opinion leader, clinical pharmacologists, hospital specialists, and teacher-physicians, was formed for each of 3 fields (hypertension, peptic ulcer/dyspepsia, depression).	No intervention. GPs randomised to other fields acted as controls.	Process outcomes: Assessment of participation: change in physicians' prescribing rates	12 months
(Norris et al. 2002)	Diabetes	Level I Quality: good	Systematic review	Unspecified	Providers and patients in any controlled studies with disease or case management as intervention	Multi-faceted intervention: Disease and case management	Usual care	Process outcomes Assessment of participation: recommended procedures and tests completed Impact outcomes Patient health status: HbA1c, total cholesterol, function, BMI, blood pressure Patient satisfaction	Varies
(Philbin et al. 2000)	CVD & stroke	Level: III-1 Quality: Good	Quasi-RCT	Acute care community hospitals in New York	Patients at 10 acute care hospitals	Multi-faceted intervention: Critical pathway Continuing medical education Patient education Feedback	Usual care	Process outcomes: Assessment of participation: measurement of left ventricular systolic function, indication of the primary cause of heart failure, poor dietary counselling, no. of prescriptions Impact outcomes: Length of stay	6 months

								Quality of Life	
(Puech et al. 1998)	Universally applicable	Level: II Quality: good	RCT	Three-partner urban general practice	325 patients over 65 years of age	Reminder: Single postcard reminder for influenza vaccination for patients aged 65 years and over	Usual care	Process outcomes: Assessment of participation: change in influenza vaccination rates	1 year
(Ray et al. 2001)	Arthritis	Level II Quality: average	RCT	General practices in Tennessee, USA	220 physicians of arthritis patients who were regular NSAID users	Academic detailing: physician-educator visit to physician, presentation of educational program to physician, answering of questions, provision of educational materials; followed up by study nurse placing reminders in charts of qualifying patients.	Usual care: data collected at baseline and at one year	Process outcomes: Assessment of participation: prescribing practice Impact outcomes: Patient health status: functional status, pain Sustainability	1 year
(Renders et al. 2004)	Diabetes	Level I Quality: good	Systematic review	Primary care, outpatient and community settings	Providers of diabetes care in these settings	Multi-faceted intervention: Organisational, professional and financial interventions	Patients receiving usual care	Process outcomes Assessment of participation: recommended tests and procedures completed Impact outcomes Patient health status: mortality, HbA1c, cardiovascular risk factors, functional status Patient complications	Varies
(Renders et al. 2001a)	Diabetes	Level III-2 Quality: poor	Non-RCT	General practitioners in The Netherlands	Patients with type 2 diabetes	Multi-faceted intervention: Clinical practice guidelines, education, audit and feedback, template to register diabetes care and a recall system.	Patients receiving usual care from GPs	Process outcomes Assessment of participation: recommended tests and procedures completed	42 months

								Impact outcomes Patient health status: blood pressure, lipids, BMI	
(Richards et al. 2001)	Universally applicable	Level II Quality: good	Cluster RCT, randomised by practice, stratified by area and size	Primary care setting, northern England	99 general practices with historically low uptake rates of breast screening	Reminders: letter to patient Flag: prompt to physician Combined reminders and prompts	Usual care	Process outcomes: Assessment of participation: physicians' encouragement of breast screening uptake	6 months
(Richards et al. 2003)	Universally applicable	Level III-2 Quality: good	Non-randomised controlled study	Primary setting, Christchurch, NZ	230 GPs in Independent GPs association	Peer-led small group education: education strategy to promote rational GP prescribing. Groups of approximately GPs attended meetings, led by an experienced GP, to discuss 4 key evidence-based messages related to rational prescribing	Control 1: intervention delayed – GPs on waiting list for program Control 2: no intervention	Process outcomes: Assessment of participation: rates of prescribing according to key messages presented during intervention	24 months
(Sanders & Satyvavolu 2002)	Diabetes	Level III-1 Quality: poor	Quasi-RCT	Primary care group practice, Virginia USA	Physicians of 160 adult patients with both hypertension and diabetes	Prompt: Generalised prompts to physicians about managing hypertension attached to patient's notes	Usual care	Process outcomes Assessment of participation: medication change Impact outcomes Patient health status: blood pressure	Not specified between clinic visits
(Schmidt et al. 2003)	Diabetes	Level III-2 Quality: poor	Non-RCT	Outpatients department of a university department of family medicine in the USA	Physicians in outpatient departments and random sample of their patients with diabetes	Multi-faceted intervention: Diabetes flowsheet to prompt recommended care (intervention 1) plus received provider feedback from chart audit. (Intervention 2)	Usual care	Process outcomes Assessment of participation: recommended tests and procedures completed Impact outcomes Patient health status: HbA1c, blood pressure, lipids	12 months
(Schned et al.	Universally	Level III-1	Quasi-RCT	Rheumatology	107 patients with	Interdisciplinary team	Usual care:	Process outcomes:	1 year

1995)	applicable	Quality: poor		Treatment and Resource Center, Minneapolis, Minnesota USA	early onset chronic inflammatory arthritis	approach: team managed outpatient care. Rheumatologist maintained ordinary, unconstrained care with patient; needs assessment conducted on each patient at baseline; half-day education and disease self-management program for patients and their families; team of health professionals met quarterly and assessed patient's progress and made appropriate management recommendations; Arthritis Care Plan formulated.	patient received "traditional" care in an unconstrained fashion from their primary physician and rheumatologist	Assessment of participation: prescribing practice, referrals, blood test ordering  Impact outcomes: Assessment of participation: functional status, pain, arthritis health status Patient quality of life Patient self-management of disease	
(Shiffman et al. 1999)	Universally applicable	Level 1 Quality: average	Systematic review	Health care providers	25 studies - RCTs, controlled before-and-after studies, time series	Computer-based CPGs: computerised implementation strategies for CPGs  Information management services model: recommendation, documentation, explanation, presentation, registration, communication, calculation, aggregation	Usual care	Process outcomes: Assessment of participation: compliance with CPGs (e.g. immunisation rates), documentation Provider satisfaction Impact outcomes: Patient ability to manage disease: cholesterol, triglycerides, blood pressure No. of hospital admissions	≥ 3 months
(Silagy et al. 2002)	Universally applicable	Level III-1 Quality: poor	RCT	Primary care practices, secondary care hospitals, tertiary teaching hospital, Adelaide, Australia	2 divisions of General Practice 400 GPs – members of the divisions of General Practice	Locally adapted guidelines: multidisciplinary panels adapted national clinical guidelines to include additional information on availability of local resources and more 'user-friendly' format  Guidelines: Prevention of Stroke	Usual national clinical guidelines	Process outcomes: Assessment of participation: compliance with CPGs; change in GPs knowledge, attitudes and practice	3 months

						Management of Lower Urinary Tract Symptoms in Men			
(Sondergaard et al. 2003)	Universally applicable	Level III-1 Quality: average	Cluster quasi-RCT	Primary care practices, Funen county, Denmark	Primary care physician groups	Feedback: mailed information on each physician's antibiotic prescription pattern and CPGs on diagnosis and treatment of respiratory tract infections. CPGs were presented in a 45-page booklet containing information on antibiotics in general, acute infections (tonsillitis, sinusitis, otitis media etc), and strength of evidence for guidelines	CPGs only	Process outcomes: Assessment of participation: difference between the number of prescriptions for antibiotics issued per 1000 listed patients per month in a 3-month period before and after intervention, difference between the fraction of prescriptions for narrow-spectrum penicillins issued in a 3-month period before and after intervention	2 years
(Stein et al. 2001)	Arthritis	Level III-1 Quality: average	Quasi-RCT	Nursing homes in Tennessee, USA	20 nursing homes with at least 75 beds covered by two consulting pharmacists and with a relatively high proportion of residents on NSAIDs	Academic detailing: meetings with nursing home staff; in-service educational program outlining optimal treatment of musculoskeletal pain; visits or calls to physicians by physician-educators and the provision of brief educational messages; provision of educational materials, including a laminated card with an algorithm for stopping NSAIDs, major intervention messages as well as reprints of 3 journal articles; reminder call from a study coordinator to physicians asking if they wanted to stop NSAID treatment for study patients and initiate acetaminophen trial.	Usual care: data collected at baseline and three months	Process outcomes: Assessment of participation: prescribing practice Impact outcomes: Patient health status: functional status, pain Patient complications	3 months

(Thomson O'Brien et al. 2000a)	Universally applicable	Level I Quality: good	Systematic review of RCTs	Community settings	18 studies 1896 primary care physicians	<b>Educational outreach visits:</b> face-to-face visit by trained person to improve a specific behaviour in the physician's own setting. Included one or more complementary interventions: <i>Educational materials</i> <i>Conferences</i> <i>Audit and feedback</i> <i>Reminders</i> <i>Opinion leaders</i> <i>Social marketing</i>	Usual care Educational materials alone	<b>Process outcomes:</b> Assessment of participation: compliance with CPGs; change in drug prescribing	1 week – 7 months
(Thomson O'Brien et al. 2001)	Universally applicable	Level I Quality: good	Systematic review of RCTs or quasi-experimental studies	Primary care settings	32 studies 2995 health professionals	<b>Educational meetings:</b> planned educational activities, including didactic interventions (seminars, lectures, symposia, meetings, conferences), interactive interventions (workshops, group discussions), and mixed interventions (didactic and interactive)	Usual care Lecture-based Large group	<b>Process outcomes:</b> Assessment of participation: drug prescribing, no of screening tests offered (mammograms, cholesterol, cervical smears), appropriate disease management, counselling provided (smoking, exercise), communication skills (recognition of emotional distress)  <b>Impact outcomes:</b> Patient health status: health care outcomes (asthmatic children) Patient self-management of disease: hypertension, smoking cessation rate	3-22 months
(Thomson O'Brien et al. 2000b)	Universally applicable	Level I Quality: good	Systematic review of RCTs	Hospital settings	8 studies 296 health professionals	<b>Local opinion leaders:</b> health professionals nominated by their colleagues as 'educationally influential' are	Usual care	<b>Process outcomes:</b> Assessment of participation: physicians'	2-12 months

						used to encourage physicians' to improve disease management activities		knowledge, attitudes; mean support during labour score; proportion of patients receiving appropriate care  <b>Impact outcomes:</b> Patient health status: pain prevalence, intensity  Length of hospital stay Patient complications	
(Thulesius et al. 2002)	Universally applicable	Level III-2 Quality: poor	Controlled before and after study	2 rural districts, Sweden	Home care staff caring for patients at the en-of-life stage.	Learner-centred education: Small group work with lectures, seminars and interactive discussions. Staff received education/training in symptom control, the last 5 days, support for significant others, ethics, ethnic groups. Plan Do Check Act model was applied throughout.	Usual care	Process outcomes: Assessment of participation: physicians' attitudes towards end-of-life care; physicians' anxiety and depression - Hospital Anxiety and Depression Scale (HADS)	1 year
(Tomson et al. 1997)	Asthma	III-2 Quality: poor	Prospective controlled before & after study	Primary health care setting in Stockholm county	General practitioners located at the health centres where the intervention took place (area 1 of Stockholm county). Also patients served at specific local pharmacies who had a prescription for anti-asthmatic drugs issued at any of the health centres.	Academic detailing: visits to physicians by a GP or a clinical pharmacist- educational materials- written presentation in monthly/bi-monthly leaflet; oral presentation at the health centres	Control area received no information	Process outcomes: Assessment of participation: physicians' knowledge of diagnosis and treatment  <b>Impact outcomes:</b> Patients' knowledge of disease	1 year
(Verstappen et al. 2003)	Universally applicable	Level II Quality: good	RCT	Primary care physician groups in 5 regions, Netherlands	26 GP groups – 174 GPs	Practice-based strategy: personalised graphical feedback for 3 specific clinical problems, including comparison of each GPs own	Three other clinical problems acted as controls for same group of	Process outcomes: Assessment of participation: number of appropriate tests requested for a range	6 months

						data with that of colleagues; dissemination of national, EBM guidelines; regular meetings on quality improvement in small groups. Focus on specific clinical problems and diagnostic tests. 3 consecutive feedback reports mailed to physicians	GPs.	of clinical problems: cardiovascular disease, abdominal complaints, respiratory illness, degenerative joint complaints, general complaints	
(Veninga et al. 1999)	Asthma	III-1 Quality: average	Quasi-RCT	Health care settings in Netherlands, Norway, Sweden	General practitioners	<b>Audit &amp; Feedback:</b> 2 evening meetings. The first looked at diagnosis, behaviour and underlying reasons for treatment. The second focused on national and international guidelines.	Educational program on urinary tract infection	<b>Process outcomes:</b> Assessment of participation: prescribing behaviour, knowledge and attitudes of general practitioners	6 months
(Wagner et al. 2001b)	Diabetes	Level III-1 Quality: average	Quasi-RCT	Primary care practices in a large HMO in Washington, USA	Physicians, nurses, pharmacists providing diabetes care	<b>Interdisciplinary team approach:</b> Chronic care clinics: group visits for education, time with physician, nurse and pharmacist, standardised assessments.	Usual care	<b>Process outcomes</b> Assessment of participation: tests completed <b>Impact outcomes</b> Patient health status: HbA1c, total cholesterol, SF-36	24 months
(Wang et al. 2002)	CVD & stroke	Level: III-2 Quality: Average	Controlled before and after study	Massachusetts General Hospital	2 intensive care units	<b>Multi-faceted intervention:</b> <b>Interdisciplinary team:</b> involved in the development of practice guidelines for routine laboratory and radiographic testing <b>Decision support:</b> computerised test ordering template <b>Education:</b> educational sessions for staff to explain the guidelines and use of the template	No intervention	<b>Process outcomes:</b> Assessment of participation: no. of tests ordered <b>Impact outcomes:</b> Length of stay Hospital and ICU readmission	3 months
(Weingarten	CVD &	Level: III-3	Interrupted	Teaching	404 low-risk patients	<b>Decision support:</b>	No intervention	<b>Process outcomes</b>	6 months

et al. 1990)	stroke	Quality: Average	time series	community hospital	with chest pain	Use of triage criteria for low-risk chest pain patients to increase the efficiency of bed use in the coronary care unit		Assessment of productivity: increased patient flow <b>Impact outcomes</b> Patient complications	
(Weir et al. 2003)	CVD & stroke	Level: Quality:	Cluster-RCT, before and after design	16 hospitals in Glasgow	1952 patients with clinical diagnosis of acute ischaemic stroke or transient ischaemic attack (TIA) within the preceding 4 months	<b>Decision support:</b> Designed to estimate annual risk of major event occurrence	Routine practice	<b>Process outcomes:</b> Assessment of participation: prescribing behaviour	6 months
(Whiting-O'Keefe et al. 1985)	Arthritis	Level III-1 Quality: average	Quasi-RCT	Arthritis clinic at the University of California, San Francisco, USA	12 health professionals – 3 staff physicians, 7 rheumatology fellows, 1 nurse practitioner and 1 medical resident	<b>Decision support:</b> Provision of computerised summary time-oriented medical record (STOR) in addition to the standard Medical record (MR). The STOR consists primarily of a concise two-part summary of a patient's clinical data. Part A is a flowsheet of a patient's problems, physical findings, therapies and clinical laboratory data. Part B contains short free-text visit notes, other kinds of free-text summary reports (i.e. pathology), laboratory results since the last clinic visit, inactive problems and therapies.	Usual care: provision of standard patient Medical Record	<b>Process outcomes:</b> Assessment of participation: predictive accuracy of clinical patient events	1 year

# Appendix F Exclusions

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## Studies that satisfied the inclusion criteria but did not contain extractable data

Universally applicable tools
(Tai et al. 1999; Fallowfield et al. 2002; Brown et al. 2000)
Asthma tools
(Premaratne et al. 1999)
Arthritis and musculoskeletal conditions
(Ahlmen et al. 1988; Hill et al. 1994; Viet Vlieland et al. 1996)
Cardiovascular disease and stroke
(Fitzmaurice et al. 2001; LaBresh et al. 2000)
Diabetes mellitus
(Griffin & Kinmonth 2001; Norris et al. 2002; Norris et al. 2001; Renders et al. 2001b)