QQUIP Quest for Quality and Improved Performance

Quest for Quality and Improved Performance: Quality Enhancing Interventions

Patient Care Teams

Marije Bosch, Marjan Faber, Gerlienke Voerman, Juliëtte Cruijsberg, Professor Richard Grol, Marlies Hulscher, Michel Wensing,

Radboud University Nijmegen Medical Centre

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The Health Foundation
90 Long Acre
London WC2E 9RA
Telephone: 020 7257 8000
Fax: 020 7257 8001

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Table of contents

Executive summary

Introduction

The delivery of healthcare by a coordinated team of health professionals is now assumed to be beneficial, and the concept of ‘teamwork’ has taken firm hold in healthcare. The expectation is that enhanced, more elaborated team approaches in selective circumstances are associated with improved healthcare delivery processes, leading to more appropriate care, better patient outcomes and lowered costs, compared to approaches with less elaborated teamwork. The establishment or enhancement of a patient care team is therefore increasingly considered a key method for improving the quality of healthcare. However, as yet, it is unclear whether teams are as effective as they are supposed to be, and under what conditions team effectiveness is optimal. For decision makers in both health policy and healthcare practice, it is imperative to identify the critical elements for effective teams in order to transform healthcare workplaces into effective team-based environments.

Objective

The authors reviewed the research literature published between 1990 and February 2008, grouping the studies according to the particular objectives of the teams. By aggregating the results to these subgroups, we aimed to draw some headline measures about the effectiveness of different types of teams. In addition, determinants for team effectiveness were collected.

Methods

Twelve literature databases were explored during January and February 2008 following a predefined search strategy. All systematic reviews of original studies or reviews, randomised controlled trials (RCTs), controlled before and after studies (CBAs) and interrupted time series (ITS) written in English were eligible for inclusion. According to the definition of team in this report, original studies or reviews were included that assessed the impact of multidisciplinary (or interdisciplinary) or professional teams. Within these studies, we organised the discussion of the evidence according to three subgroups we identified: 1) teams with enhanced clinical expertise; 2) teams with improved coordination; and 3) teams with both enhanced clinical expertise and coordination. Titles and abstracts of unique studies were assessed by two reviewers (or three in case of disagreement). Two reviewers studied the retrieved full-text articles, extracted information and discussed findings. If no consensus was reached, a third reviewer assisted.

Results

Main findings: enhanced clinical expertise

We identified eight studies in which a team member was added to the care because of his or her additional clinical expertise. Given the consultative character of these interventions, one would expect to find an impact on process measures, such as those reflecting guideline adherence, and thus – ultimately − improved patient outcomes. With respect to the process measures, most of these studies indeed measured such outcomes, and results were at least partly in favour of the intervention groups. However, although at least some positive results were reported in terms of process, studies showed mixed results in relation to patient outcomes.

Main findings: improved coordination

Five studies were identified that focused on improving coordination: in three studies, a coordinator was added to the team; and in two studies, improved communication and coordination structures were introduced. Patient outcomes seemed to show some positive results, but given that the main aim was to improve coordination, one would also expect an impact on resource utilisation and efficiency in healthcare delivery. All five studies included such measures. However, overall, there was very little evidence to conclude that resource utilisation and costs reduced as a result of improved coordination in patient care teams, although some studies reported shorter length of stay.

Main findings: enhanced clinical expertise and coordination

Ten studies were identified in which the intervention comprised both clinical expertise and coordination. Process measures were hardly reported, and the studies showed limited effect on patient outcomes and little effect on costs and resource utilisation. We therefore found little evidence to conclude that the combination of enhanced coordination and expertise added value compared to enhanced clinical expertise only or improved coordination only.

Very little information was found on the determinants of team effectiveness, such as the presence or absence of a team leader and task descriptions for team members.

Overall conclusion and implications

From our review of the evidence, enhanced clinical expertise may indeed improve appropriateness of care, although this did not consistently translate into improved patient outcomes. It remained unclear what costs were involved in achieving the improvements. We suggest that putting in additional resources may be acceptable, as they are an investment in better patient outcomes; however, formal evidence on efficiency would be helpful for decision makers. The improvements in processes, if present, did not consistently translate into improved patient outcomes. This finding may be due to many reasons, including methodological problems in the research itself, and needs further exploration in future.

Improved coordination did not show a consistent reduction in resource utilisation or costs, as might have been expected. The effects on patient outcomes were, to some extent, positive. Process measures were hardly mentioned. We suggest that the intended effects of improved coordination, either through adding a human coordinator or through adding more coordination structures, need to be examined. If reduced utilisation and costs are indeed the objective (for example, by shortening hospital stay), the mechanism by which this is achieved should be clarified. Currently, there is limited evidence to suggest to decision makers that adding a team member with a coordination role or more coordination activities has a beneficial effect.

We speculated that enhanced expertise and coordination might add value, as coordination may be most effective when combined with added expertise and integrated into an appropriate organisational context. Unfortunately, the available studies did not provide evidence to support these expectations.

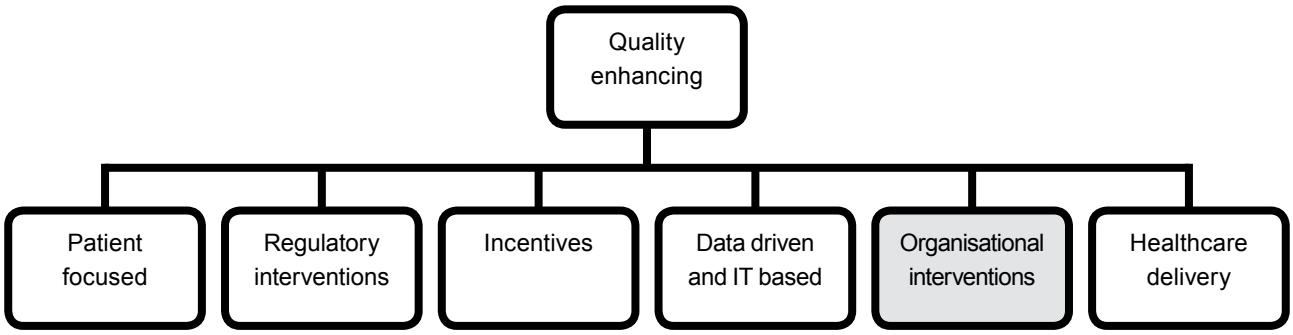
Decision makers who want to know what components contribute to the effectiveness and optimisation of patient care team interventions should plan evaluations alongside programmes to enhance patient care teams. It is important that expectations of enhanced team approaches are clarified. Is the aim to improve patient outcomes or to achieve equivalent patient outcomes with reduced costs and/or higher capacity?

Project background

QQUIP (Quest for Quality and Improved Performance) is a five-year research initiative of the Health Foundation. One of the three main focuses of QQUIP is the Quality Enhancing Interventions (QEI) programme. The QEI programme includes a series of structured evidence-based reviews of the effectiveness of a wide range of interventions designed to improve the quality of healthcare. The six main categories of QEIs for which evidence will be reviewed are shown below. The main category, 'Organisation interventions', focuses on improving managerial, professional and institutional behaviours in healthcare (figure 1). Within this category, this report will focus on patient care teams, also called clinical delivery teams.

Healthcare is increasingly provided by formalised teams of health professionals, rather than by doctors in less elaborated team approaches. The expectation is that elaborated and formal team approaches in selective circumstances are associated with improved healthcare delivery processes, leading to more appropriate care, better patient outcomes and lowered costs, compared to less elaborated team approaches. The establishment or enhancement of a patient care team is therefore increasingly considered a key method for improving the quality of healthcare. In this study, we have searched for research evidence to support these claims. Our aim is to provide guidance for decision makers in healthcare regarding patient care teams, and to offer suggestions for research and development in this domain.

Overview of review categories in the QEI programme



Introduction

The delivery of healthcare by a coordinated team of health professionals is now assumed to be beneficial (Wagner, 2001) and the concept of 'teamwork' has taken firm hold in healthcare (Baker, Day and Salas, 2006). In 1978, the World Health Organization (WHO) began to put emphasis on the importance of teamwork (WHO, 1978). From that time, teamwork in healthcare has been increasingly recognised and recommended by health policy makers. The expectation is that enhanced, more formalised team approaches in selective circumstances are associated with improved healthcare delivery processes, leading to more appropriate care, better patient outcomes and lowered costs, compared to less elaborated team approaches. In addition, it is considered that specific tasks in patient care are too complex to be performed well by a single professional, and therefore that teamwork is needed. Teamwork may overcome the fragmentation of care caused by professional specialisation. Patients who receive care from a team of carers may benefit from more 'eyes and ears', the various insights of different bodies of knowledge (for example, medicine and nursing) and a wider range of skills (Wagner, 2001). Teams satisfy individuals' needs for social interaction, status, recognition and respect (Cohen and Bailey, 1997). At the same time, teamwork is complex and specific characteristics of teams can require compromise. For example, teamwork means that team members have to sacrifice some of their individual autonomy in the interests of collective decision-making.

The appeal of the potential advantages of teamwork, and the emerging evidence, has meant that policy documents from countries with disparate health systems such as the USA and the UK (Department of Health, 2000; Institute of Medicine, 2000; Institute of Medicine, 2001) reinforce its importance in healthcare. However, despite this pressure, it is as yet unclear whether teams are as effective as they are supposed to be, and under what conditions team effectiveness is optimal.

For decision makers in both health policy and healthcare practice, it is imperative to identify the critical elements for effective teams in order to transform healthcare workplaces into effective team-based environments.

Definition of 'team'

Despite the often cited indistinctness of the concept of 'team' (Oandasan et al, 2006), there seems to be a general consensus in the literature that a team consists of two or more individuals who have specific roles, perform interdependent tasks, are adaptable and share a common goal (Salas et al, 1992; Xyrichis and Ream, 2008). These characteristics are in line with the MeSH definition for a patient care team (first introduced in 1968): 'Care of patients by a multidisciplinary team usually organised under the leadership of a physician; each member of the team has specific responsibilities and the whole team contributes to the care of the patient.' 'Collaboration' is often used as a synonym for 'team'; however, these words are not mutually exchangeable (Oandasan et al, 2006). Collaboration can be seen as a prerequisite for teamwork. People may collaborate without being part of a defined team. For example, in primary care, the family physician, a physiotherapist and a dentist may provide care to the same individual, yet they may not see themselves as a team working collaboratively with the patient. Teamwork explicitly requires a decision by team members to cooperate in meeting predefined and collective objectives. So, a collective goal is what distinguishes a team from a group of collaborating people (Firth-Cozens, 1998; Saltman et al, 2007).

Conceptual framework

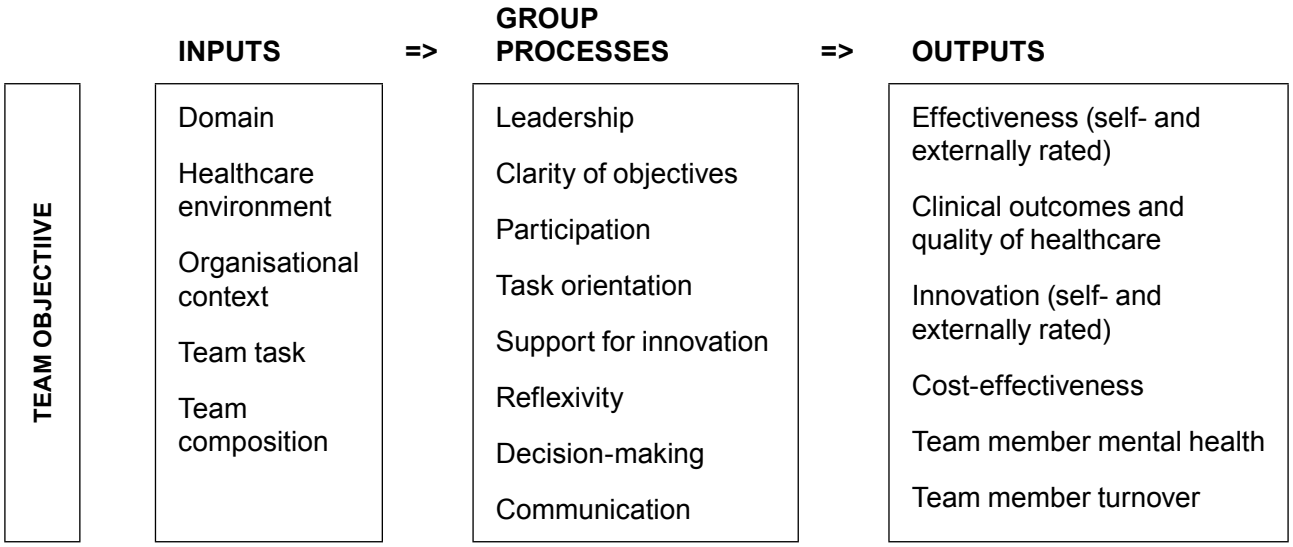
From the field of psychology, West et al have been frontrunners in bringing the message that effective team activities are characterised by input, structural factors (such as team composition and skill mix), team processes (such as communication between several team members) and team effectiveness (the output of the team) (West, Borrill and Unsworth, 1998). They proposed a model, based on organisational and management literature, which was mainly applied to non-healthcare settings. In healthcare settings, Oandasan et al (2006) distinguished between two types of team: project teams and care delivery teams. Project teams (or quality improvement teams) are often time-limited, and once their project goal has been achieved they are discontinued (Cohen and Bailey, 1997). Care delivery teams (work teams or patient care teams) are continuing work units responsible for providing services (Cohen and Bailey, 1997). Patient care teams can be further subdivided according to patient populations (such as geriatric teams), disease type (such as stroke teams) or delivery settings (such as primary care, hospital and long-term care).

After the work of West, Borrill and Unsworth (1998), Lemieux-Charles and McGuire (2006), in their review of healthcare team effectiveness, extended the explanatory model for team effectiveness and adapted it to the healthcare situation. Their model integrates both types of teams as distinguished by Oandasan et al (2006). In addition, Lemieux-Charles − and others − identified the team characteristics expected to foster or hinder teamwork in patient care. (Lemieux-Charles and McGuire, 2006; Xyrichis and Lowton, 2008). Field studies showed, for example, that the type and diversity of clinical expertise involved in team decision-making was expected to account for improvements in patient care and organisational effectiveness (Lemieux-Charles and McGuire, 2006; Xyrichis and Lowton, 2008). Also, for teams to be effective, structures were required that outlined team objectives, the different roles and responsibilities of team members, mechanisms for exchanging information, and coordinating mechanisms for team activities and staffing (Oandasan et al, 2006; Xyrichis and Lowton, 2008). Thus, team members may be needed for their specific knowledge or expertise, their coordinating or leadership role, or both.

Considerable numbers of evaluations of teamcare interventions have been published. However, these studies have been criticised for a number of reasons. First, the explicit qualification by type of team, as distinguished by Oandasan, has often not been taken into account. Second, outcome measures have been highly heterogeneous, making comparisons across studies difficult (Lemieux-Charles and McGuire, 2006). Underlying team objectives have been overlooked, despite the need in evaluation studies to select effect measures that closely relate to the intervention objective (Ovretveit and Gustafson, 2002). In addition, many studies have failed to provide insight into the important question of which characteristics of teamwork contribute to effectiveness. In a way, since team characteristics have seldom been measured and/or provided, making it impossible to establish which characteristics have contributed to effectiveness, the intervention has often remained a ‘black box’. In summary, previous evaluations have tended to make overall syntheses of team interventions based on heterogeneous literature.

In this review, we took the above critiques into account. We classified the types of outcome, and grouped the studies according to the underlying objectives of the teams, since different teams may be effective on different outcomes. For our analyses, we slightly redesigned the conceptual model of West et al (Borrill et al, 2000; West, Borrill and Unsworth, 1998) by separating the team objective from other input characteristics and group processes (figure 1).

Figure 1: Input, process and output model of team effectiveness



after West, Borrill and Unsworth, 1998

Objectives

Our aim was to assess the effectiveness of patient care teams in healthcare settings on outcomes. In this review we focus exclusively on patient care teams according to the MeSH definition, that is, multidisciplinary (or multiprofessional) in nature and contributing to the care of the patient. The evidence was organised according to three subgroups we identified. This classification was derived from the information the authors provided on the objectives of the team and the description of the intervention components. More specifically, we aim:

1. To examine the effects of adding a relevant specialist to a patient care team compared to usual (team) care (‘enhanced clinical expertise’)
2. To examine the effects of adding a coordinating person or system to a patient care team compared to usual (team) care (‘improved coordination’)
3. To examine the effects of patient care teams with both added clinical expertise and enhanced coordination compared to usual (team) care (‘enhanced clinical expertise and coordination’).

In addition, determinants for team effectiveness, such as the characteristics of team members and team processes, were collected.

Methods

Data sources and searches

We searched the following databases for literature: PubMed; PsycINFO; CINAHL; EMBASE; Cochrane Database of Systematic Reviews; Database of Abstracts of Reviews of Effects (DARE); NHS Economic Evaluation Database (NHS EED); Health Technology Assessment Database (HTA); Web of Science; World Health Organization (WHOLIS); Organisation for Economic Cooperation and Development (OECD); and Sociological Abstracts. All databases were searched from January 1990 to February 2008 inclusive.

Since the outcome measures of patient care teams were rather diverse, searches were not limited to specific outcomes. Instead, based on our experience of initial searches, which included MeSH terms and text word fields, we decided to limit the searches to terms in titles to enable us to find the most relevant studies. To narrow down the number of hits further, while ensuring that we would find the studies that would be most useful for a review on *effectiveness*, we used a filter that limited our search results to designs considered acceptable for EPOC reviews (www.epoc.cochrane.org). In addition, we limited our searches with healthcare terms in the databases that also contained studies in other sectors. Appendix A shows the PubMed search for studies, which was slightly adapted to meet the specific requirements of the other databases. Appendix B presents the search strategies and results for each database.

Study selection

Types of studies

All systematic reviews of original studies or reviews, randomised controlled trials (RCTs), controlled before and after studies (CBAs) and interrupted time series (ITS) were eligible for inclusion.

Types of interventions

According to the definition of team in this report, original studies or reviews were included that assessed the impact of:

1. Multidisciplinary (or interdisciplinary) teams: active participation of professionals from more than one discipline (for example, geriatrics, cardiologists and general practitioners) in the ongoing management of patients
2. Multiprofessional (or interprofessional) teams: active participation of professionals from more than one profession (for example, medicine, nursing, pharmacy, nutrition) in the ongoing management of patients.

We subsequently categorised the interventions within these studies into three subgroups:

1. **Enhanced clinical expertise**: First, we identified interventions in which a relevant specialist was added to a patient care team (or formed a new team with a usual care provider) and functioned as more than a conventional consultant by referral. The addition of a team member, such as a pharmacist or nurse with skills in managing behavioural problems, may ensure that critical elements of care that doctors either do not have the training or time to do well are competently performed (Wagner, 2000). Involvement may vary: it may be consultative,

where a specialist advises the usual caregiver on the management of specific patient groups; or patients may be directed to expert services: for example, a population-based expert team such as a diabetes team may visit a primary care practice by invitation to see patients with the primary care team and establish a model for good diabetes care.

2. **Improved coordination**: While in the first category it seemed that team members were involved for their specific clinical expertise, we also identified interventions that appeared to focus on enhancing coordination and/or communication. These included the introduction of structures through which team goals could be communicated (for example, regular (mandatory) team meetings or the involvement of team members in a patient care team who primarily carried out coordinating functions (for example, case managers, coordinators).
3. **Enhanced expertise and coordination**: Third, studies were included in which the above elements were combined. These were compared with the usual, non-coordinated (team) care without the specific enhancement of clinical expertise.

Across this classification, information on the determinants of effectiveness related to 'input' or 'group processes' in the conceptual framework (figure 2) were collected and analysed. Potential determinants included: the professions and disciplines involved; the presence of a team leader or coordinator; characteristics such as team size, age of team members or team tenure; and the presence or absence of explicit task descriptions of team members.

Inclusion criteria

We included studies that: a) compared a patient care team versus (team or non-team) usual care: b) were conducted in healthcare settings: c) used objective outcome measures (or used validated questionnaires to measure subjective outcomes): d) treated the team rather than the team member as a unit of analysis: and e) were published in English. Teamwork could take place in any healthcare setting (inpatient, outpatient, or other, such as community-based or mixed) and it could focus on any clinical domain in prevention, chronic disease management (physical and mental illnesses) and acute care. Inclusion criteria for reviews were: 1) at least a description of the search strategy had to be provided, and 2) inclusion criteria had to be mentioned, and 3) some sort of analysis/integration of the data of the included studies had to be present (no narrative reviews), and 4) the review included at least 50 per cent of studies with an RCT, CBA or ITS design. No additional inclusion criteria for RCT, CBA or ITS designs were adopted.

Exclusion criteria

Articles were excluded if they were not published in English, could not be retrieved, were anecdotal, did not make comparisons with a control group over time, focused on teamwork without linking to outcomes, or were doctoral dissertations, books or book chapters. Studies that evaluated the effectiveness of (Breakthrough) collaboratives or other quality improvement teams were excluded, as were studies in which the intervention was too confounded by other interventions, such as studies on integrated care with a main focus on logistics of care service delivery, or studies that compared similar teams in different care structures. Studies that focused mainly on relocating care, on the inclusion of lay people in teams or primarily on team-based learning were excluded. Outreach team studies in which the 'consultant(s)' did not take part in the actual care for patients were also excluded. Reviews that did not fulfil the above inclusion criteria were excluded.

Types of outcome measures

Patient care teams may have impact on many different types of outcomes. Frequently, study outcomes were patient outcomes such as mortality. Outcomes were grouped differently by different authors, and categories are therefore unlikely to be exclusive. For example, the number of prescriptions may be

seen as a resource utilisation measure, while the appropriateness of a prescription may be seen as a process of care (quality) outcome. From the description of the studies it was not always clear which specific outcome had been measured. For the purpose of comparison we grouped outcomes of interest into six categories. The outcomes reported in the included studies were assigned to one of these six categories, although the authors did not necessarily use the same taxonomy. Box 1 shows the taxonomy of outcomes used in this report.

Table 1: Outcomes of interest

Outcome measure	Examples
Clinical patient outcomes	Morbidity Mortality Physical functioning Quality of life
Behavioural patient outcomes	Satisfaction Preference Knowledge Compliance/adherence to treatment
Process of care (ie quality) delivered	Adverse events (eg unscheduled hospital admissions; visit accident and emergency department) Provision of advice Guideline adherences (eg appropriate prescriptions and management)
Provider outcomes	Subjective workload measures such as stress, burn-out Satisfaction Attitudes to teamwork
Resource utilisation	Number of prescriptions Number of tests and investigations Number of consultations Number of hospitalisations Length of hospital stay
Cost-effectiveness and cost outcomes	QUALYs Staff costs Cost savings

Data extraction procedure

Abstracts were independently screened for inclusion by two reviewers (MB and JL or MW or MF or MH). Full-text versions were retrieved for the papers that were potentially useful. All studies were reviewed by one reviewer who assessed the text for study quality criteria, study period, number of patients randomised or included in the study, country, setting, clinical domain, type of intervention, control group, professions and disciplines involved, presence of team leader or coordinator, team characteristics, presence of explicit task descriptions of team members, and results in the categories as specified in appendix A. Outcomes within specific patient groups (for example, men) were not included if the overall outcomes were reported. After data collection, a second reviewer assessed the data collection forms for correctness and completeness. Disagreements were solved through discussion, including a third

reviewer. We used a modified version of the EPOC data collection checklist to extract data from the studies in a standardised way (see appendix C).

Quality assessment

For RCT and CBA studies, the EPOC quality criteria were used. These included seven items, six of which applied to both designs: follow-up of professionals (at least 80 per cent); follow-up of patients (at least 80 per cent); blinded assessment of primary outcomes; baseline measurement (measured prior to the intervention and where no substantial differences were present, or where the study was corrected for baseline); reliable primary outcome measures (agreement of 90 per cent, or kappa > 0.8, or outcomes from an automated system, or validated instruments with Chronbach α > 0.7); and protection against contamination (where it was unlikely that the control group received the intervention). For RCTs the additional item was concealment of allocation (randomisation process is explicitly described); and for CBAs it was similar characteristics for studies using second site as control. For reviews, the following criteria were used: search period specified; search terms specified; databases specified; data extraction by at least two reviewers; quality assessment provided; and methodological quality reported. For all studies an overall score out of the total number of criteria was provided.

Data synthesis

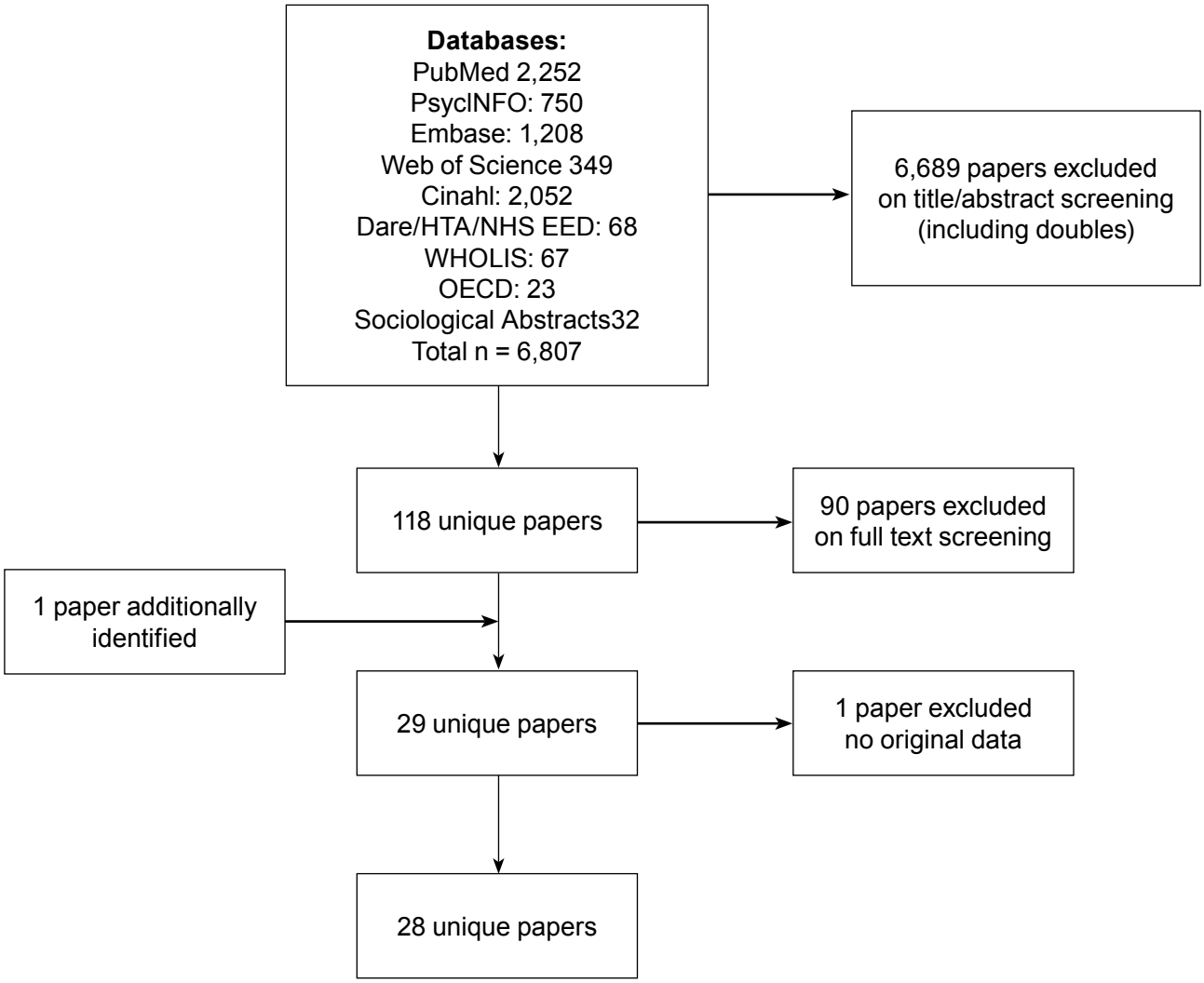
The data were considered to be too heterogeneous to allow statistical pooling, so we summarised data narratively according to three subgroups we identified during the review process. For each of these objectives, we grouped the results as follows. Here, we first present the results for the process measures (processes of care and provider outcomes), followed by patient outcomes (clinical and behavioural) and, finally, costs (resource utilisation, costs and cost-effectiveness). This distinction is important, since the aim and components of the intervention have implications for how to assess the outcomes. Ideally, one evaluates the outcomes that are most directly linked to the intervention itself (Eddy, 1998; Ovretveit and Gustafson, 2002). Different aspects of teamwork may impact on different outcomes. For instance, if a hospitalist is added to the team because of their coordinating role, one would expect changes in outcomes such as resource utilisation. If a pharmacist is added to the team because of their clinical expertise, one might expect to see changes in clinical behaviour (process measures). Because both interventions and control conditions were rather heterogeneous, and context is important in interpreting outcomes of a specific study (Oandasan et al, 2006), we start each results section with a description of the intervention and the control conditions of the study.

Results

Identification of evidence

We identified 6,807 abstracts. Full-text versions were retrieved for the 118 papers that were potentially useful. After reviewing the full text, we selected 29 articles that provided relevant data. One more paper was excluded since it did not provide original data, which left 28 articles for our review. Appendix D provides a list of excluded studies with reasons for exclusion.

Figure 2: Study flow



Description of studies

A total of 28 papers were included in this review, which presented the results of 25 studies, including two reviews (Malone et al, 2007; Mitchell, Del and Francis, 2002) and two studies with CBA design (Jack et al, 2003; Mudge et al, 2006). All other studies were (quasi) RCTs. Table 2 presents pertinent information

on all included studies, including a summary of the evidence and an overview of intervention and control group characteristics. Appendix F provides the results for each study in more detail. A small majority of the studies (56 per cent) were published after 2000.

Types of team intervention

Eight of the single studies we identified were classified as 'enhanced clinical expertise', five as 'improved coordination'. Ten single studies were identified that contained elements of both additional clinical expertise and coordination. The reviews we identified in our search were not categorised, since the single studies they summarised contained a mix of these elements.

Participants and settings

Most of the studies were undertaken in the USA (43 per cent), the UK (22 per cent) or Canada (13 per cent). The majority of the studies were performed in an inpatient setting, six studies were performed in an outpatient setting, three studies examined results of team interventions in community care, and six studies had mixed settings. With respect to the clinical domain, a large number of studies examined patient care teams in psychogeriatrics or palliative care, some examined team interventions in mental health or psychiatry, some studied outcomes in various chronic care conditions such as cardiovascular disease and diabetes mellitus, and some focused on stroke care, rheumatoid arthritis, general or internal medicine, infectious diseases and orthopaedics.

Methodological quality of the studies

Appendix E presents the methodological quality of studies. Overall, methodological quality was rather poor. In particular, protection against contamination was a problem in the studies examined. This might imply that the available research underestimates the effectiveness of team approaches.

1A. Interventions: enhanced clinical expertise (n = 8)

Bogden et al, 1997, 1998 assessed the effect of a programme that encouraged teamwork between physicians and pharmacists on attempts to improve evidence-based care in two groups of patients in an ambulatory primary care centre in the USA. They presented their results in two papers: one on the management of patients with total cholesterol concentrations of 6.2mmol/L or more, and the other on patients with uncontrolled hypertension. In the intervention arm, a pharmacist routinely interacted with and advised patients and physicians on the best course of pharmacological therapy. During such visits, patients met with the pharmacist for half an hour before seeing their physician (resident or intern). At that time, the pharmacist took a medication history, answered questions and encouraged compliance. After meeting the patient, the pharmacist reviewed laboratory data with the physician. The pharmacist attached recommendations for the physician to the patient's chart. The resident or intern discussed these with the supervising physician in order to accept or reject them as part of the overall treatment plan. The physician was responsible for possible referrals to other health professionals. In the control group, patients received usual care by resident physicians and interns under supervision of the control arm physicians.

Dey et al, 2005 determined the impact on outcome of immediate access to a mobile team. The team attempted to promote clinical and ward staff adherence to guidelines on effective management during the acute phase of stroke in two district general hospitals in the UK that had stroke rehabilitation units but did not have either a direct admissions stroke unit or an acute stroke ward. Three hundred and eight patients were randomly allocated to a mobile stroke team, which supported the clinical team (n = 157/112

before/after), or to usual ward-based care (n = 151/116). When patients were allocated to the intervention group, their details were forwarded to the mobile team, which included a consultant with a special interest in stroke and a senior therapist. The team visited patients within 12 hours of randomisation. The responsibility for patients remained with the admitting clinicians and ward staff, but the team advised on acute stroke management using evidence-based guidelines (adherence was also recorded by the team). The team revisited patients as necessary to review progress. Members of the team could visit patients alone, but were expected to meet regularly to discuss the case. Patients in the control group received usual ward-based care during the acute phase of stroke and were referred to the stroke rehabilitation unit at the request of the clinician of care.

Gattis et al, 1999 evaluated the effect of a clinical pharmacist on outcomes in outpatients with heart failure in the USA. For patients in the intervention group, the clinical pharmacist discussed the patient's case and verbally provided therapeutic recommendations on the optimisation of therapy to the attending physician. The pharmacist then discussed changes made in drug therapy with the patient, the purpose of each drug and the importance of adhering to the regime. Patients were able to ask the pharmacist questions and were provided with a telephone number for the pharmacist should questions arise. The pharmacist provided telephone follow-up at 2, 12 and 24 weeks after the initial clinic visit to identify the occurrence of clinical events. In the case of worsening symptoms, patients were advised to contact their clinician for further evaluation and the pharmacist contacted the physician to discuss these cases. The control group received usual care, in which patient assessment and education were provided by the attending physician and/or physician assistant or nurse practitioner. The pharmacist contacted the control group by telephone at 12 and 24 weeks after the enrolment visit to identify clinical events.

Gums et al, 1999 aimed to identify the financial and outcome benefits of therapeutic intervention by a multidisciplinary antimicrobial treatment team composed of pharmacists, a clinical microbiologist and an infectious disease specialist in a community hospital in the USA. Two hundred and seventy-two patients were randomised to either multidisciplinary care (n = 138/127 before/after) or usual care (134/125). Team members identified eligible patients and prepared a typed consult for the attending physician within two hours of randomisation. The consult contained the rationale, with appropriate references, for changing antimicrobial therapy. It also provided a comparison of advantages of each suggested therapy and information regarding costs. Patients allocated to the control group received usual care by the attending physician.

Jack et al, 2003 evaluated the impact of a hospital palliative care team in patients with a confirmed diagnoses of cancer in a controlled before and after study. The aim was that the palliative care team would transfer the principles of hospice care to the acute setting. The team consisted of four clinical nurse specialists, supported when required by a consultant (who, in addition, had sessional commitments at a local hospice) and a specialist registrar. Medical staff referred patients, who were located on wards distributed throughout the hospital, to the team. Patients received specialist intervention from the team, which focused on individualised assessment, advice, psychological support, symptom control and evaluation in addition to their standard care. Other cancer patients not referred to the palliative care team acted as a standard care control.

Koproski, Pretto and Poretsky, 1997 studied the effects of a diabetes team (a diabetes nurse educator and an endocrinologist) on length of stay and other outcomes of hospitalisation in patients. A total of 179 patients were randomly assigned to receive usual care supplemented with (85/85) or without (94/94) a diabetes team intervention. The diabetes team visited patients on a daily basis. Orders were written by the endocrinologist after discussion had taken place with the primary care physician. Nutrition and social work consultations were requested by the team, based on individual need. The control group received care, usually in medical/surgical units, from physicians, nurses, nutritionists and social workers.

Rubin et al, 2005 examined the effects of collaboration between an internist and psychiatrists on the processes and costs of care among psychiatric inpatients. Patients in the intervention group met with an internist who participated in their care by communicating with the patients' primary care physician (PCP), assessing needs, updating appropriate health maintenance services, managing chronic and acute medical problems, and attending hospital work rounds. Patients in the usual care group were cared for by psychiatric house staff who had rotations in the inpatient unit that lasted for a month. They saw patients daily, and their progress was followed by one of the four psychiatric attending physicians who were permanently assigned to the units. Consultations from medical specialists were obtained using the usual hospital services.

Scott et al, 2005 assessed the economic and clinical implications of systematic long-term nutrition team follow-up of patients after percutaneous endoscopic gastronomy. Intervention patients were visited at least weekly by the nutritional support team (NST) nurse and/or dietitian while in the acute hospital and at least monthly after discharge into the community. There was regular liaison between the NST and the ward and PCPs, with advice and help on a proactive basis for any problems or questions that arose. Patients and their carers were counselled, educated and trained in all relevant aspects of nutritional support, and were given a telephone number to contact at any time, if required. Patients in the control group received no specific input from the NST before or after discharge, which is standard practice. This did not exclude referrals to the team if the ward or community team felt this was necessary; however, the level of input was generally limited to advice only. The time and input of ward dietitians (not part of the NST) for setting up home feeding and deliveries from the homecare company were common to both groups.

1B. Evidence: enhanced clinical expertise

Process measures

Some studies evaluated whether clinical guideline adherence improved in intervention patients. Overall, results were mainly in favour of the intervention groups. Bogden et al (1997, 1998) found that, overall, physicians accepted around 90 per cent of the recommendations made by the pharmacist; when physicians declined the recommendations, the success rate for reaching the goals was significantly lower (17 per cent versus 51 per cent) (intervention only). Gattis et al (1999) found that patients in the intervention group were significantly closer to target ACE inhibitor dose at six months follow-up (1.0; 0.5 to 1 (25th to 75th percentile) versus 0.5; 0.19 to 1). However, no difference was found in prescription of ACE inhibitors between groups (78 patients (87 per cent) in intervention versus 72 (79 per cent) in control at follow-up). Significantly more patients in the intervention group received alternative therapy (9 (75 per cent) versus 5 (26 per cent)). Also, Koproski, Pretto and Poretsky (1997) found that significantly more patients in the intervention (diabetes team) group had their blood monitored for glucose levels (98 per cent versus 57 per cent), had insulin administration (69 per cent versus 25 per cent), received education of any kind (87 per cent versus 37 per cent) and received nutritional education (76 per cent versus 40 per cent). However, these results have to be interpreted with care since they were based on post-intervention measures only. In addition, Rubin et al (2005) found positive effects for integrating an internist in the psychiatry team for 12 of 17 processes of care measures, such as better needs assessment (89 per cent ± 1 4 per cent versus 59 per cent ± 20 per cent), better health maintenance (56 per cent ± 34 per cent versus 3 per cent ± 7 per cent) and coordination of care (81 per cent ± 40 per cent versus 40 per cent ± 55 per cent). Scott et al (2005), however, failed to find positive effects on median time to removal of PEGS and time to antibiotics treatment in patients receiving follow-up care by the nutrition team.

Patient outcomes

Effects on patient outcomes were mixed. In their study, Bogden et al (1997, 1998) found that patients in the physician–pharmacist team had a significantly greater reduction in total cholesterol levels (44 ± 47mg/dL (1.1 ± 1.2mmol/L) versus 13 ± 51mg/dL (0.3 ± 1.3mmol/L)), diastolic blood pressure (14 ±11mm Hg versus 3 ± 11mm Hg) and systolic blood pressure (23 ± 22mm Hg versus 11 ± 23mm Hg). In

43 per cent of patients in the physician–pharmacist team cholesterol goals were met, compared with 21 per cent in control patients (a significant difference). Also, significantly more intervention patients reached blood pressure goals (55 per cent versus 20 per cent). By contrast, Koproski et al (1997) found no significant difference in blood glucose between hospitalised patients treated by a diabetes team versus usual care patients. Studies that measured all cause mortality or survival generally did not find significant results comparing their intervention with control patients (Dey et al, 2005; Gattis et al, 1999; Gums et al, 1999a; Scott et al, 2005). Other clinical endpoints showed mixed results: Gattis et al (1999) found significantly higher event rates in their control group, such as non-fatal heart failure (11 versus 1; OR = 0.08 (0.004 to 0.40), total non-fatal cardiovascular events (23 versus 8; OR = 0.31; 0.31 to 0.69), and total events (36 versus 29; OR = 0.73, 0.39 to 1.33). One study (Scott et al, 2005) evaluated patient satisfaction with care, and showed no differences between intervention and control group patients.

Resource utilisation and costs

Studies that included resource utilisation and cost reported a wide range of outcome measures and did not show clear effects in favour of the intervention or control groups. Several studies measured hospital length of stay (LoS) and readmission rates. Gums et al (1999) found that antibiotic therapy intervention by a multidisciplinary consult team reduced LoS in the intervention group by 37 per cent (9.0 ± 0.5 days in control patients versus 5.7 ± 0.5 days in intervention patients). By contrast, others (Koproski, Pretto and Poretsky, 1997; Rubin et al, 2005; Scott et al, 2005) did not find effects of the input of a team on LoS of patients. Scott et al (2005) found no difference in readmission of patients with team care compared to patients in their control group, while Koproski, Pretto and Poretsky (1997) found that significantly fewer patients in the intervention group were readmitted (13 per cent versus 30 per cent). Bogden et al (1997) studied the added value of pharmacists working closely with physicians. They did not identify significant differences in medication charges, frequency of emergency department visits, referrals to dietitians and ordered panels, although they did report more clinical visits in the intervention group (12 versus 9; $p < 0.05$). A mean reduction in medication charges of $6.80 in the intervention group compared to a $6.50 increase in the control group did not reach statistical significance (Bogden et al, 1998). Dey et al (2005) reported that patients treated by a mobile stroke team were transferred significantly earlier to the stroke rehabilitation unit compared to control patients (14.7 versus 24.4 days; CI difference –17.0 to –2.6), although the number of patients transferred to the unit was not different for intervention and control patients. Also, they failed to find significant differences on their other measures: time to uptake of other interventions, and number of patients receiving CT scans or anti-platelet therapy. Gums et al (1999) measured several cost categories (antibiotic, laboratory, radiology, non-ICU, ICU, total room and board costs) and found that geriatric assessment by a team led to lower hospital costs (total costs: $12,207 ± $1,042 versus $9,153 ± $761 for the intervention patients). The implementation costs, however, were $21,000 per year. Scott et al (2005) reported a similar number of referrals in patients treated by the nutrition team compared to control patients, and the same number of contacts. Again, no statistical differences were found in total costs of both groups of patients. Likewise, Rubin et al (2005) found no significant differences in hospital costs as a result of adding an internist to the inpatient psychiatry team. They also found no differences on their other measures in this category, which were hospital services after discharge and emergency department visits.

2A. Interventions: improved coordination (n = 5)

Forster et al, 2005 evaluated whether adding a clinical nurse specialist (CNS) to physician teams in hospitals that already had discharge planning services made a difference. In two teaching hospitals, patients were randomly assigned to regular hospital care or care with a clinical nurse specialist. All four general medicine teams participated in the study. These services primarily treat undifferentiated and acute, multisystem medical illnesses. Each team was supervised by a staff internist with a senior (postgraduate, year 2) medical resident and varying numbers of postgraduate, year 1 residents and medical students. If required, social workers, home care workers and physiotherapists facilitated patient care. In the intervention teams, each of the four CNSs worked closely with their team to facilitate patient care. CNSs prioritised their activities as follows: retrieving information collected by family physicians and

consultants before admission; arranging in-hospital imaging, procedures and consultations; facilitating patient discharge by arranging follow-up visits and providing patient education; and telephoning patients early after discharge from hospital to answer questions and address early problems.

Huddleston et al, 2004 determined the impact of providing a collaborative, hospitalist-led* model of care on postoperative outcomes and costs among adult high-risk patients having elective primary or revision total hip or knee arthroplasties in a teaching hospital in the USA. Five hundred and twenty-six patients were randomly assigned to either multidisciplinary collaborative hospitalist–orthopaedic team (HOT) care (n = 251/232 before/after) or standard orthopaedic-managed practice (n = 254/237 before/after). In the standard model of peri-operative care, the orthopaedic surgical team was responsible for postoperative patient issues that required additional diagnostic evaluation or treatment throughout the hospitalisation. The HOT care model was designed to integrate internal medicine faculty hospitalists with the orthopaedic surgical team (largely interfacing with the surgical residents) and the orthopaedic surgery nurses. Unlike standard practice, the hospitalist, rather than the orthopaedic surgeons, provided all indicated postoperative medical care after the surgical team completed initial postoperative orders. Hospitalists saw patients more than once a day and were able to order appropriate diagnostic tests and medications.

Moher et al, 1992 determined the effect of a medical team coordinator (MTC) on the length of stay in a teaching hospital. The MTC was a baccalaureate nurse, and her role was to facilitate administrative tasks such as discharge planning, coordinating tests and procedures, and collecting and collating patient information. Although these duties required the MTC to act as liaison between other members of the clinical team, her primary role was to function as part of the house staff team. Control patients received standard medical care.

Mudge et al, 2006 evaluated the effect of incorporating patient-centred multidisciplinary (MD) teams in a general medicine service in a controlled before and after study. The internal medicine department consisted of eight general medical teams grouped into four clinical units. Newly admitted patients were allocated to a medical team according to a cyclical roster. Each team consisted of one to two consultant general physicians, a registrar and an intern. A total of 1,538 patients entered the study, 792 of whom were included in the intervention group and 746 in the control group. The intervention consisted of several elements: the number of allied health personnel (AHP) was increased, which allowed for a consistent individual member of staff for each discipline in each intervention unit; the MD team was formed for every intervention unit, and comprised medical staff, allied health staff and the unit clinical nurse consultant (CNC). The team provided care to all patients belonging to a unit, wherever their physical location. A structured communication system involving daily team meetings was introduced, with mandatory attendance by all disciplines, at which all patients in the unit were discussed. An explicit planned discharge date and destination were also identified and documented in the team meeting within 24 hours of admission. On the other hand, control units continued their usual practice of medical and/or nursing referral to ward-based AHP, where staffing was frequently inconsistent, leading to interruptions in continuity of care and communication.

Yagura et al, 2005 evaluated the efficacy of a regular interdisciplinary stroke team approach on rehabilitation outcome. A stroke rehab unit (SRU) with weekly regular interdisciplinary (ID) stroke team conferences was compared with general rehab ward (GRW) care without such conferences in the same rehabilitation hospital. On the GRW, ID team conferences were not offered, but patients received daily rehab intervention, including rehab nursing care, physical therapy, occupational therapy and/or speech therapy, and they received discharge planning by medical social workers. In both groups, the

** hospitalists are hospital-based doctors who manage admissions from the primary care doctor. They coordinate all diagnostic tests and processes during the person's stay, which allows the primary care physician to do more office-based work.*

rehabilitation programme and the nursing care were identical. For the SRU group, discharge planning was provided to patients by social workers based on the information presented at the weekly ID conferences. However, for the GRW group, discharge planning was provided by the social worker as well, based on the information he or she gathered from various team members. Conferences were held irregularly only for those patients with unsolved medical or social problems.

2B. Evidence: improved coordination

Process measures

In these studies, hardly any processes were measured. One study reported on medical care information provision (Moher et al, 1992). In a subgroup of this study's population (n = 40), information was provided equally to the control and intervention patients.

Patient outcomes

Some positive results were found in studies reporting on patient outcomes. Huddleston et al (2004) found that most patients in the hospitalist-led team were discharged without complications (61.6 per cent versus 49.8; CI difference 2.8 to 20.7). Also, intervention patients had fewer minor complications (30.2 per cent versus 44.3 per cent; CI difference –22.7 to –5.3), although the frequency of intermediate and major complications was statistically equal. Yagura et al (2005) found no significant differences in functional impairment of intervention and control patients. Mudge et al (2006) reported that significantly fewer patients in the intervention group died (31 (3.9 per cent) versus 48 (6.4 per cent)); however, this was no longer significant after six months. Significantly fewer patients in the intervention group showed functional decline in the hospital (3.2 per cent versus 5.4 per cent), and self-rated health was better in intervention patients (data not provided). In addition, Forster et al (2005) and Moher et al (1992) did not find any significant effects on mortality or occurrence of post-discharge events (Forster et al, 2005).

Three studies evaluated patient satisfaction. Forster et al (2005) found that patients in the clinical nurse specialist group perceived the quality and processes of care to be superior: doctors had sufficient information (70.4 per cent versus 58.1 per cent); patients were contacted by hospital personnel (49.6 per cent versus 18.1 per cent); and overall quality was higher (8.2 ± 2.2 versus 7.6 ± 2.4). In addition, Moher et al (1992) reported that patients in the intervention group were significantly more satisfied (89 per cent versus 62 per cent; CI 2 per cent to 52 per cent), whereas Huddleston et al (2004) found no significant difference in patient satisfaction for their control and intervention patients.

Resource utilisation and costs

Overall, no clear positive (or negative) effects were identified regarding costs and resource utilisation. Moher et al (1992) reported a significant shorter LoS in their intervention patients compared to control patients (7.43 versus 9.40 days; CI 1.02 to 2.92 days), although they did not find any differences in readmission rates. Foster et al (2005) reported no significant differences in time to discharge, hospital readmissions, time to ER or time to readmission. Huddleston reported patients in hospitalist-led team had shorter adjusted LoS (5.1 versus 5.6 days; CI difference –.8 to –.1). In contrast, Mudge et al (2006) failed to find significant differences in LoS between team care and usual non-team care, as did Yagura et al (2005), who also found no difference in discharge position. In addition, Mudge et al (2006) found no significant differences in six-month readmission, inpatient bed occupancy and discharge to residential care. Huddleston reported that physician costs were significantly higher in the HOT care model ($2,689 versus $2,367; CI difference $175 to $484), although hospital costs and total medical costs were not significantly different. Finally, Yagura et al (2005) did not find significant differences in costs of hospitalisation between intervention and control patients.

3A. Interventions: enhanced clinical expertise and coordination (n = 10)

Banerjee et al, 1996 investigated the efficacy of intervention by a psychogeriatric team in the treatment of depression in elderly disabled people receiving home care from their local authority in the UK. Sixty-nine patients were randomly assigned to the psychogeriatric team in the catchment area (n = 33/29 before/after) or usual care (n = 36/32). Each case in the intervention group was presented at a MD team meeting, which included community psychiatric nurses, occupational therapists, senior and junior medical staff, a social worker and a psychologist. The team formulated management plans for each subject on an individual basis, as for any referral to the team. A team member acted as each person's keyworker. The study population differed in their management only by being assigned a doctor. The control group received GP care. Patients, however, could be referred to the psychogeriatric team as normal (which was the case in 6 per cent of controls).

Germain et al, 1995, in their RCT, aimed to decrease the LoS of hospitalised patients on a waiting list for admission to an inpatient geriatric assessment unit (GAU), and to optimise use of the GAU and other hospital services in an acute hospital in the USA. Experimental subjects received the consultative services of a geriatric assessment and intervention team (GAIT) immediately after qualifying for GAU admission, in place of waiting for GAU services. The GAIT was staffed by a consultant geriatrician, social worker, physical therapist and geriatric nurse. GAIT consultations are initiated by referrals from primary physicians who identify functional deterioration in their elderly inpatients. After completion of comprehensive geriatric assessment, the team physical therapist and geriatric nurse began a variety of therapeutic interventions. Upon referral, the geriatrician qualified patients for the GAIT. Each team member assessed the patient. The geriatrician reviewed the patient's medical condition and mental status, followed patients regularly, and offered advice to primary care physicians concerning medical management. The social worker visited all patients and families during the discharge planning period for home care services or nursing home placement. The geriatric nurse conducted an initial nursing assessment of all patients, was in contact with the physical therapist (who saw patients every day) on a daily basis and served as liaison with families and nursing homes regarding implementation of aftercare plans. The GAIT met weekly to discuss all assessment results. Control patients, having been accepted by the geriatrician to the GAU waiting list, received a standard consultation, which usually involved a review of medical conditions and screening for cognitive and functional problems by the geriatrician with recommendation to primary care physicians for ad interim changes in therapy. The social worker arranged the transfer. In this arm, several features of GAIT were missing: a) the team approach to diagnosis, care planning and treatment; b) order writing responsibility for patients' geriatric problems prior to their GAU transfer; and c) the early involvement of the geriatric nurse.

Hogan and Fox, 1990 researched the effects of a geriatric consultation team (GCT) in acute care in a Canadian hospital. One hundred and thirty-two patients were allocated to management in the usual manner by their attending physician (n = 66/65) or the services of the GCT (66/66), which comprised a specialist in geriatric medicine, a nurse coordinator, an occupational therapist, a physiotherapist, a social worker, a dietitian and a representative from pastoral care. The only person hired specifically for the programme was the coordinator; the other members were reassigned from other duties. Initial contact by the GCT was through a physician–physician consultation by the coordinator or the physician. Other team members became involved as required. Full-team rounds were held each week. The emphasis of the programme was on addressing functional problems and providing post-discharge follow-up. The attending service decided whether or not to adopt the recommendations from the consulting service.

Lincoln et al, 2004 studied the effectiveness of stroke rehabilitation by a community stroke team. Four hundred and twenty-one patients were randomised to either coordinated multidisciplinary rehabilitation in the community (n = 189/154) or routine rehabilitation services (n = 232/175). The team included occupational therapists, physiotherapists, speech and language therapists and a mental health nurse. It exclusively treated stroke patients, thereby providing a specialist service. All patients were initially seen at home by two team members and were discussed at weekly team meetings. Following these meetings, the team allocated therapists according to the nature of the patients' problems. All patients were seen at their homes and were treated for as long as they were considered to be benefiting. The control

group received services that were available to patients in each area, including day hospitals, outpatient departments and social services occupational therapy. A list of alternative rehabilitation services was provided to the referring agent (physician or patients).

Phelan et al, 2007 assessed the effect of a team of geriatrics specialists (senior resource team (SRT)) on the practice style of primary care providers (PCPs) and the functioning of their patients aged 75 and older in two primary care clinics in Seattle. The team consisted of geriatrically oriented clinicians. These included one full-time fellowship-trained geriatrician, two half-time gerontological advanced registered nurse practitioners and an off-site pharmacist with specialised geriatric training. The team met weekly throughout the intervention period to address team operations and to ensure that they were following a standard approach with each patient. The nurse practitioners first conducted an initial in-clinic assessment and then scheduled a follow-up visit for the patient approximately two weeks after the date of the initial assessment. Before the follow-up visit, the geropharmacist reviewed the patient's medication list and made recommendations to the nurse practitioner. The geriatrician reviewed the findings of the initial assessment and reached a consensus with the nurse practitioner on clinical priorities for the patient. Through a collaborative process including the patient, a final set of goals and a proposed action plan were written. The team made medication changes and the nurse practitioners provided telephone and face-to-face follow-up for issues each patient was working on, focusing on self-management, support and the barriers assessed.

Rabow et al, 2004 conducted an RCT to evaluate an intervention in which an interdisciplinary team offered palliative medicine consultation and direct services to outpatients, their families and their primary care physicians (PCPs), in addition to the usual primary care. The team, called the comprehensive care team (CCT), comprised a social worker, nurse, chaplain, pharmacist, psychologist, art therapist, volunteer coordinator and three physicians who addressed physical, emotional and spiritual issues. All team members except the volunteer coordinator had expertise in palliative care. The programme integrated PCP consultation, case management, volunteer and group support, chaplaincy consultations and artistic expression. The seven main components of the team were: 1) consultation with PCPs was based on in-depth and follow-up patient assessments conducted by the social worker. Assessments were presented to the entire team at regularly scheduled meetings; 2) the social worker provided case management and offered psychological support in person and by telephone; 3) a nurse provided family caregiver training and support through formal classes and informal individual consultations; 4) a pharmacist performed a medical chart review of patient medications; 5) a chaplain offered spiritual and psychological support; 6) patients and their families were invited to monthly support groups that included discussions about symptom management and advance care planning; and 7) medical and pharmacy students provided volunteer patient support and advocacy through weekly telephone contacts with patients. Control patients received usual primary care only.

Schmidt et al, 1998 evaluated the effect of regular multidisciplinary team interventions on the quantity and quality of psychotropic drug prescribing in Swedish nursing homes. Experimental homes participated in an outreach programme that was designed to influence drug use through improved teamwork among physicians, pharmacists, nurses and nurse assistants. A pharmacist from outside the nursing home was assigned to spend one day a month in the intervention. He or she supported cooperation and organised MD team meetings for nursing home physicians and nursing personnel. Multidisciplinary team meetings were held on a regular basis (one a month) throughout the 12-month study period to discuss the drug use of individual residents and to encourage participation. The aim was to improve drug treatment and reduce the prescription of non-recommended drugs, as defined by guidelines distributed to all physicians at approximately the same time at the start of the study. In the control homes, no efforts were made beyond the normal routine to influence drug prescribing. In Sweden, pharmacists visit nursing homes approximately once a year to supervise drug storage and regulatory issues. Physicians and nurses discuss drug therapy as needed, but they generally have no structured reviews nor meet as a group to discuss drug use with under-nurses and nursing assistants.

Schned et al, 1995 determined whether an outpatient team management programme for persons with early chronic inflammatory arthritis would produce improved clinical outcomes and lower costs than traditional, non-team, outpatient rheumatologic care in a clinic setting. The intervention had the following characteristics: 1) the rheumatologist maintained ordinary primary or consultative services and patient contact in a unconstrained manner; 2) a detailed standardised needs assessment interview was conducted by the project director after randomisation; 3) a half-day education and management programme for newly enrolled patients and family members or friends was conducted on site; 4) the team of rheumatologists and allied health professionals met and reviewed all newly enrolled patients monthly and all other patients quarterly; 5) patients were referred to any of the team members for care based on demonstrated need noted by the telephone interviews; 6) standardised telephone interviews were carried out every three months, and a defined formal written arthritis care plan was formulated and updated quarterly by the rheumatologist for the patient and for the primary or referring physician. The control group received traditional care in an unconstrained fashion from their primary care physicians and rheumatologists. There was no standardisation of care in any way, and communication was usually restricted to the office visit, occasional telephone calls, patients' charts and letters.

Tijhuis et al, 2002, 2003 and **van den Hout et al, 2003** compared the long-term effectiveness of care delivered by a clinical nurse specialist (CNS) with inpatient team care and day patient team care in patients with rheumatoid arthritis (RA) and increasing functional limitations. All patients randomised to care provided by a CNS were seen by a nurse specialist attached to the transmural nurse clinics of one of the six participating hospitals. The care provided by the CNS was additional to the usual outpatient care provided by rheumatologists. The CNS provided information about RA and prescribed, in consultation with the rheumatologist, joint splints, adaptive equipment and house adaptations if needed. If indicated, the patient could also be referred to other health professionals such as an occupational therapist, physical therapist or social worker. The MD inpatient team care and day patient team consisted of a rheumatologist, occupational therapist, physical therapist and a social worker. Inpatients and day patients followed a prescribed treatment programme of equal intensity for both groups and tailored to their needs. Treatment goals and modalities were discussed during weekly MD team conferences. Apart from the intervention period in the two team care groups, the decision to change or introduce disease-modifying drugs and injections was left to the rheumatologist at the outpatient clinic in all three study groups.

Vliet Vlieland, Breedveld and Hazes, 1997 compared the long-term effect of a period of 11 days of inpatient multidisciplinary team care, followed by routine outpatient care in 80 patients with rheumatoid arthritis (RA). Inpatient treatment consisted of primary medical and nursing care, daily exercise therapy, occupational therapy and support from a social worker. Treatment goals and modalities were discussed during weekly MD team conferences. During outpatient care, the prescription of medication and paramedical treatment was left to the attending rheumatologist at the outpatient clinic in both groups. There was no attempt to alter the treatment regime normally employed in the outpatient clinic.

3B. Evidence: enhanced clinical expertise and coordination

Process measures

Few studies compared the process measures of usual care providers and team care, and there were no clear effects. Tijhuis et al (2002, 2003) compared the long-term effectiveness of care delivered by a clinical nurse specialist (CNS) with inpatient team care and day patient team care in patients with rheumatoid arthritis (RA). No differences in medical treatment (drug use or injections) were reported between the three arms. Phelan et al (2007) did not identify significant differences in the specialist group versus control patients for primary care physician management, prescription of high-risk medication and proactive screening, and satisfaction or self-efficacy of primary care physicians. One study measured for the intervention group whether the team treatment led to high rates of implementation of proposed interventions (Banerjee et al, 1996). They found that 78 to 100 per cent of the proposed interventions

by the psychogeriatric team were completed, except for outreach referral, where 43 per cent of the interventions were completed.

Patient outcomes

Several studies measured patient outcomes. Overall, these studies showed mixed results for a wide range of outcome measures. For survival rates, Germain et al (1995) reported that one-year survival in patients treated by the geriatric assessment and intervention team was not significantly different from survival in control patients. One study (Phelan et al, 2007) reported higher mortality in the intervention group (11.5 per cent versus 7.6 per cent). Hogan and Fox (1990) found significantly longer survival at 180 days in the intervention group, but not at 365 days. In addition, they found significantly higher improvements in Barthel index after 12 months (75 per cent versus 44 per cent). Banerjee et al (1996) found that significantly more patients in the psychogeriatric team group recovered from depression (19 versus 9, or 33 per cent; CI difference 10 per cent to 55 per cent), or improved (27 versus 17, or 35 per cent; CI difference 14 per cent to 56 per cent). Fewer remained the same (2 versus 9, or 19 per cent; CI difference –35 per cent to –3 per cent), or became worse (0 versus 6, or 17 per cent; CI difference –29 per cent to –5 per cent). Also, the change in mean depression rating was greater in intervention patients. Rabow et al (2004) found that the odds for dyspnea in control patients were higher than for the patients who received care from the comprehensive care team (OR = 6.07; CI 1.04 to 35.56). Also, sleep and anxiety improved in intervention patients. However, depression and quality of life scores were similar for both groups. Lincoln et al (2004) failed to find positive effects of the community stroke team on functional independence in activities of daily living (ADL), extended ADL, general health and quality of life. Schned et al (1995), in their study on the effects of team-managed outpatient care, measured a wide range of clinical measures, and found that all 16 were not significantly different for team care and control patients. Vliet Vlieland, Breedveld and Hazes (1997) found that significant changes on a wide range of disease activity outcomes were only present at short-term measures, although the proportion of patients showing clinical improvement was, over the total period, higher in the intervention group than in the outpatient group. In addition, Tijhuis et al (2002, 2003) compared the long-term effectiveness of care delivered by a clinical nurse specialist (CNS) with inpatient team care and day patient team care in patients with RA and increasing functional limitations. No significant differences were found in a comparison of clinical outcomes among the three groups, or among the CNS group versus the two team groups. Finally, Phelan et al (2007) found no differences in functional status and self-rated health for patients treated by the team compared to the control patients, although intervention patients scored higher on psychological well-being.

Some studies evaluated behavioural outcomes. Rabow et al (2004) evaluated patient satisfaction with care and found no differences between intervention and control group patients. Lincoln et al (2004) evaluated patient satisfaction with care (no overall difference) and knowledge of stroke (not significant). They also measured how carers judged their general health (no difference between routine carers and team members: how carers judged the burden of care (lower levels of strain were reported in the intervention group (median 8 versus 10; IQR 5–10 versus 6–12); and how carers judged their satisfaction with care and their satisfaction with knowledge (both higher in intervention group). Finally, Tijhuis et al (2002) reported that patients treated by clinical nurses were slightly less satisfied with their care than patients in the two team groups (the VAS score was 73mm ± 23 for nurse specialists versus 85mm ± 19 in inpatients and 92mm ± 10 in day patients).

Resource utilisation and costs

Overall, no consistent reduction in costs or resource utilisation was observed in the studies reporting on these outcomes. Several studies included LoS as an endpoint. For example, Germain et al (1995) found that patients receiving team care had significantly lower LoS (42.8 ± 20.8 days versus 65.5 ± 23.5 days) in both high functioning and low functioning patients. However, Rabow et al (2004) did not find effects of the input of a diabetes team in the LoS of patients. Several studies measured rehospitalisation

or readmission rates but did not find significant differences on (re)admission between intervention and control patients (Germain et al, 1995; Hogan and Fox, 1990; Schned et al, 1995; Tijhuis et al, 2002, 2003; van den Hout et al, 2003) or hospitalisations (Hogan and Fox, 1990; Phelan et al, 2007; Rabow et al, 2004; Tijhuis et al, 2003). One study (Germain et al, 1995) reported significantly higher percentages of patients discharged to home, especially in high-functioning patients (42 per cent versus 13 per cent in high-functioning patients and 10 per cent versus 7 per cent in low-functioning patients). Finally, Schned et al (1995) reported no differences in health professional visits, number of referrals, medication provided, use of aids and devices, number of surgical procedures or the number of blood tests ordered.

Few studies reported cost categories. Tijhuis et al (2002, 2003) found that QALY differences in the three arms of their study were less than 0.1 year (not significant). Significantly higher costs were reported for the initial assessment and treatment of patients in both team care groups compared to patients in the clinical nurse specialist (CNS) group (€5,000 for inpatient care and €4,100 for outpatient care versus €200 for CNS). Although other healthcare and non-healthcare costs were not significantly different, average total healthcare costs per patient were lower for the nurse group patients compared to the two team group patients (€8,092 versus €16,581 and €13,252 respectively). Costs for society were also significantly lower in CNS group patients versus the other two groups: at least €5,400. Over the two-year follow-up period, no significant differences were found for the aggregate of rheumatoid arthritis quality of life and QALYs based on the four different instruments used. The use of services and the introduction of specific equipment were not significantly different between the three groups, except that, at two-year follow-up, more inpatients than CNS group patients received home help (23 versus 10), and visits to a clinical nurse specialist were more frequent in the CNS group than in the two team groups. Finally, Rabow et al (2004) reported that patients treated by the outpatient palliative medicine team made fewer visits to their GP and urgent care clinics (7.5 ± 4.9 versus 10.6 ± 7.5/0.6 ± 0.9 versus 0.3 ± 0.5), but no differences were found with respect to specialty care clinics or emergency department visits. The mean charge per patient was $4,711 ± $73,009 in intervention patients versus $43,338 ± $69,647 in control patients.

4. Description of interventions and results derived from review studies

Two reviews were included in this category.

Malone et al, 2007 performed a Cochrane review to evaluate the effects of community mental health team (CMHT) treatment for anyone with serious mental illness compared with standard non-team management. Three studies were included, with a total of 587 participants. The CMHTs in each study were involved in multidisciplinary assessments of each person, followed by regular team reviews. Care involved monitoring and prescribing medication and different forms of psychological intervention (including family intervention), with a special focus on continuity of care. Standard care was coordinated from hospital-based staff who assessed and treated people primarily in hospital outpatient and inpatient settings. Care involved psychiatrists, nurses and social workers, but this was not closely coordinated and was not carried out by a single team. Treatment covered the range of psychiatric interventions.

Process measures: No process measures were reported.

Patient outcomes: No conclusions could be drawn for the mental state of the participants. Patients in the team group had more contact with the police (social functioning: RR 2.07; CI 1.1 to 4.0). No differences were reported in death from any cause. Fewer people in the team group were not satisfied with their care compared to usual care (RR = 0.37; CI 0.2 to 0.8).

Costs: Lower admissions to a hospital were reported in team groups (RR 0.81; CI 0.7 to 1.0), whereas no clear evidence was reported on hospital admissions, use of emergency services, contact with primary care and contact with social services.

Mitchell, Del and Francis, 2002 conducted a systematic review to assess whether primary medical practitioner involvement with a specialist team improved patient outcomes, the behaviour of medical practitioners and the costs of health delivery. Seven studies were included, with 1,862 participants in total. Patient groups included chronic patients (five studies), frail aged (one study) and orthopaedic referrals (one study). They defined organised cooperation between primary medical practitioners and specialists as any formal arrangement that linked the GPs with specialist practitioners in the care of patients. This definition included case conferences between the GP and specialist (n = 1), shared consultations (n = 1), organised consultations by GPs with patients in specialist inpatient units (n = 1), visits by specialist staff to a GP clinic (n = 2), and formal shared care arrangements between the patients' GPs and specialist clinics (n = 2). The category 'specialist' included medical and nursing specialists.

Process measures: Four studies showed improved clinical behaviour for GPs. The three studies that reported retention rates all demonstrated improved rates within programmes involving GPs compared with standard outpatient specialist care of chronic patients.

Patient outcomes: The studies found mixed effects for physical outcomes. With a few exceptions, no intervention group showed worse results. GP involvement in care led to greater patient satisfaction (four studies) and patients felt better prepared for discharge from hospital when the GP was involved in pre-discharge planning (one study).

Costs: Four studies showed improved waiting times. Mixed results were found on cost aspects. The measurement of costs differed too much to allow for making comparisons.

5. Team characteristics as determinants of effect

We attemped to retrieve information on the professions and disciplines involved, the presence of a team leader or coordinator, characteristics such as team size, age of team members or team tenure, and the presence of explicit task descriptions of team members. In general, hardly any information on these topics could be retrieved from the articles. In less than half of the studies, was any description (partly) provided regarding the tasks of the team members. In just a few cases, information was provided about who in the team was to be considered the leader or coordinator. None of our included studies provided information regarding the number of team members, age and gender of team members or tenure of the team.

Table 2: Summary of the evidence and intervention characteristics

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Enhanced clinical expertise					
Bogden et al, 1997, 1998	RCT n = 100 Hawaii/USA Outpatient Patients with elevated cholesterol Patients with uncontrolled hypertension	Physician–pharmacist teamwork vs Usual care	Pharmacist, physician, resident or intern vs Physician, resident or intern	To assess the effect of a programme that encourages teamwork between physicians and pharmacists on attempts to lower total cholesterol levels and to meet recommended goals proposed by the National Cholesterol Education Program To assess the effect of a physician and pharmacist teamwork approach to uncontrolled hypertension in a medical resident teaching clinic, for patients who failed to meet the recommended goals of the fifth Joint National Commission on Detection, Evaluation and Treatment of High Blood Pressure	Positive effects of team intervention on care delivery and intermediate patient outcomes, especially for patients with CHD or risk factors (increased risk patients). Effect of intervention was absent in patients without CHD and fewer than two risk factors Positive effects of team intervention on care delivery and intermediate patient outcomes
Dey et al, 2005	RCT n = 308 UK Inpatients Stroke (acute phase)	Organised stroke care/mobile stroke team vs Usual care	Stroke consultant and senior therapist (team) vs Clinical nursing staff and therapists	To determine the impact on outcome of access to a mobile team during the acute phase of stroke among patients admitted to general wards	No positive (or negative) effect of mobile stroke team
Gattis et al, 1999	RCT n = 181 USA Outpatients Heart failure patients	Addition of clinical pharmacist to heart failure management team vs Usual care	Pharmacist, physician (assistants, NP) vs Physician (assistants, NP)	The objective of the study was to evaluate the effect of a clinical pharmacist on outcomes in outpatients with heart failure	Addition of clinical pharmacist to management team of heart failure seems to have beneficial effect on patient outcome, some aspects of care delivery and reduction of events

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Gums et al, 1999	RCT n = 252 USA Inpatient Infectious diseases	Multidisciplinary team (providing recommendations concerning antibiotic therapy and monitoring when necessary) vs Usual care	Clinical microbiologist, infectious disease specialist vs Attending physician	To test the hypothesis that a timely consult from a MD antimicrobial therapy team would improve the quality of care, reduce patient charges, and result in net savings to the hospital	Multidisciplinary antimicrobial therapy team effective in improving LoS and reducing costs
Jack et al, 2003	CBA n = 100 UK Inpatient Palliative care	Hospital-based palliative care teams vs Standard care	Four clinical nurse specialists, supported when required by a consultant (who additionally had sessional commitments at all local hospices) and a specialist registrar vs 'Standard care' (not clear)	To determine whether the hospital-based palliative care team had a greater effect on improving cancer patients' symptoms when compared to standard care alone. (The palliative care team was meant to transfer the principles of hospice care to the acute setting)	Both groups significant improvements in patient outcomes which seem larger in team group, but statistical methods used are not adequate for rating effectiveness of the intervention
Koproski, Pretto and Portesky, 1997	RCT n = 179 USA Inpatients Diabetes	Diabetes team intervention vs Control group with usual care	Care from physicians, nurses, nutritionists and social workers supplemented with diabetes team (a diabetes nurse educator and an endocrinologist) plus nutrition and social work consultations if necessary vs Care from physicians, nurses, nutritionists and social workers normally received in the medical/ surgical units	To study the effects of a diabetes team on length of stay and other outcomes of hospitalisation	Generally positive effects for diabetes team intervention on various performance measures (although measured post-intervention only) and partly on resource utilisation (readmission rates at 3 and 6 months but not LoS)

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Rubin et al, 2005	RCT n = 139 USA Inpatients Psychiatric patients	Addition of internist to inpatient psychiatry team vs Usual care group	Internist, psychiatry house staff, PCP vs Psychiatry staff (and usual consultations from specialists if necessary)	To examine the effects of collaboration between an internist and psychiatrists on the processes and cost of care among psychiatric inpatients. To test the hypothesis that this collaboration would improve the processes of care without increasing cost	Process of care significantly better in intervention group, but no effects on resource use
Scott et al, 2005	RCT n = 112 UK Inpatient/ outpatient/ community Internal medicine (nutrition)	Nutrition team after gastronomy vs Usual care	Nutritional support team (NST) nurse and/or dietitian, primary care professionals, ward team professionals vs Ward team, ward dietitian, primary care team	To test the hypothesis that systematic nutrition team follow-up after PEG insertion would lead to a decrease in the cost of care and maintenance of (or improvement in) clinical outcomes. (The hypothesis was that generalists would feel uncertain, so specialist services would be needed)	No clear effects of nutrition team
Improved coordination					
Forster et al, 2005	RCT n = 620 Canada Inpatients All kinds of patients in hospital	Care with clinical nurse specialist (CNS) (team) vs Regular care	Internists, residents, medical students plus clinical nurse vs Internists, residents, medical students	Several randomised trials have found that discharge planning improves outcomes for hospitalised patients. We do not know if adding a clinical nurse specialist to physician teams in hospitals that already have discharge planning services makes a difference. (Hypothesis: this is an intervention that may improve either efficiency or safety of hospitalisations)	CNS does not have a beneficial effect on clinical patient outcomes and recourse utilisation measures, but increases the perceived quality of care (inpatient satisfaction)

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Huddleston et al, 2004	RCT n = 526 USA Inpatients Patients needing hip/knee arthroplasty	Hospitalist–orthopaedic team (HOT) vs Standard orthopaedic managed care	Hospitalist and orthopaedic vs Orthopaedic	To determine the impact of a collaborative, hospitalist-led model of care on postoperative outcomes and costs among patients having hip or knee arthroplasty	HOT: fewer minor complications (but not for more severe ones), more patients discharged without complications and shorter adjusted LoS. Preferred by professionals, but higher costs and equal patient satisfaction
Moher et al, 1992	RCT n = 267 Canada Inpatients General medical clinical teaching units	Medical team coordinator (MTC) vs Usual care	'Clinical team' (not clear), plus MTC = baccalaureate nurse vs 'Clinical team' (not clear)	To assess the effect of an MTC on the length of hospital stay, the frequency of readmission and the satisfaction with hospital care in a general medical clinical teaching unit to which patients were admitted from the emergency department	Generally slight positive effect, as LoS is reduced in MTC group, but no effect on readmissions and death. Patients were more positive and received more information (subgroup analysis)
Mudge et al, 2006	CBA n = 1538 Australia Inpatients Internal medicine	Team intervention (patient-centred multidisciplinary teams in a general medicine service) vs Control group with usual care	The MD team was formed for every intervention unit and consisted of medical staff, allied health staff and the unit clinical nurse consultant (CNC) vs Usual care: control units on the other hand continued their usual practice of medical and/or nursing referral to ward-based AHP, where staffing was frequently inconsistent, leading to interruptions in continuity of care and communication (not clear)	To evaluate the effect of an enhanced model of care on hospital utilisation and patient outcomes	Generally positive effects of team intervention on patient outcomes (in-hospital mortality (not significant at 6 months), functional decline, and self-rated health, though not on restoration to previous functional level 1 month after discharge), but not on resource utilisation (LoS, 6 months readmission, inpatient bed occupancy, discharge to residential care; only access to any allied health professionals greater in intervention group)

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Yagura et al, 2005	(Semi) RCT n = 178 Japan Inpatients (hospital) Initial stroke	Stroke rehabilitation unit (SRU) (= team) vs General rehabilitation ward (GRW)	Clinical psychologist, physical therapist, occupational therapist and/or speech therapist, social work, rehab nurse vs Clinical psychologist, physical therapist, occupational therapist and/or speech therapist, social work, rehab nurse	To compare the functional outcome of two types of stroke rehabilitation programmes at the inception of the SRU	No effect on two measures of functional impairment. No effect on LoS or cost of hospitalisation. Only marginal positive effect for SRU on discharge position, especially for severe patients with regard to discharge to home
Enhanced clinical expertise and coordination					
Banerjee et al, 1996	RCT n = 69 UK Community Geriatrics (frail elderly)	Psychogeriatric team vs Standard GP care	Several disciplines (medical, OT, psychology, social work) vs GP	To investigate the efficacy of intervention by a psychogeriatric team in the treatment of depression in elderly disabled people receiving home care from their local authority	Team intervention more effective compared to GP care with respect to recovery from depression
Germain et al, 1995	RCT n = 108 USA Inpatients Geriatrics	Consultative services of a geriatric assessment and intervention team (GAIT) vs Usual hospital care	Consultant geriatrician Social worker PT Geriatric nurse vs Geriatrician plus whoever is necessary	The objective was to develop and evaluate the impact of a new geriatric assessment and intervention team (GAIT) on the length of stay of hospitalised patients on a waiting list for admission to an inpatients geriatric unit	Positive effect for GAIT on LoS and discharge to home, but not on rehospitalisations, nursing home discharge and 1-year survival

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Hogan and Fox, 1990	Prospective, controlled trial (randomisation not explicitly mentioned) n = 132 USA Inpatients Geriatrics	Geriatric consultation team (GCT) vs Usual care by physician	Geriatric consultation team (GCT): specialist in geriatric medicine, a nurse coordinator, an occupational therapist, a physiotherapist, a social worker, a dietitian and a representative from pastoral care vs Physician only? (not clear)	To test the usefulness of geriatric consultation teams in an acute care setting	Positive effect on 180-day but not on 365-day survival, and on improvement in ADL. No effects on living arrangements or hospitalisations
Lincoln et al, 2004	RCT n = 428 UK Community Stroke	Community stroke team (CST) vs Routine care	Occupational therapists, physiotherapists, speech and language therapists and a mental health nurse, and treated exclusively stroke patients vs Services available to patients in each area including day hospitals, outpatient departments, and social services occupational therapy (not clear)	To assess whether rehabilitation by a specialist multiprofessional team improved the outcome in terms of functional abilities, mood, quality of life and satisfaction with care compared to conventional outpatient rehabilitation services	No effects on clinical patient outcomes. CST results in some beneficial aspects for both the patient and the carer on satisfaction level. Carers experienced less strain

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Phelan et al, 2007	RCT n = 874 USA Outpatients (primary care clinics) Gerontology	Senior resource team (SRT); team of geriatric specialists vs Usual GP care	Geriatrically oriented clinicians, including one full-time fellowship-trained geriatrician, two half-time gerontological advanced registered nurse practitioners, and an off-site pharmacist with specialised geriatric training vs GP	To assess the effect of a team of geriatrics specialists on the practice style of primary care providers and the functioning of their patients aged 75 and older. (The hypothesis was that, by interacting with a geriatrically trained physician in relation to a small number of patients (roughly 10), a PCP's knowledge about management of older adults would increase and their self-efficacy to provide care to older adults would be enhanced. This might translate into improved quality of care delivered to older adults in the PSP's practice)	No or negative effects in team intervention: higher deaths and no superior performance, hospitalisation rates or other patient outcomes
Rabow et al, 2004	RCT n = 90 USA Outpatients (tertiary care) Palliative care	Comprehensive care team (CCT); palliative outpatient medicine teams vs Usual PCP care	Social worker, nurse, chaplain, pharmacist, psychologist, art therapist, volunteer coordinator and three physicians who addressed physical, emotional, and spiritual issues. All team members except the volunteer coordinator had expertise in palliative care vs PCP	To compare physical, psychological, social and spiritual outcomes between an intervention group of patients receiving a multifaceted, outpatient, palliative medicine consultation intervention plus usual primary care and a control group receiving only usual primary care	Better results by team intervention for dyspnoea, anxiety and well-being, but not for pain and depression and quality of life. Intervention patients made fewer visits to GP and urgent care clinics, but no difference for speciality care clinics, emergency department visits, number of hospitalisations, number of days in hospital and charges per patient

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Schmidt et al, 1998	RCT (block randomisation) n = 1854 Sweden Inpatient (nursing homes) Geriatrics (psychotropic prescriptions)	Intervention (team) vs Control	Physicians, pharmacists, nurses and nurses' assistants vs Physicians, nurses and nurses' assistants.	To evaluate the impact of regular multidisciplinary team interventions on the quantity and quality of psychotropic drug prescribing in Swedish nursing homes	Generally, teamwork seemed to improve the way psychotropics were described. However, no direct comparisons were made between both groups
Schned et al, 1995	RCT (no blinding) n = 107 USA Outpatient Chronic inflammatory arthritis	TEAMCARE; team managed outpatient care vs TRADCARE; usual outpatient care (control group)	Rheumatologist, allied health professionals (and primary or referring physician?) vs PCP and rheumatologists	To determine whether an outpatient team management programme for persons with early chronic inflammatory arthritis would produce improved clinical outcomes and lower costs than traditional, non-team, outpatient rheumatologic care in a clinic setting. It was hypothesised that team-managed care provided early in the course of chronic inflammatory arthritis might afford better outcomes than previously reported, and that the benefits of early intervention might also include improved long-term economic outcomes	No effect found for patient outcomes or resource utilisation

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Tijhuis et al, 2002, 2003, and van den Hout et al, 2003	RCT n = 210 Netherlands Inpatient and outpatient Rheumatoid arthritis	Clinical nurse specialist care (CNSC) vs Inpatient multidisciplinary team care (IMTC) vs Day patient multidisciplinary team care (DMTC)	The care provided by the CNS was additional to the usual outpatient care provided by rheumatologists. If indicated, the patient could also be referred to other health professionals vs The MD inpatient team care and day patient team consisted of a rheumatologist and occupational therapist, a physical therapist and a social worker	To compare the long-term (clinical) effectiveness of care delivered by a clinical nurse specialist with inpatient team care and day patient team care in patients with RA and increasing functional limitations. To assess the relative cost effectiveness of CNS care, inpatient team care and day patient team care	CNSC is treatment of preference, at least from health economic point of view. No superior treatment rated in terms of clinical efficacy
Vliet Vlieland, Breedveld and Hazes, 1997	RCT n = 80 Netherlands Inpatients and outpatients vs Outpatients alone Rheumatoid arthritis	Inpatient MD team care vs Routine outpatient care For active RA	Primary medical and nursing care, physical therapists, occupational therapists, social worker vs Rheumatologist	To evaluate whether the improvement achieved by a short inpatient multidisciplinary treatment programme could be maintained over a 2-year period	Intervention seems to have positive effects on disease activity; however, no significant effect remained at 2-year follow-up

Study and design	Study characteristics	Intervention	Disciplines and professionals involved	Aim of study and underlying hypotheses (if any)	Key findings
Evidence derived from reviews					
Malone et al, 2007	Mental illnesses Community care	(Review, three studies included) Community mental health teams vs Usual care	Community mental health teams (CMHT) vs Standard care was coordinated from hospital-based staff who assessed and treated people primarily in hospital outpatient and inpatient settings. Care involved psychiatrists, nurses and social workers but this was not closely coordinated and was not carried out by a single team	To review the effects of CMHT management, when compared to non-team community management, for anyone with serious mental illness	Community mental health teams are not inferior to non-team standard care and in some aspects even superior (acceptance of treatment, hospital admission, avoiding death by suicide)
Mitchell, Del and Francis, 2002	Various	Review (seven studies included) Organised cooperation between GP and specialist vs Usual care	Organised cooperation between primary medical practitioners and specialists, as any formal arrangement that linked GPs with specialist practitioners in the care of patients	It is assumed that GPs should contribute usefully to the management of patients who need specialist services. To determine what differences, if any, close, formalised cooperation makes to the health outcomes of patients, the behaviour of medical practitioners and the costs of health delivery	Cooperation between GP and specialist seems not to affect the physical outcome but may improve retention rates, patient satisfaction and clinical behaviour of GPs

Discussion

This review identified 28 evaluations of patient care teams. Enhanced clinical expertise was demonstrated to have the potential to improve professional performance as measured by appropriateness of care processes, but its impact on patient outcomes was mixed. Costs and resource utilisation − if provided − seemed to remain mainly unchanged. Coordinated teams, as defined by a narrow set of structures, showed some positive effects on patient outcomes but little impact on costs and resource utilisation. Care process measures were infrequently examined in studies on coordinated teams. Finally, enhanced expertise and coordination showed some limited effect on patient outcomes only. We conclude that enhanced clinical expertise seems to be an important component of patient care teams, while the added value of improved coordination remains uncertain.

Discussion of main findings

Enhanced clinical expertise

We identified eight studies in which a team member was added to the care because of his or her added clinical expertise. Given the consultative character of these interventions, one would expect to find impact on care process measures, such as those reflecting guideline adherence, and thus – ultimately − improved patient outcomes. Indeed, most of these studies measured such outcomes, and results were at least partly in favour of the intervention groups. For instance, Gums et al (1999) found improved performance of physicians when a clinical microbiologist and infectious disease specialist provided recommendations on antibiotic therapy and monitoring, leading to shorter length of stay and total hospital costs in the intervention group. Two studies evaluated the effect of programmes that encouraged teamwork between physicians and pharmacists on attempts to improve guideline-compliant care in patients with high cholesterol levels and blood pressure (Bogden et al, 1997, 1998) and heart failure (Gattis et al, 1999). In both studies, positive results were reported for process measures as well as for (intermediate) patient outcomes. These findings are in line with a recent Cochrane review on the expanding role of pharmacists. This review reported that studies that compared pharmacist services targeted at health professionals versus the delivery of no comparable service demonstrated that pharmacist interventions produced the intended effects on physicians' prescribing practices (Beney, Bero and Bond, 2000).

Although at least partially positive results were reported in terms of process measures, studies showed mixed results regarding patient outcomes. For instance, a relatively well-conducted study found no effect of the advice of a mobile stroke team to the responsible clinical team on mortality and morbidity (Dey et al, 2005). This conclusion is in line with the findings of recent reviews. For instance, a Cochrane review on shared care interventions (across primary and secondary care) in chronic disease management concluded that there is, at present, insufficient evidence to demonstrate significant benefits from shared care apart from improved prescribing (Smith, Allwright and O'Dowd, 2007). There could be several reasons for the absence of a relation between process measures and patient outcomes, including inadequate length of follow-up, inadequate case-mix adjustment or insufficiently responsive outcome measures. Alternatively, the underlying clinical research evidence may be interpreted as being too optimistic in relation to treatment effects. We suggest that further exploration of the link between process and outcomes is needed, but that enhanced expertise is a potentially effective component of patient care teams.

Improved coordination

Five studies were identified that focused on adding a coordinator to the team (three studies) or improved communication and coordination structures (two studies). Patient outcomes seemed to show some positive results, especially on 'soft' measures such as patient preferences. But given that

mainly coordination was improved, one would expect an impact on resource utilisation and efficiency of healthcare delivery. All five studies included such measures. Huddleston et al (2004), for example, reported shorter adjusted length of stay in patients treated by the collaborative, hospitalist-led model of care. They reported higher physician costs, although hospital and total medical costs were not significantly different. However, overall, there is very little evidence to conclude that resource utilisation and costs reduce as a result of improved coordination in patient care teams, although some studies reported shortened length of stay. These mixed findings are in line with a Cochrane review, which compared the effects of closely coordinated community mental health team treatment with standard non-team management (Malone et al, 2007). They reported that lower admissions to a hospital were reported in the team group, while no clear evidence was reported on admittance to emergency services, contact with primary care and contact with social services. No differences were reported in death from any cause. Fewer people in the team group were not satisfied with their care, compared to usual care.

Enhanced clinical expertise and coordination

Ten studies were identified in which the intervention contained both clinical expertise and coordination. Process measures were hardly reported, and the studies showed mixed results regarding patient outcomes and little effect on costs and resource utilisation. We therefore found little evidence to conclude that the combination of enhanced coordination and expertise added value compared to enhanced clinical expertise only or improved coordination only. It was not possible to disentangle the influence of specific components of these teams with enhanced expertise and coordination because these were not well described and analysed. One study (Tijhuis et al 2002, 2003; van den Hout et al, 2003), which compared care provided by a clinical nurse specialist in addition to the usual outpatient rheumatologist care versus both multidisciplinary inpatient and day patient team care, showed that standard ‘full’ multidisciplinary care may not always be preferable, since the full inpatient and day patient team approach did not lead to better results in terms of clinical efficacy and led to higher costs.

Evidence derived from reviews

Finally, two reviews were identified by our search. Given the fact that the reviews included different interventions (specifically Mitchell, Del and Francis, 2002), we did not classify them under the three categories we used for the description of the single studies. Mitchell et al (2002) concluded that cooperation between GP and specialist did not seem to affect physical outcomes but may have improved retention rates, patient satisfaction and the clinical behaviour of GPs. However, only seven studies were included and conclusions may be based on one study only. Malone et al (2007) concluded that community mental health teams may in some respects be superior to non-team standard care.

Methodological considerations

We encountered difficulties in defining a sensitive search strategy with a feasible number of potential eligible studies. Given the high number of hits when ‘patient care team’, as a MeSH term, was included, or team search terms in the title and abstract were used, ultimately, the search was limited to terms which only appeared in the titles of papers. We therefore realised that relevant studies would be missed. This explains why there was little overlap with selected studies from an earlier review (Lemieux-Charles and McGuire, 2006). We tried to overcome this problem by snowball sampling from the identified studies. For example, Huddleston et al (2004) was not identified in our search, but was later included because we identified a summary of that paper in our search. The sample sizes of the included studies were often small and the methodological quality was often rather poor, therefore limiting our ability to draw firm conclusions on the basis of our sample of included studies. In addition, it was often unclear what the expected effects of enhanced team approaches were, and therefore what scientific hypothesis was tested in the evaluation. We grouped studies to three subgroups of teams rather than according to setting or other factors. In doing so, we may not have paid enough attention to the context in which the

care took place (for example, outpatient versus inpatient care (Hearld et al, 2008; Lemieux-Charles and McGuire, 2006)). This limits the external generalisability of our conclusions. Finally, some of the studies included comparisons across different settings, which may also have confounded the effects. Despite our efforts to collect information regarding the impact of potential determinants on team effectiveness, no conclusions could be drawn owing to the limited availability of this type of information. Intervention studies which focus primarily on improving team functioning by altering team characteristics or processes probably include a more comprehensive set of factors.

Despite the possible limitations, this review has a clear strength. In previous studies, outcome measures were highly heterogeneous, thereby making comparisons across studies difficult (Lemieux-Charles and McGuire, 2006). Since different teams may be effective in relation to different outcomes, in this review, we classified the type of outcome and grouped the studies according to the underlying objectives of the teams (enhanced clinical expertise, improved coordination, and a combination of these features). In doing so, we gained insight into the relative importance of these elements. A better understanding of the relevance of mechanisms underlying teamwork is important for both decision makers and for the design of future studies on the impact of clinical delivery teams.

As we based our conclusions on experimental designs only, evidence on the outcomes of patient care teams is strong. Observational designs (including process evaluations, case studies and ethnographic studies) have a high risk of bias with respect to conclusions on effectiveness. However, there is an ongoing debate in the literature whether interventions such as patient care teams and teamwork may be too complex to measure in an RCT (Norman, 2003). For instance, according to Salas et al (2005), teamwork is dynamic, and its manifestation can vary based on a vast number of variables such as team environment, type of task, individual difference and perceived workload. Therefore, it has been argued, to fully understand such a construct it is insufficient to take a single ‘snapshot’ of team performance. Instead, teamwork should be sampled during a variety of conditions and situations, including laboratory and applied research settings (Salas et al, 2005). Thus, other waves of research focus primarily on dynamic processes of collaboration that improve interteam work around patients (Kerosuo and Engeström, 2003; Leonard, Graham and Bonacum, 2004; Salas et al, 1992), using a range of qualitative methodologies such as team performance measures on single teams (Jeffcott and Mackenzie, 2008; Salas et al, 2008), situation analysis (Outhwaite, 2003), ethnographic and interview methods (Hunter et al, 2008) and video feedback (Carroll, Iedema and Kerridge, 2008).These studies may be helpful in building new theory, especially in identifying the process factors that will eventually lead to better outcomes and identifying the conditions under which this will take place. These studies would ideally be complemented by experimental designs to explore whether relationships that are observed in observational studies also hold in experimental designs.

Implications for health policy

Improving quality in healthcare has become a priority for countries worldwide. Figuring out how to achieve this in an evidence-based manner without adding to the already unsustainable cost burden is an imperative. This means that we must go beyond invocations such as ‘we need more teamwork’ to understanding with precision exactly when, in what circumstances and with what properties teamwork contributes to better patient outcomes. For this reason, we specifically tried to examine different team subgroups.

Policy makers can create and optimise stimulating environments and conditions such that workers in diverse healthcare settings are able to perform to the best of their ability. The following conclusions and recommendations for health policy makers may be drawn from our review:

1. Enhanced clinical expertise: the available research indicated that adding clinical expertise may indeed improve appropriateness of care, although this did not consistently translate into improved patient outcomes. This may be due to the relatively short follow-up periods of most studies. It remained unclear what investments were made to achieve these improvements. We suggest that putting in additional resources may be acceptable, as they are an investment in better patient outcomes, but that formal evidence on efficiency would be helpful for decision makers.
2. Regarding enhanced coordination, the available research did not show a consistent reduction in resource utilisation or costs, as might have been expected. We suggest that the intended effects of enhanced coordination, either through an added human coordinator or through additional coordination structures, should be examined. If reduced utilisation and costs are indeed the aim (for example, by shortening hospital stay), the mechanism by which this is achieved should be clarified. Currently, there is only limited evidence to suggest to decision makers that adding a team member with coordination tasks or introducing more coordination activities has a beneficial effect.
3. Coordination may be most effective when combined with added expertise and integrated into an appropriate organisational context. Similar results were found for these studies as for those with improved coordination alone.
4. Despite our in-depth analysis of the studies, the amount of detailed information provided on patient care teams in terms of team structure, processes and outcomes was limited. This hinders our ability to make strong recommendations on levels for effective team environments and conditions.
5. Questions regarding cost-effectiveness of team approaches cannot be answered adequately because of the lack of sufficient studies. Additional resources for teamwork may be acceptable, as they are an investment in better patient outcomes, but formal evidence on efficiency is not available. The intended effects of enhanced coordination, either through adding a co-coordinator or through introducing coordination structures, are worthy of further exploration. If reduced utilisation and costs are indeed at the aim (for example, by shortening hospital stay), the mechanism by which this is achieved should be clarified. Currently, there is very limited evidence to suggest to decision makers that enhanced coordination in patient care teams has a beneficial effect.
6. Decision makers wishing to know what components contribute to the success of teams and how patient care team interventions can be optimised should plan evaluations alongside strategic programmes to enhance patient care teams. Careful consideration should be given to how to interpret these programmes. As yet, it is often unclear how the results of these measures should be interpreted. For example, if consumption of nurse-led care is higher than consumption of care provided by physicians, does this mean that nurse-led care is less favourable? Outcomes should therefore be related to cost consequences.

The evidence may be weaker than might be expected by policy makers and managers in supporting a case for investment in resources for coordination, which is often a very high priority for policy and public interest in healthcare. The usual arguments can be made that research methods may be responsible for the weaker than expected findings. Studies did not consistently focus on outcomes where one would expect to see most effect. On the other hand, one might focus on the strength of the finding that enhancement of clinical expertise in teams does, as expected, appear to be associated with improvements in the delivery of healthcare.

Implications for research

This review has focused on two potential ingredients of effective teamwork: more clinical expertise and better coordination in patient care. From a research perspective, the challenge in our review was to extract features that contribute to successful teamwork. We formulated the categories from the information provided by authors on the objectives of the teams and from the description of the intervention components. We focused on a team structure attribute (adding expertise) and a team process attribute (adding coordination). From the analysis we make a number of observations:

1. Interventions to enhance patient care teams are not well described in research publications. We strongly recommend that the description of the content, integrity and context of these interventions is improved (or that a link to sources where such information can be found is provided).
2. Reports on studies of patient care teams should follow guidelines for the evaluation of complex interventions in healthcare (Medical Research Council, 2008). Currently, studies do not consistently focus on outcomes where one would expect the most significant results. Only when more information on the interventions and their context is provided can we start to learn about factors associated with effects on performance, patient outcomes and costs.

In addition to robust reviews taking a clinical epidemiology perspective to build theory, more explorative reviews should be conducted including a range of qualitative methodologies.

Appendix A: Search strategy for QQUIP teams review in PubMed

#	Search term	Number of hits
1	Team (TI)	9,757
2	Teams (TI)	1,909
3	Teamwork (TI)	1,073
4	Teamworking (TI)	18
5	1 OR 2 OR 3 OR 4	12,658
6	Interdisciplinary (TI)	3,421
7	Inter disciplinary (TI)	28
8	Multidisciplinary (TI)	4,118
9	Multi disciplinary (TI)	243
10	Interprofessional (TI)	614
11	Inter professional (TI)	41
12	Multiprofessional (TI)	109
13	Multi professional (TI)	46
14	6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13	8,579
15	Collaboration (TI)	4,328
16	14 AND 15	228
17	5 OR 16	11,828
17	Publication Date from 1990, Humans, English	5,098,227
18	EPOC study design criteria	7,272,377
19	17 AND 18 AND 19	2,252

Appendix B: Search strategy and results per database

Database	Source	Search terms	Date + number of hits
PubMed	University library	#((((((((((((((((((((((((((((((Randomized Controlled Trial[ptyp])))) OR (((Controlled Clinical Trial[ptyp]))))) OR (((Comparative Study[ptyp])))) OR (((Evaluation Studies[ptyp])))) OR ((“comparative study”))) OR ((“effects”))) OR ((“effect”))) OR ((“evaluations”))) OR ((“evaluating”))) OR ((“evaluation”))) OR ((“evaluates”))) OR ((“changing”))) OR ((“changes”))) OR ((“change”))) OR ((“interventions”))) OR ((“intervention”))) OR ((“impact”))) OR ((“random allocation”))) OR ((“post test”))) OR ((“posttest”))) OR ((“pre test”))) OR ((“pretest”))) OR ((“time series”))) OR ((“experimental”))) OR ((“experiments”))) OR ((“experiment”))) OR ((“intervention studies”))) OR ((“intervention study”))) OR ((“controlled clinical trial”))) OR ((“randomised controlled trial”))) OR ((“randomized controlled trial”)) and #Limits: (“1990”[PDAT]: “3000”[PDAT]) AND “humans”[MeSH Terms] AND English[lang] and #Interdisciplinary collaboration and team search terms: ((((((((((“interdisciplinary”[TI])) OR ((“interdisciplinary”[TI]))) OR ((“multidisciplinary”[TI]))) OR ((“multi disciplinary”[TI]))) OR ((“interprofessional”[TI]))) OR ((“interprofessional”[TI]))) OR ((“multiprofessional”[TI]))) OR ((“multi professional”[TI])))) AND ((collaboration[TI])))) OR ((team[TI])) OR ((teams[TI])) OR ((teamwork[TI])) OR ((teamworking[TI]))	25–01–2008 Number of hits: 2,252

Database	Source	Search terms	Date + number of hits
PsycINFO	University library	#(((evaluation studies) or (evaluation study)) or (evaluations) or ((evaluate) or (evaluates) or (evaluation)) or (pretest) or ("pre test") or ("time series") or (intervention study) or (intervention studies) or (controlled clinical trial) or (randomised clinical trial) or (randomized clinical trial) or ((change) or (changes) or (changing)) or ((experiment) or (experiments) or (experimental)) or (interventions) or (intervention) or (impact) or (random allocation) or (posttest) or ("post test") or (comparative study) or ((effect) or (effects))) and (LA:PSYI = ENGLISH) and (PY:PSYI >= 1990) and # ((((collaboration) in TI) and (((“inter disciplinary”) in TI) or ((multidisciplinary) in TI) or ((“multi disciplinary”) in TI) or ((interprofessional) in TI) or ((multiprofessional) in TI) or ((“inter professional”) in TI) or ((interdisciplinary) in TI) or ((“multi professional”) in TI))) or (((teamworking) in TI) or ((teamwork) in TI) or ((teams) in TI) or ((team) in TI))) and (LA:PSYI = ENGLISH) and (PY:PSYI >= 1990) and # ((general practice or medical or physician* or medicine or clinician*) or (patient or patients or inpatient or inpatients or outpatient or outpatients or hospital or hospital* or healthcare or health institution* or primary care or primary practice* or family practice*)) or ((community health) or (clinical) or (nurses) or (mental health) or (care) or (caregivers)) and (LA:PSYI = ENGLISH) and (PY:PSYI >= 1990) Note: No selection on study type (as done in Pubmed)	15–02–2008 Number of hits: 750
EMBASE	University library	#1(((evaluation studies) or (evaluation study)) or (evaluations) or ((evaluate) or (evaluates) or (evaluation)) or (pretest) or ("pre test") or ("time series") or (intervention study) or (intervention studies) or (controlled clinical trial) or (randomised clinical trial) or (randomized clinical trial) or ((change) or (changes) or (changing)) or ((experiment) or (experiments) or (experimental)) or (interventions) or (intervention) or (impact) or (random allocation) or (posttest) or ("post test") or (comparative study) or ((effect) or (effects))) #2((((collaboration) in TI) and (((“inter disciplinary”) in TI) or ((multidisciplinary) in TI) or ((“multi disciplinary”) in TI) or ((interprofessional) in TI) or ((multiprofessional) in TI) or ((“inter professional”) in TI) or ((interdisciplinary) in TI) or ((“multi professional”) in TI))) or (((teamworking) in TI) or ((teamwork) in TI) or ((teams) in TI) or ((team) in TI))) # (((general practice or medical or physician* or medicine or clinician*) or (patient or patients or inpatient or inpatients or outpatient or outpatients or hospital or hospital* or healthcare or health institution* or primary care or primary practice* or family practice*)) and (LA:EMBV = ENGLISH) and (PY:EMBV >= 1990)) and (#2 and (LA:EMBV = ENGLISH) and (PY:EMBV >= 1990)) and (#1 and (LA:EMBV = ENGLISH) and (PY:EMBV >= 1990)) Note: Limited selection on healthcare	08–02–2008 Number of hits: 1,208

Database	Source	Search terms	Date + number of hits

Web of Science	University library	# Topic=(Caregiver* or care or nurse* or “mental health” or “community health” or clinical or ((general practice or medical or physician* or medicine or clinician*) or (patient or patients or inpatient or inpatients or outpatient or outpatients or hospital or hospital* or healthcare or health institution* or primary care or primary practice* or family practice*)))
		Databases=SCI-EXPANDED, SSCI, A&HCI Timespan=1990-2008
		and
		# Title=((((collaboration)) and (((“inter disciplinary”)) or ((multidisciplinary)) or ((“multi disciplinary”)) or ((interprofessional)) or ((multiprofessional)) or ((“inter professional”)) or ((interdisciplinary)) or ((“multi professional”)))) or (((teamworking)) or ((teamwork)) or ((teams))) or ((team))))
		Databases=SCI-EXPANDED, SSCI, A&HCI Timespan=1990-2008
		and
		# Title=((((evaluation studies) or (evaluation study)) or (evaluations) or ((evaluate) or (evaluates) or (evaluation)) or (pretest) or (“pre test”) or (“time series”) or (intervention study) or (intervention studies) or (controlled clinical trial) or (randomised clinical trial) or (randomized clinical trial) or ((change) or (changes) or (changing)) or ((experiment) or (experiments) or (experimental)) or (interventions) or (intervention) or (impact) or (random allocation) or (posttest) or (“post test”) or (comparative study) or ((effect) or (effects))))
		Databases=SCI-EXPANDED, SSCI, A&HCI Timespan=1990-2008
		Note: Limited selection on healthcare
			15–02–2008
			Number of hits: 349

Database	Source	Search terms	Date + number of hits
Cumulative Index to Nursing & Allied Health Literature (CINAHL)	University library	# (((((collaboration) in TI) and (((“inter disciplinary”) in TI) or ((multidisciplinary) in TI) or ((“multi disciplinary”) in TI) or ((interprofessional) in TI) or ((multiprofessional) in TI) or ((“inter professional”) in TI) or ((interdisciplinary) in TI) or ((“multi professional”) in TI))) or (((teamworking) in TI) or ((teamwork) in TI) or ((teams) in TI) or ((team) in TI))) and (LA:NU = ENGLISH) and (PY:NU >= 1990)) and ((((evaluation studies) or (evaluation study)) or (evaluations) or ((evaluate) or (evaluates) or (evaluation)) or (pretest) or (“pre test”) or (“time series”) or (intervention study) or (intervention studies) or (controlled clinical trial) or (randomised clinical trial) or (randomized clinical trial) or ((change) or (changes) or (changing)) or ((experiment) or (experiments) or (experimental)) or (interventions) or (intervention) or (impact) or (random allocation) or (posttest) or (“post test”) or (comparative study) or ((effect) or (effects))) and (LA:NU = ENGLISH) and (PY:NU >= 1990)) and (LA:NU = ENGLISH) and (PY:NU >= 1990) and # ((((collaboration) in TI) and (((“inter disciplinary”) in TI) or ((multidisciplinary) in TI) or ((“multi disciplinary”) in TI) or ((interprofessional) in TI) or ((multiprofessional) in TI) or ((“inter professional”) in TI) or ((interdisciplinary) in TI) or ((“multi professional”) in TI))) or (((teamworking) in TI) or ((teamwork) in TI) or ((teams) in TI) or ((team) in TI))) and (LA:NU = ENGLISH) and (PY:NU >= 1990) and # (((evaluation studies) or (evaluation study)) or (evaluations) or ((evaluate) or (evaluates) or (evaluation)) or (pretest) or (“pre test”) or (“time series”) or (intervention study) or (intervention studies) or (controlled clinical trial) or (randomised clinical trial) or (randomized clinical trial) or ((change) or(changes) or (changing)) or ((experiment) or (experiments) or (experimental)) or (interventions) or (intervention) or (impact) or (random allocation) or (posttest) or (“post test”) or (comparative study) or ((effect) or (effects))) and (LA:NU = ENGLISH) and (PY:NU >= 1990) Note: no selection on healthcare	08–02–2008 Number of hits: 2,052
Database of Abstracts of Reviews of Effects (DARE) + HTA + NHS EED	www.crd.york.ac.uk/crdweb	# (team:ti OR teams:ti OR teamwork:ti OR teamworking:ti) or # multidisciplinary:ti AND collaboration:ti or # interdisciplinary:ti AND collaboration:ti or # multiprofessional:ti AND collaboration:ti or # interprofessional:ti AND collaboration:ti	15–02–2008 Number of hits: 68

Database	Source	Search terms	Date + number of hits
Cochrane Database of Systematic Reviews	University library	# “team in Record Title or teams in Record Title or teamwork in Record Title or teamworking in Record Title or # “multidisciplinary in Record Title and collaboration in Record Title or # “interdisciplinary in Record Title and collaboration in Record Title or # “multiprofessional in Record Title and collaboration in Record Title or # “interprofessional in Record Title and collaboration in Record Title	15–02–2008 Number of hits: 6
World Health Organisation Library Database (WHOLIS)	www.who.int	# title “team” OR title “teams” OR title “teamwork” OR title “teamworking” or #title “multidisciplinary” and “collaboration” or #title “interdisciplinary” and “collaboration” or #title “multiprofessional” and “collaboration” or #title “interprofessional” and “collaboration”	15–02–2008 Number of hits: 67
Organisation for Economic Cooperation and Development (OECD)	www.oecd.org	# (multidisciplinary and (team or teams or teamwork or teamworking) and “healthcare”) and year>=1990 and year<=2008 or # (interdisciplinary and (team or teams or teamwork or teamworking) and “healthcare”) and year>=1990 and year<=2008 or # (interprofessional and (team or teams or teamwork or teamworking) and “healthcare”) and year>=1990 and year<=2008 Note: the number of hits were not useful, because it was not possible to search within title words)	29–02–2008 Number of hits: 23
Sociological Abstracts	University library	# ((TI=(team or teams or teamwork or teamworking)) or (TI=((interprofessional or interdisciplinary or multidisciplinary or multiprofessional) and collaboration))) and (((general practice or medical or physician* or medicine or clinician*) or (patient or patients or inpatient or inpatients or outpatient or outpatients or hospital or hospital* or healthcare or health institution* or primary care or primary practice* or family practice*)) or ((community health) or (clinical) or (nurses) or (mental health) or (care) or (caregivers))) and (((evaluation studies) or (evaluation study)) or (evaluations) or ((evaluate) or (evaluates) or (evaluation)) or (pretest) or (“pre test”) or (“time series”) or (intervention study) or (intervention studies) or (controlled clinical trial) or (randomised clinical trial) or (randomized clinical trial) or ((change) or (changes) or (changing)) or ((experiment) or (experiments) or (experimental)) or (interventions) or (intervention) or (impact) or (random allocation) or (posttest) or (“post test”) or (comparative study) or ((effect) or (effects)))	22–02–2008 Number of hits: 32

Appendix C: Data collection forms

Review

- First author and year
- Type of the review
- Aim of the review
- Search period
- Data sources
- Number of studies
- Included study design
- Procedure study selection and data extraction
- Language (inclusion criteria, and actually included)
- Countries (inclusion criteria, and actually included)
- Brief description of the intervention
- Brief description of the control condition
- Setting
- Clinical domain
- Main outcomes
- Findings per outcome category:
  - Clinical outcomes
  - Behavioural patient outcomes
  - Process of care outcomes
  - Provider outcomes
  - Resource utilisation
  - Cost-effectiveness and cost outcomes
- Conclusions
- Study limitations
- Our comments

Other study design

- First author and year
- Study design
- Aim of the study
- Study period
- Number of participants (randomised, before and after in all groups)
- Country
- Setting
- Clinical domain
- Brief description of the intervention:
  - Professions and disciplines involved
  - Presence of team coordinator
  - Team tenure
  - Explicit task description team members
- Brief description of the control condition:
  - Professions and disciplines involved
  - Presence of coordinator
  - Usual care provider tenure details
  - Explicit task description usual care providers
- Findings per outcome category:
  - Clinical outcomes
  - Behavioural patient outcomes
  - Process of care outcomes
  - Provider outcomes
  - Resource utilisation
  - Cost-effectiveness and cost outcomes
- Conclusions
- Our comments
- Study limitations

Appendix D: Excluded studies and reason for exclusion

If a study did not meet one of the criteria, it was not further examined whether the other criteria were met

Author, year	Design	Intervention	Other
Naji, 1994		x	
HSE report, 2002			x
Bellomo, 2004	x		
Aberg-Wistedt, 1995		x	
Agius, 2007	x		x
Aneman, 2006	x		
Anderson, 1999		x	
Bellomo, 2004	x		
Bithoney, 1991	x		
Baggs, 2004	x		
Bakewell-Sachs, 1991	x		
Boland, 1996			x
Bakheit, 1996	x		
Bond, 1991		x	
Bristow, 2000	x		
Dewachter, 2007			x
Bell, 2005	x		
Ball, 2003	x		
Chaboyer, 2004			x
Chaboyer, 2004			x
Chung, 2007	x		
Cohen, 1991	x		
Corser, 2004	x		
Costantini, 2003	x		
Bostrom, 2003	x		x
Cowan, 2006	x		
Dacey, 2007	x		
Britton, 2006			x
Buist, 2002	x		
King, 2006		x	
Eappen, 2007		x	
Evans, 2002		x	
Felton, 1995			x
Fisher, 1996	x		
Francke, 1999	x		
Gales, 1994	x		
Haig, 1991	x		
Hanks, 2002		x	

Author, year	Design	Intervention	Other
Hassell, 1994	x		
Hearn, 1998	x		
Higginson, 2001	x		
Higginson, 2003	x		
Palmer, 2000		x	
Hillman, 2005		x	
Hughes, 2000		x	
Jack, 2004	x		
Jack, 2006			x
Johnson, 2005		x	
Jones, 2005	x		
Jones, 2007	x		
Karjalainen, 2001		x	
Karjalainen, 2001		x	
Khetarpal, 1999	x		
Hultberg, 2006		x	
Kucukarslan, 2003	x		
Laffel, 2002			x
Le, 1998	x		
Jansson, 1992	x		
Levetan, 1995	x		
Martin, 1994		x	
McCrone, 1994		x	
McDonnell, 2002	x		
Mickan, 2005	x		
Muijen, 1994		x	
Kennedy, 2002			x
Naylor, 2004	x		
Kennedy, 2005	x		
Rowley, 1995		x	
Britton, 2000		x	
Faulkner, 1999	x		
Soifer, 1998		x	
Stephens, 2006	x		
Litaker, 2003	x		
Stroebel, 2000	x		
Suarez, 2004	x		
Vliet Vlieland, 1997	x		
Webster, 1999	x		
Nikolaus, 2003		x	
Ovretveit, 1993			x
Waldenstrom, 2000		x	
Richardson, 2000		x	

Author, year	Design	Intervention	Other
Robinson, 2005		x	
Upchurch, 2007			x
Vliet Vlieland, 2004	x		
Teague, 1995	x		
Vliet Vlieland, 2004	x		
Vos, 2003	x		
Hanson, 1999	x		
Williams, 2002			x
Ziran, 2003	x		

Appendx E: Methodological quality studies

RCTs

First author, year	A	B	C	D	E	F	G
Huddleston et al, 2004	+	?	+	?	?	?	-
Banerjee et al, 1996	+	+	+	+	+	+	-
Bogden et al, 1997	-	+	+	+	+	?	-
Dey et al, 2005	+	?	+	+	?	+	-
Forster et al, 2005	+	?	-	+	?	+	-
Gattis et al, 1999	+	?	+	+	?	?	-
Germain et al, 1995	+	?	+	?	?	?	-
Gums et al, 1999	?	?	+	+	?	+	-
Hogan and Fox, 1990	-	+	+	-	+	+	-
Koproski, Pretto and Poretsky, 1997	?	?	?	?	+	?	-
Lincoln et al, 2004	+	?	-	-	-	?	-
Moher et al, 1992	+	?	+	?	?	?	?
Phelan et al, 2007	+	+	+	+	+	+	+
Rabow et al, 2004	-	?	-	+	+	+	?
Rubin et al, 2005	?	?	+	?	?	?	?
Schmidt et al, 1998	?	+	+	?	+	?	+
Schned et al, 1995	?	?	-	-	+	?	-
Scott et al, 2005	+	?	+	+	?	?	-
Tijhuis et al, 2003	+	?	+	+	+	+	-
Yagura et al, 2005	-	?	+	+	+	?	-
Vliet Vlieland, Breedveld and Hazes, 1997	+	?	+	+	+	+	-

A = concealment of allocation; B = follow-up of professionals; C = follow-up of patients or episodes of care; D = blinded assessment of primary outcomes; E = baseline measurement; F = reliable primary outcome measures; G = protection against contamination

CBAs

First author, year	A	B	C	D	E	F	G
Mudge et al, 2006	-	+	+	-	+	?	-
Mudge et al, 2006	-	+	+	+	+	?	+

A = baseline measurement; B = characteristics for studies using second site as control; C = blinded assessment of primary outcomes; D = protection against contamination; E = reliable primary outcome measures; F = follow-up of professionals; G = follow-up of patients or episodes of care

Reviews

First author, year	A	B	C	D	E	F
Malone et al, 2007	+	+	+	+	+	+
Mitchell, Del and Francis, 2002	+	+	+	+	+	-

A = search period specified; B = databases specified; C = data extraction by at least two reviewers; D = search terms specified; E = quality assessment provided; F = methodological quality reported

Appendix F: Results per study

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Bogden et al, 1997	RCT n = 100 Hawaii / USA Outpatient Patient with elevated cholesterol	Physician–pharmacist teamwork vs Usual care	**Primary**: 1. Absolute change in total cholesterol concentration from baseline enrolment **Other**: 2. Achievement of NCEP (National Cholesterol Education program) goals dependent on risk factors and coronary heart disease	1. Significantly larger reduction in total cholesterol in intervention group compared to control. Total cholesterol levels in the intervention arm declined 44 ± 47mg/dL (1.1 ± 1.2mmol/L) versus 13 ± 51mg/dL (0.3 ±1.3 mmol/L). Reduction in men not significantly different between two groups (1.5 ± 1.3mmol/L in intervention vs 0.7 ± 0.7mmol/L in control). Significant difference in women: 1.0 ± 1.2mmol/L vs 0.2 ± 1.4mmol/L). No statistical difference between men and women in reduction (p = .18) 2. Success rate in intervention group 43% vs 21% in control group, statistically significant (intervention group: when physician declined recommendation of pharmacologist then success rate significantly lower, ie 17 vs 51%), also when stratified for sex. Effect of intervention significantly larger in patients with CHD or ≥ 2 risk factors (13/34 or 38% vs 5/36 or 14%). In patients with fewer than 2 risk factors no significant effect (7–13 or 54% vs 5–11 or 45%) 3. Other effects: medication charge was not significantly different between two groups, nor were frequencies of emergency department visits, referrals to dietitians and ordered panels. Significantly more clinical visits in intervention group (12 vs 9) Additional: pharmacist made 186 recommendations; 90% of them were adopted by physicians (all with regard to patient education; 94% with regard to alter dosage, and 93% with regard to patient monitoring. 19% of drugs selection recommendations were rejected by physician
Bogden et al, 1998	RCT n = 100 Hawaii/USA Outpatient Patients with uncontrolled hypertension	Physician–pharmacist teamwork vs Usual care	**Primary**: 1. % patients who attained blood pressure goals (systolic pressure below 140; diastolic below 90mm Hg) **Secondary**: 2. Absolute change in blood pressure levels (systolic and diastolic)	1. Significantly more patients in intervention group reached goals (55% vs 20%) 2. Decline in diastolic pressure in intervention group is 14 ± 11mm Hg vs 3 ± 11mm Hg in control group. Decline in systolic pressure in intervention group is 23 ± 22mm Hg vs 11 ± 23mm Hg in control group Additional: pharmacist made 162 recommendations; 7.4% were declined by physicians Costs: $6.8 reduction in mean medication charges in intervention group, and $6.5 increase in control group (no sig level reported)

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Dey et al, 2005	RCT n = 308 UK Inpatients Stroke (acute phase)	Organised stroke care/mobile stroke team vs Usual care	**Primary**: 1. Mortality **Secondary**: 2. Death or dependency; 3. Death or institutionalised care Not formally denoted: Barthel index for functional outcome and Canadian neurological scale (CNS) for stroke severity, EuroQol	1. No difference between groups at 6 weeks/12 months 2. and 3. No difference between groups at 6 weeks nor at 12 months No significant difference in number of patients receiving CT scans, anti-platelet therapy or in number transferred to stroke rehab unit Patients in intervention group transferred to stroke rehab unit significantly earlier than control group (14.7 vs 24.4 days, CI difference –17.0 to –2.57), but time to uptake of other intervention was similar No differences in functional outcome or quality of life measures (Barthel index/and CNS, and EuroQol)
Gattis et al, 1999	RCT n = 181 USA Outpatients Heart failure patients	Addition of clinical pharmacist to heart failure management team vs Usual care	Primary end points: 1. Events (death/mortality and heart failure event/hospitalisation/emergency department visit for health failure) 2. Clinical data	1. All-cause mortality and non-fatal heart failure in intervention 4 and in control group 16: OR = 0.22 (0.06–0.63) (sig) Death/all-cause mortality not significantly different between the two groups: three in intervention and five in control group; OR = 0.59 (0.12 to 2.49). Non-fatal heart failure significantly higher in control group (11 vs 1; OR = 0.08 (0.004 to 0.4). Total non-fatal cardiovascular events were significantly higher in control group (23 vs 8; OR = 0.31; 0.31 to 0.69). Total events higher in control group vs intervention group (36 vs 29; OR = 0.73, 0.39 to 1.33) 2. Patients in intervention group were significantly closer to target ACE inhibitor dose at 6 months follow-up (1.0; 0.5 to 1 vs 0.5; 0.19 to 1) , but no difference in ACE inhibitor use between groups (78 patients (87%) in intervention vs 72 (79%) in control at follow-up). Significantly more patients in intervention group received alternative therapy (9 (75%) vs 5 (26%))

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Gums et al, 1999	RCT n = 252 USA Inpatient Infectious diseases	Usual care vs Multidisciplinary team (providing recommendations concerning antibiotic therapy and monitoring when necessary)	**Primary**: 1. Length of stay (LoS) **Secondary**: 2. Charges to patients for antibiotics, laboratory and radiology services; 3. Room and board; 4. ICU charges; 5. Non-ICU charges; 6. Total patient charges; 7. Estimated hospital cost; 8. Survival; 9. (Cost of implementing interdisciplinary approach); 10. Physician acceptance	1. Length of stay: median LoS 3.3 days (37.1%) significantly shorter in intervention group (9.0 ± 0.5 days in control vs 5.7 ± 0.8 days) 4. Median ICU days statistically equal (9.4 ± 1.1 vs 7.3 ± 0.8 days) 5. Significantly 36.7% (3.3 days) shorter in intervention group (9.0 ± 0.8 vs 5.7 ± 0.5 days) 6. Total costs significantly lower in intervention group 12,207 ± 1,042 vs 9,153 ± 761 dollars) 7. Hospital costs significantly lower in intervention group. Median patient charges reduced by 4,404/intervention; median hospital cost: reduced by $2.642/ intervention 8. Not statistically significant between both groups (intervention: 6.3% of 127 vs control: 12.0% of 125 of the patients died). RR = 1.35 (ns) (before exclusions/ corrections RR = 1.16) 9. Implementation costs: $21,000/year 10. Suggested interventions rejected by 11%
Jack et al, 2003	CBA n = 100 UK Inpatient Palliative care	Palliative care team vs Usual care control group	PACA tool: 1. Pain; 2. Anorexia; 3. Nausea; 4. Insomnia; 5. Constipation	Significant improvement over time in PC team (% improvement): 1. 56.9% (mean 2.32–1.42–1.00); 2. 44.7% (mean 2.46–1.72–1.36); 3. 51.8% (mean 2.24–1.42–1.08); 4. 48.9% (mean 1.80–1.18–0.92); 5. 42.5% (mean 0.8–0.74–0.46) Significant improvement over time in usual care group (% improvement): 1. 16.3% (mean 2.08–1.78–1.74); 2. 10.7% (mean 2.24–2.08–2.00), 3. 14.8% (mean 1.76–1.56–1.50); 4. 9.8% (mean1.22–1.18–1.10), 26.4% (mean 1.36–1.24–1.00) 3. 4. 5. Significant difference between interventions at time 1 (baseline) 1. 2. Significant difference between interventions at time 2 1. 2. 3. 5. Significant difference between interventions at time 3
Koproski, Pretto and Poretsky, 1997	RCT n = 179 USA Inpatients Diabetes	Diabetes team intervention vs Control group with usual care	1. Length of stay (LoS); 2. Blood glucose control; 3. Readmission rate; 4. Entries for insulin administration, glucose monitoring, and nutrition and social service consultations	1. No significant difference between the two groups (primary diagnosis 7.8 ± 6.7 in intervention versus 10.3 ± 8.5 in control group; and secondary diagnosis: 12.9 ± 10.0 versus 14.1 ± 11.7) 2. No significant difference between the two groups (154.6 ± 64.0 in intervention vs 153.9 ± 59.7 in control group) 3. Significantly fewer patients in intervention group readmitted at 3 months (13 vs 30, or 15% vs 32%) and effect remained at 6 months [data not shown] 4. Significantly more patients in intervention group had their blood monitored for glucose level (89% vs 57%); idem for insulin administration (69% vs 25%) Significantly more patients in intervention group had had education of any kind (87% vs 37%); 76% vs 40% received nutritional consultation (significant)

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Rubin et al, 2005	RCT n = 139 USA Inpatients Psychiatric patients	Addition of internist to inpatient psychiatry team vs Usual care group	1. Processes of care: functions of a general internist (coordinating care, developing needs assessment/ documenting problems, updating health services) Needs assessment included: updating list of problems, updating medication list, looking for potential adverse drug reactions. Appropriate health maintenance services were judged on US Preventive Services Task Force Coordination of care: calling primary care providers at admission and discharge 2. Recourse use: LoS, total hospital costs; hospital inpatient days; emergency visits (latter 2 for subgroup)	1. Intervention group had better scores on process of care; 12 of 17 were significant. Only summary scores are presented here: needs assessment better in intervention group (89 ± 14 vs 59 ± 20); health maintenance better in intervention group (56 ± 34 vs 3 ± 7) and coordination of care also better in intervention group (81 ± 40 vs 40 ± 55) 2. LoS not significantly different in intervention vs control group (11.5 ± 9 vs 10.9 ± 7.3). Hospital costs not significantly different between two groups (8,527 ± 6,512 vs 8,558 ± 5,703 dollars). No differences in hospital services after discharge (4.2 ± 1 1.3 inpatient days vs 4.4 ± 19.6 or emergency department visits (1.1 ± 3.2 vs 0.7 ± 2.2)
Scott et al, 2005	RCT n = 112 UK In- outpatient/ community Internal medicine (nutrition)	Nutrition team after gastronomy vs Usual care	**Primary**: 1. Total costs of health service (unit cost data and patient use of services **Secondary**: 2. Clinical complications; 3. LoS; 4. Readmissions; 5. Nutritional status; 6. QOL	1. Similar number of referrals in both groups (96% vs 98%) and same number of contacts (52% vs 55%). No statistical difference in total costs (16,858 ± 16,351 in control and 13,330 ± 15,505 dollars in intervention groups; 21% difference). (Table 5 provides detailed subdivisions of costs) 2. Mortality was similar between the two groups (no additional data provided). Clinical outcomes were all statistically equal between the two groups (time to removal of PEG (60 (6–366) vs 113 (11–366) days); complications specified in table 2; durations of antibiotic use (8 (0–43) vs 11 (0–158)) 3. LoS statistics similar between the two groups (different aspects of length of stay mentioned in table 3) 4. No significant difference in readmissions (18 in intervention, 29 in control) 5. ? 6. Better results on social functioning element of QoL at SF36 (details not presented) for intervention group. Other elements of SF36 were similar, as were carer/patient satisfaction

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Forster et al, 2005	RCT n = 620 Canada Inpatients All kinds of patients in hospital	Care with clinical nurse specialist (CNS) (team) vs Regular care	**Primary**: 1. In-hospital deaths; 2. Occurrence of a post-discharge event (about 30 days after discharge) including symptoms **Secondary**: 3. Time to ER visit; 4. Hospital readmission; 5. Death; 6. Time to readmission; 7. Time to death; 8. Inpatient satisfaction	1.–7. No significant difference between control and intervention groups 8. Patients in CNS group perceived quality and process of care to be superior: doctors had sufficient information (70.4% [95] vs 58.1% [90] in control group), and patients recalled being contacted by hospital personnel (49.6% [67] vs 18.1% [28]). Overall quality of care was better (8.2 ± 2.2 in CNS vs 7.6 ± 2.4 in control group), although this did not reach significance (p = 0.052)
Huddleston et al, 2004	RCT n = 526 USA Inpatients Patients needing hip/knee arthroplasty	Hospitalist–orthopaedic team (HOT) vs Standard orthopaedic managed care	**Primary**: 1. Post-operative complication rate; 2. LoS **Secondary**: 3. Patient satisfaction; 4. Provider preference; 5. Hospital and physician costs	Primary: 1. Most frequent postoperative complication rate were electrolyte abnormalities (30%), postoperative fever (13%), urinary tract infection (4%). Most patients in HOT discharged without complications (61.6% vs 49.8; CI difference 2.8 to 20.7). HOT patients had fewer minor complications (30.2 vs 44.3%; CI difference –22.7 to –5.3); frequency of intermediate and major complications statistically equal (6.9% to 4.6%; CI difference –2.1% to 6.6% and 1.3% to 1.3%, CI difference –2.3 to 2.4) 2. Patients in HOT had shorter adjusted LoS (5.1 vs 5.6 days; CI difference –.8 to –.1) 3. Patient satisfaction did not differ (no absolute values provided, only graph) 4. Nurses and orthopaedics preferred HOT (no absolute values provided, only graph) 5. Physician costs: significantly higher in HOT ($2,689 vs $2,367, CI difference $175 to $484); but hospital costs and total medical costs were not significantly different ($12,684 vs $12,916, CI difference –1,096 to 636) and 15,373 vs 15,283, CI difference $–887 to $1,067)
Moher et al, 1992	RCT n = 267 Canada Inpatients General medical clinical teaching units	Medical team coordinator (MTC) vs Usual care	1. LoS; 2. Death; 3. Readmissions Subgroup n = 40: 4. Patient satisfaction; 5. Medical care information	1. Patients in MTC group had significantly shorter length of stay compared to control group (CI 1.02 to 2.92 days). No significant effect for sex, age and discharge destination categories. Effect positive for digestive diseases and negative for circulatory system deficits. Table 3 provides LoS stratified for several different variables (age, sex, etc) 2. 10 patients (7%) in intervention died before discharge vs 8 (6%) in control (ns) 3. 22 patients (16%) in intervention were readmitted vs 18 (14%) in control (ns) 4. Significantly more patients in intervention group satisfied (89% vs 62%; CI 2% to 52%) 5. Information provided to 100% of patients in intervention vs 86% in control (ns)

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Mudge et al, 2006	CBA n = 1538 Australia Inpatients Internal medicine	Team intervention vs Control group with usual care	**Primary**: 1. Length of stay; 2. Death; 3. Mortality (in-hospital and 6 months); 4. Functional decline in hospital **Secondary**: 5. 6 months readmission; 6. Inpatient bed occupancy; 7. Discharge to residential care; 8. Self-rated health change 1 month after discharge; 9. Restoration to previous functional level 1 month after discharge; 10. Health utilisation	1. No significant difference 2. Significantly fewer patients in intervention group died (example from community patients: 31 (3.9%) vs 48 (6.4%)), but no longer significant at 6 months 4. Significantly fewer patients in intervention group showed functional decline in hospital (3.2% vs 5.4%) 5. No difference in rate of readmission 6. No significant difference between the groups 7. 7.4% vs 5.4% (not significant) 8. Self-rated health better in patients from intervention group (data not provided) 9. 81.1% vs 80.9% (not significant) 10. Significantly greater access to health services; eg 53.2% vs 63.9% (or 397 vs 506 patients) for any allied health service. OT, social work, nutrition, speech therapy and discharge liaison also better effect for intervention group Overall additional cost per patient for intervention group $184
Yagura et al, 2005	(Semi) RCT n= 178 Japan Inpatients hospital Initial stroke	Stroke rehabilitation unit (SRU) (= team) vs General rehabilitation ward (GRW)	**Primary**: 1. Functional impairment measure (FIM); 2. Discharge disposition **Secondary**: 3. Stroke impairment assessment set (SIAS); 4 Length of hospital stay; 5. Cost of hospitalisation per day	1. No significant difference, also not when stratified for severity 2. No significant difference; stratifying for severity showed significantly more severe patients discharged to home in SRU than in GRW (47.4% vs 0%) 3. No significant difference, also not when stratified for severity 4. No significant difference, also not when stratified for severity 5. No significant difference, also not when stratified for severity
Banerjee et al, 1996	RCT n = 69 UK Community Geriatrics (frail elderly)	Psychogeriatric team vs Standard GP care	1. Recovery from depression (AGECAT score and Montgomery Asberg depression rating scale, MADRS) 2. Uptake proposed management plans (intervention only!) Not reported in methods section: 3. management of depression 4. Referral to psychiatric team/ admittance to psychiatric unit	1. AGECAT: significantly more patients in intervention group recovered (19 vs 9, or 33%; CI difference 10 to 55), significantly more patients improved (27 vs 17, or 35%; CI difference 14 to 56) and fewer remained the same (2 vs 9, or –19%; CI difference –35 to –3) or became worse (0 vs 6 or –17%, CI difference –29 to –5) 1. MADRS change was greater in intervention group than in control group; –8.3 ± 6.5 vs 11.6 ± 6.4 (CI difference in points –10 to –3) 1. ORadj for effect of antidepressants was 0.3 (0.0–1.9), ns 2. 78–100% of proposed interventions were completed, except for outreach referral (43%) 3. 16% of control patients vs 69% of intervention patients received antidepressants (however, no significant levels provided) 4. 2 and 1 patients in control group vs 3 and 0 in intervention group (however, no significant levels provided)

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Germain et al, 1995	RCT n = 108 USA Inpatients Geriatrics	Consultative services of a geriatric assessment and intervention team (GAIT) vs Usual hospital care	1. Length of stay (LoS); 2. Discharge to home; 3. Rehospitalisation; 4. Survival rate; 5. Nursing home discharge	1. Significantly lower in GAIT (42.8 ± 20.8 vs 65.5 ± 23.5), both in high functioning and low functioning patients 2. Significantly higher in GAIT, especially in high functioning patients (42% vs 13% in high and 10% vs 7% in low functioning patients) 3. Rehospitalisation 1 year after discharge statistically equal between both groups (48% vs 46%) 4. One-year survival statistically equal in both groups (75% vs 64%) 5. No difference
Hogan and Fox, 1990	Prospective, controlled trial (randomisation not explicitly mentioned) n = 132 USA Inpatients Geriatrics	Geriatric consultation team (GCT) vs Usual care by physician	1. Survival status; 2. Living arrangements; 3. Subsequent hospitalisation; 4. Barthel index	1. Significantly larger survival at 180 days in GCT group, but not at 365 days (no absolute numbers given, % in graph, not accurate) 2. Equal admittance to nursing home (14% vs 19%) and from nursing home to general community (25% vs 8%) 3. Equal hospital readmittance after 3, 6 and 12 months (at 12 months 41% vs 57%) 4. Significantly higher improvement in Barthel index in GCT (75% vs 44% of the patients) after 12 months. Not after 3 and 6 months (69% vs 52% and 77% vs 69% respectively)
Lincoln et al, 2004	RCT [No baseline measurement! Assessment only at 6 months] n = 428 UK Community Stroke	Community stroke team (CST) vs Routine care	**Patient**: 1. Barthel index (BI); 2. Extended ADL; 3. General health questionnaire –12 (GHQ-12); 4. EuroQol; 5. Satisfaction with care (4-point Likert scale, practical, emotional, overall); 6. Knowledge of stroke **Carer**: 7. GHQ-12 ; 8. Carer strain index (CSI) ; 9. EuroQol_carer; 10. Satisfaction with care (knowledge of stroke; practical support; emotional help, overall satisfaction)	1. 2. 3. 4. 5 (Practical/overall); no significant differences between groups at 6 months post-stroke 6: No significant differences 5. CST group more satisfied with emotional help they received (median 3 vs 2) 7. 9. 10. (Practical help and emotional support) no difference between groups 8. Lower levels of strain in CST group (median 8 vs 10; IQR 5–10 vs 6–12) 10. Higher satisfaction with knowledge (median 2 vs 2; IQR 2–3 vs 1-3) and overall satisfaction (median 2 vs 2; IQR 2–3 vs 1–3) in CST group

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Phelan et al, 2007	RCT n = 874 USA Outpatients (primary care clinics) Gerontology	Senior resource team (SRT); team of geriatric specialists vs Usual GP care	**Primary**: 1. PCP care (management, prescription, proactive screening); 2. Physical and affect subscales of functional status (arthritis impact measurement scale 2 – short form (AIMS-2SF) **Secondary**: 3. PCP satisfaction; 4. Provider self-efficacy; 5. Provider satisfaction; 6. New disabilities in ADL; 7. Self-rated health; 8. Psychological well-being, mental health index (MHI); 9. Hospitalisations 10. Vital status (death)	1. PCP management improved at 12 months in control but not in intervention; at 24 months no statistical difference between the two groups (64% in intervention vs 61% in control group at baseline; 65% vs 69% at 12 months; 61% vs 62% at 24 months); no change in prescription over follow-up (high-risk medication: 34% vs 40%; 38% vs 39%; 36% vs 39%); higher proportions of patients screened in intervention group during first year, not at 24 months follow-up (differentiated between depression, cognitive impairment and falls in table 2) 2. No effects on AIMS-2SF, no group differences (physical subscale: 1.27 vs 1.28; 1.53 vs 1.51; 1.68 vs 1.59) (affect subscale: 2.39 vs 2.47; 2.53 vs 2.60; 2.60 vs 2.66) (sd not reported) 3. Satisfaction with intervention was high 4. Mean self-efficacy of provider was high in both groups, no change or difference 5. Rather low satisfaction of provider; no difference between groups 6. Lower rate of disability in intervention group at 12 months, not at 24 months (12 months: 10 vs 15; 24 months: 14 vs 16) 7. No differences in self-rated health over time or between intervention groups (70% vs 75%; 69% vs 70%; 67% vs 71%) 8. Higher MHI score in intervention group at 24 months only (78.8 vs 78.5; 77.1 vs 76.9; 77.6 vs 75.5) (no sd reported) 9. Hospitalisation not significantly different over time nor between interventions (11.5% vs 12.3%; 19.4% vs 16.2%; 18.2% vs 16.4%) 10. Higher mortality in intervention group (11.5% vs 7.6%)

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Rabow et al, 2004	RCT n = 90 USA Outpatients (tertiary care) Palliative care	Comprehensive care team (CCT); palliative outpatient medicine teams vs Usual PCP care	1. Physical functioning and symptoms: rapid disability rating scale; 2. Dyspnea (University of California, San Diego shortness of breath questionnaire); 3. Brief pain inventory and pain medications and treatment; 4. 6 items from Medical Outcomes Study Psychosocial and spiritual wellbeing: 5. Profile of mood states; 6. Centre of Epidemiology Studies depression scale; 7. Spiritual wellbeing scale; 8. QoL scale – cancer version; 9. Care satisfaction: Group Health Association of American Consumer Satisfaction Survey Advance care planning (several single questions)	1. ? 2. Increased odds for dyspnea at time 2 for control group compared to intervention (OR = 6.07; CI 1.04 to 35.56), lower interference with daily activities due to dyspnea in intervention group but high in control group. (6.5 at T2 vs 7.1 at T3 in control group and 5.8 vs 3.6 in intervention) 3. No changes and differences in pain scores (interference with activities: 39.9 vs 40.8 and 43.1 vs 36.4). 4. Improvement in sleep in intervention group but not different group x time interaction (quality: 10 vs 11 and 11.9 vs 12.5) 5. Anxiety improved in the intervention group and deteriorated in the control group (5.5 at T2 vs 5.9 at T3; 6.8 at T2 vs 5.3 at T3) 6. No significant difference for depression scores between control and intervention (17.5 at T2 vs 15.3 at T32; 16.5 at T2 vs 12.4 at T3) 7. Intervention group pt showed significantly increased level of spiritual wellbeing but control group unchanged (91.2 at T2 vs 92.4 at T3 in control group; 98.0 at T2 vs 105.5 at T3) 8. No difference in QoL (65.4 at T2 vs 67.7 at T3 in control group; 69.7 vs 69.3 at T3 in intervention) 9. No differences/improvements (74.5 at T2 vs 72.4 at T3; 69.6 at T2 vs 70.1 at T3) Advanced care planning: significantly more pt in intervention group had completed funeral arrangements at end of follow-up (35% vs 5% in control group) Healthcare utilisation: intervention patients made fewer visits to their GP and the urgent care clinics (7.5 ± 4.9 vs 10.6 ± 7.5/0.6 ± 0.9 vs 0.3 ± 0.5), but no differences with regard to specialty care clinics, emergency department visits, number of hospitalisations, number of days in hospital (see also table 5). Mean charge per patient was 47,211 ± 73,009 dollars in intervention vs 43,338 ± 69,647 in control group (not significant)

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Schmidt et al, 1998	RCT (block randomisation) n = 1854 Sweden Inpatient (nursing homes) Geriatrics (psychotropic prescriptions)	Intervention (team) vs Control	1. **Drugs prescription in four classes**: antipsychotics, hypnotics, anxiolytics, antidepressants **Number of drugs**: 2. % with psychotropic drugs; 3. % with polymedicine; 4. % with therapeutic duplication; 5. Number of drugs prescribed; 6. % with non-recommended drugs prescribed; 7. % with acceptable drugs in each class **Selectivity of drugs**: 8. Classified according to SMPA guidelines	1. 2. 3. 4. No significant difference before and after in experimental homes 1. 4. Significant increase before and after in control homes: (mean number of drugs increased from 2.06 to 2.2; use of ≥ 2 drugs increased from 20.7 to 24.2) 1. 19%, significant reduction in antipsychotics description in experimental group only (control group 7% decrease) 1. Hypnotics description changed in experimental group only: non-recommended hypnotics description declined with 37% (acceptable hypnotics increased from 9% to 15% and overall rate of hypnotic prescriptions declined by 16%) 1. No change in prescription of non-recommended anxiolytics (both groups), but increase in prescription of acceptable anxiolytics in experimental homes (13.9% vs 20.8%) and overall increase in anxiolytics prescription in experimental homes (29%)
Schned et al, 1995	RCT (no blinding) n = 107 USA Outpatient Chronic inflammatory arthritis	TEAMCARE vs TRADCARE (control group)	**Physical**: 1. Joint inflammation measured with the Ritchie articular index; 2. Duration of morning stiffness **Severity measures**: 3. Presence of nodules; 4. Fatigue; 5. Vasculitis; 6. Felty's syndrome **Self-reports**: 7. Modified health assessment questionnaire (mHAQ); 8. Arthritis helplessness index (AHI); 9. VAS for pain; 10. Arthritis impact measurement scales (AIMS); 11. Beck depression inventory (BDI) **Costs**: 12. Cost part of HAQ; 13. Medication; 14. Number of referrals; 15. Use of aids and devices; 16. Arthritis-related procedures **Laboratory**: irregularly! erythrocyte sedimentation rate; hemoglobin; hand radiographs; latex fixation	**Data 1 year after intervention started** 1.–16. No significant difference between the two groups Data collection for laboratory measures was described as being inadequate and outcomes were not reported

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Tijhuis et al, 2003 **van den Hout et al, 2003** **Tijhuis et al, 2002**	RCT n = 210 Netherlands In-patient and outpatient Rheumatoid arthritis	Clinical nurse specialist care (CNSC) vs Inpatient multidisciplinary team care (IMTC) vs Day patient multidisciplinary team care (DMTC)	(#98; #113) **Primary**: functional status measured with 1. Health assessment questionnaire (HAQ), and 2. MacMaster Toronto arthritis patient preference interview (#98, 99) **Other**: QALYs measured with: 3. Quality of life assessed with RA-specific QoL questionnaire (RAQoL), and 4. Rand-36 (#99) 5. Rating scale on current health (TRS) (#99) 6. Time trade-off (TTO) for preference of current health (#99) 7. Costs for hospitalisation (cost-price data) and (#99) 8. Societal costs (for CEA) (#98) 9. Disease activity score (DAS) (#98) 10. Grip test (#98) 11. Walk test Not specified in methods sections: (#113) 12. patient satisfaction (VAS) #98. 13. Use of services of other health professionals; introduction of adaptive equipment; number of hospitalisations; medical treatment	1. All three groups improved on HAQ. Change scores in CNSC group at weeks 12, 52, and 104: 0.2 (0.07 ± 0.33); 0.17 (0.03 ± 0.30); 0.2 (0.06 ± 0.33); change score in IMTC group: 0.15 (0.02 ± 0.27); 0.19 (0.06 ± 0.32); 0.13 –0.03 ± 0.26). In DMTC patients: 0.34 (0.21 ± 0.47); 0.366 (0.23 ± 0.50); 0.35 (0.22 ± 0.48). Significant difference between CNSC and DMTC and between CNSC and IMTC at baseline. #113 also provides data at weeks 6 and 26; provide same picture. Comparison of clinical outcome among three groups and comparison between CNSC group and two others did not show significant differences. 2. Significant improvement in MACTAR; additional improvement between weeks 12 and 52 and deterioration between weeks 52 and 104 in day DMTS and CNSC. DMTC largest improvement at week 52 compared to other groups. Change scores in CNSC group at weeks 12, 52 and 104: –2.1 (–4.7 ± 0.5); –4.3 (–6.8 ± –1.8); –0.6 (–3.3 ± 2.1). In IMTC group: –0.3 (–2.9 ± 2.4); 0.6 (–2.0 ± 3.1); 0.8 (–2.0 ± 3.6). In DMTC group: –1.5 (–4.2 ± 1.2); –5.3 (–7.9 ± 2.6); –.2 (-3.0 ± 2.5). #113 also provides data at weeks 6 and 26; provide same picture. 3. 4. 5. Patients in all groups showed significant improvements over 2 years. Aggregated over all three groups of care, average improvements were 1.5 ES 0.21 (RAQoL), 0.045 ES 0.49 (SF-36), 0.061 ES 0.18 (TSR), and 0.046 ES 0.18 (TTO). QALY differences less than 0.1 year. No difference between groups. #113 also provides data at weeks 6 and 26; provide same picture. 7. Significantly higher costs for initial care for both team care groups: 5,000 euros for inpatient and 4,100 euros for outpatient vs 200 euros for CNSC. Healthcare and non-healthcare costs were not significantly different 8. Costs for society significantly lower in CNSC vs other two groups, at least 5,400 euros 9. Significant improvements of DAS at weeks 12, 52 and 104 compared to baseline in each of the three groups. #113 also provides data at weeks 6 and 26; provide same picture. 10. Significant improvement over time in the three groups. Deterioration on test for day patients between weeks 52 and 104. 11. Significant improvement over time in the three groups. Deterioration on test for inpatients between weeks 52 and 104. 12. At end of treatment period, inpatients and day patients were significantly more satisfied with care than nurse specialist patients (73mm ± 23mm for nurse specialists vs 85mm ± 19mm in inpatients, and 92mm ± 10mm in day patients). 13. In general, all not significant, except for weeks 52–104: more inpatients than CNS patients received home help (23 vs 10), and during the periods 12–52 and 52–104 weeks, visits to a CNS were more frequent in the CNS group than in the two team groups.

First author, year	Study design, sample size, country, setting, condition	Intervention	Outcome measures	Results
Vliet Vlieland, Breedveld and Hazes, 1997	RCT n = 80 Netherlands Inpatients and outpatients vs outpatients alone Rheumatoid arthritis	Inpatient MD team care vs Routine outpatient care For active RA	1. Modified Ritchie articular index (MRAI); 2. Number of swollen joints; 3. VAS pain; 4. VAS disease activity; 5. Physician level of disease activity (0–3); 6. Erythrocyte sedimentation rate (ESR); 7. Health assessment questionnaire (HAQ)	1. – 5. Inpatient groups shows significant improvement at 2 weeks; difference between two groups from 2–104 weeks was significant, but MRAI deteriorated significantly rather than improved. All outcome values are presented in table 2, for intervention and control group separately at each follow-up period!!! 1. –7. Inpatient groups showed no significant improvement at 104 weeks Significantly greater proportion of patients showed clinical improvement (based on ACR criteria, see figure 1) in intervention group at weeks 2, 4, 12 and 52, not 104 (weeks 2: 6/39 vs 0/41; week 4 7/39 vs 0/41; week 12 10/39 vs 3/39; wk 52 18/39 vs 9/39; week 104 20/39 vs 18/39) **(changes in) drug prescriptions not described since not defined as endpoint, and results are not clear as to the timing of the reported measures**
Malone et al, 2007	Intervention review n = na Study group from UK Community Mental illness and disordered personality	Three studies included; together 587 participants **Death**: no difference in death from any cause Satisfaction with service: fewer people in team group not satisfied compared to usual care (RR = 0.37; CI 0.2 to 0.8) **Service use**: Lower admissions to hospital in team groups (RR 0.81; CI 0.7 to 1.0); no clear evidence on hospital admissions; no significant difference for use of emergency services (RR 0.86; CI 0.8 to 1.1); no difference on contact with primary care (RR 0.94; CI 0.8 to 1.1); no difference on contact with social services (RR 0.76; CI 0.6 to 1.0) **Mental state**: no conclusions could be drawn **Social functioning**: team groups had more contact with policed (RR 2.07; CI 1.1 to 4.0)		
Mitchell, Del and Francis, 2002	Intervention review n = na Study group from Australia Organised cooperation between GP and specialist vs Usual care	Seven studies included; together 1,862 participants **Health outcomes**: mixed effects for physical outcomes, many different physical outcomes **Contact with services**: GP involvement showed improved retention rates in patients with hypertension, diabetes and schizophrenia **Patient satisfaction with service**: GP involvement showed improved patient satisfaction in patients with diabetes, schizophrenia, hypertension, and geriatric problems **Clinical behaviour of GPs**: four studies showed improved clinical behaviour for GPs **Costs**: mixed results on cost aspects; measurement of costs differs dramatically between studies which makes comparison impossible		

n = n after randomisation; na = not applicable; ns = not significant; CI = confidence interval; RR = relative risk; GP = general practitioner

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