Implementation of Complex Interventions in UK General Practice

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A thesis submitted for the degree of PhD in Health Services Research

Volume II of II - Appendices

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Appendix 1: MEDLINE search strategy

1 Translational Medical Research/
2 translational gap.mp.
3 knowledge transfer.mp.
4 research uptake.mp.
5 knowledge translation.mp.
6 evidence to practice.mp.
7 evidence practice gap.mp.
8 research practice gap.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
9 exp Evidence-Based Practice/
10 research to practice.mp.
11 Guideline Adherence/
12 1 or 3 or 4 or 5 or 6 or 10 or 11
13 2 or 7 or 8
14 primary care.mp.
15 exp General Practice/
16 general practi*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
17 GP.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
18 general practitioners/ or physicians, family/ or physicians, primary care/
19 Nurse Practitioners/ or Primary Care Nursing/
20 family doctor*.mp.
21 family practice.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
22 primary medical care.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
23 family medicine.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
24 family physician*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
25 primary health care/ or "continuity of patient care"/
26 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27 12 and 26
28 systematic review.mp.
29 meta-synthesis.mp.
30 meta-ethnography.mp.
31 narrative review.mp.
32 "Review"/
33 Meta-Analysis/
34 "Review Literature as Topic"/
35 Qualitative Research/
36 28 or 29 or 30 or 31 or 32 or 33 or 34
37 meta.mp.
38 35 and 37
39 36 or 38
40 implement*.mp.
41 integrat*.mp.
42 adopt*.mp.
43 normali*.mp.

44 facilitat*.mp.
45 routini*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
46 diffusion.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
47 dissemination.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
48 gap.mp.
49 barrier*.mp.
50 obstacle*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
51 cause*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
52 promotor*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
53 48 or 49 or 50 or 51 or 52
54 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47
55 27 and 39
56 53 or 54
57 9 and 26 and 39 and 56
58 29 or 30
59 26 and 58
60 13 and 39
61 intervention*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
62 Medical Records Systems, Computerized/ or Electronic Health Records/
63 Telemedicine/
64 Decision Making, Computer-Assisted/ or Decision Support Systems, Clinical/
65 Medical Informatics/
66 Models, Organizational/
67 Organizational Innovation/
68 61 or 62 or 63 or 64 or 65 or 66 or 67
69 26 and 39 and 54 and 68
70 56 and 58
71 53 and 54
72 26 and 39 and 71
73 55 or 57 or 59 or 60 or 69 or 70 or 72

Appendix 2: Systematic review 1: scope of the review – domains and types of complex interventions included in the review

Broad topic*	Specific topics covered in the review
Guidelines or evidence-based practice	Guidelines in general, children and adolescent mental health, arthritis, chronic diseases, children with attention-deficit-hyperactivity disorder, in rural and remote practice.
E-health	Computerised decision support system, computerised cognitive behavioural therapy, electronic prescribing, electronic medical records, information and communication technologies or health information exchange, e-health service in rural communities, telemedicine, telehealth, paediatric information technology
Management of care	Chronic care model/ chronic diseases, advanced care planning in palliative care, process/quality improvement, quality measurement, audit, mental health, dementia, depression, diabetes, nurse-led care
Public health or preventative medicine	HIV testing, fall prevention programmes, breast and colorectal cancer screening, behaviour change interventions, brief alcohol interventions, smoking cessation
Integration of new role or collaborative working	Nurse practitioner role implementation, nurse-physician collaboration, collaborative practice or inter-professional team working
Prescribing	Change in prescribing practice/behaviour

**Topic domains are not mutually exclusive.*

Appendix 3: Systematic review 1: Characteristics of included studies

First author, year (reference) Title Review type	Aims and objectives	Inclusion and exclusion criteria	Number and type of included studies Description of study screening and abstraction process Description of study selection or flow diagram?	Synthesis method Quality assessment? Any rating or commentary? Theory used/ considered? Perspective(s)	Barriers/ facilitators/ both
Guideline implementation and evidence based practice					
Novins DK, 2013 Dissemination and implementation of evidence-based practices (EBPs) for child and adolescent mental health: a systematic review. Systematic review	To identify key findings from empirical studies examining the dissemination and implementation of EBPs for child and adolescent mental health.	**Inclusion criteria** Included were English language empirical journal articles that examined the dissemination and implementation of EBPs in child and adolescent mental health between 1991 and December 2011.	60 (quantitative and qualitative) Yes Yes	Framework analysis Yes Yes (analysis) EPIS model/ framework and CFIR Unclear	Facilitators only
Zwolsman S, 2012 Barriers to GP's use of evidence-based medicine: a systematic review Systematic review	To determine the barriers encountered by GPs in the practice of evidence based medicine and to come up with solutions to the barriers identified.	**Inclusion criteria** Studies about barriers in the practice of evidence based medicine (EBM); studies with GP as subjects; reported outcomes, barriers to the practice of evidence based medicine/ more than one of the EBM steps	22 (9 qualitative, 12 quantitative and one mixed methods) Yes Yes	Analysis based on Model of evidence-based decision making in GPs Yes (criteria used by another similar review on EBM)	Barriers only

		Exclusion criteria Studies that had primary care physicians as subjects and in which the outcomes of GPs were not presented separately. Studies describing the application or use of specific guidelines		No GPs	
Mickan S, 2011 Patterns of 'leakage' in the utilisation of clinical guidelines: a systematic review. Systematic review	To review evidence in different settings on the patterns of 'leakage' in the utilisation of clinical guidelines using Pathman's awareness-to-adherence model. To summarise any identified barriers to guideline implementation.	**Inclusion criteria** Studies that look at the utilisation of one or more clinical practice guideline recommendation(s), that measure awareness and agreement and either adoption or adherence (or both); Design: any primary survey or cross-sectional study; Response rate: not specified as we wished to include internet surveys, and determining the denominator is not always possible; Outcome measures: both objective and self-reported Specialty or area: any area of healthcare Healthcare objective: any (e.g. diagnosis, prevention, screening)	11 surveys (8 mailed surveys, 2 internet surveys, 1 was given to participants after a personal interview) Clearly stated Yes	Unclear Yes (using a proforma quality criteria) Yes (Pathman awareness to adherence model) Physicians	Facilitators and barriers

Ogundele M, 2011 Challenge of introducing evidence based medicine into clinical practice: an example of local initiatives in paediatrics.	To review the available literature on how clinicians meet the daily challenge of translating medical information into clinical evidence based medicine.	**Inclusion criteria** Unclear **Exclusion criteria** None stated.	Unclear Unclear Unclear	Narrative No No Professionals	Facilitators and barriers
Lineker SC, 2010 Educational interventions for implementation of arthritis clinical practice guidelines in primary care: effects on health professional behaviour Systematic review	To evaluate the influence of educational programs designed to implement clinical practice guideline for osteoarthritis and rheumatoid arthritis in primary care.	**Inclusion criteria** English articles published between 1994 and 2009, and were related to implementation of arthritis CPG in primary care; prospective evaluation studies that targeted primary care providers working with adults with rheumatoid arthritis or osteoarthritis and if they reported behavioural outcomes that ensured actual knowledge utilisation in primary care. **Exclusion criteria** None stated.	7 (6 randomised controlled trials (RCTs) and 1 before and after study) Unclear No	Narrative Yes (Modified Philadelphia Panel grading system) No GPs	Barriers only (not stated as an objective; data found in results and discussion)
Kendall E, 2009 When guidelines need guidance considerations and	To investigate barriers to guideline uptake and dissemination practices and	**Inclusion criteria** Peer-reviewed journals between January and April 2008	Unclear Not stated Not given	Unclear No	Facilitators and barriers

strategies for improving the adoption of chronic disease evidence by general practitioners Literature review	options for improving the process of embedding evidence into practice	Studies that explored the barriers and issues associated with the use of guidelines in general practice **Exclusion criteria** Unclear		Yes (discussion) Uptake model GPs	
Langberg JM, 2009 Interventions to promote the evidence-based care of children with attention deficit-hyperactivity disorder (ADHD) in primary-care settings Review	To review the efficacy of intervention models that designed to improve physician use of the evidence-based recommendation for evaluating and treating children with ADHD.	**Inclusion criteria** Interventions that specifically target the improvement of evidence-based ADHD-related physician practice behaviours, and not mental healthcare in general and only intervention that published quantitative outcomes were included. **Exclusion criteria** School and community based approaches for improving the identification and management of children with ADHD that have been proposed but not evaluated formally.	9 (2 observational, 1 RCT, 1 cluster RCT, 5 interrupted time series) Not stated Not given	Unclear No (quality not discussed) No Physicians	Facilitators and barriers (not stated as an objective)
Dulko D, 2007 Audit and feedback as a clinical practice guideline implementation strategy: a model for	To evaluate the effectiveness of audit and feedback as a guideline implementation strategy.	**Inclusion criteria** Articles published in English between 2001 and 2005; focused on physical symptoms related to cancer or cancer treatment **Exclusion criteria**	16 (unclear) Not stated Not given	No No Yes (discussion) Change theory Nurse practitioners	Facilitators and barriers

acute care nurse practitioners Systematic review		None stated.			
McKenna H, 2004 Barriers to evidence based practice in primary care: a review of the literature Narrative review	To examine evidence-based practice in primary and review the barriers encountered by professionals when attempting to introduce evidence into practice	**Inclusion criteria** Articles related to terms such as primary care, barriers to research utilisation and evidence-based practice and those that focus on policy and research papers, the role of patients and client in the planning and delivery of primary care. **Exclusion criteria** None stated.	Unclear Not stated Not given	Narrative No Yes (discussion) Kitson's conceptual framework enabling implementation of evidence based practice Health professionals	Facilitators and barriers
Parsons J, 2003 Evidence-based practice in rural and remote clinical practice: where is the evidence? Systematic review	To review the evidence regarding barriers to implementing research findings in rural and remote settings.	**Inclusion criteria** Articles that included information on the barriers to the implementation of evidence faced in rural and remote areas; interventions for implementing evidence-based practice or an element of evidence-based practice in rural and remote areas. **Exclusion criteria** -	2 (survey) Not stated Not given	Narrative Quality of the included studies and their applicability were discussed. No Health professionals	Barriers only
Cabana MD, 1999	To review barriers to physician adherence	**Inclusion criteria** Articles that focused on clinical practice guidelines,	76 (surveys and qualitative studies)	Theory based analysis	Barriers only

Why don't physicians follow clinical practice guidelines? A framework for improvement. Systematic review	to clinical practice guidelines. To examine candidate titles of papers describing theories of physician behaviour change to find constructs useful in describing barriers.	practice, parameters, clinical policies, national recommendations or consensus statements, and that examined at least 1 barrier to adherence. Only barriers that could be changed by an intervention were included. **Exclusion criteria** None.	Yes Yes	No (quality was discussed) Yes (analysis) The knowledge, attitudes, behaviour framework Physicians	
Wensing M, 1998 Implementing guidelines and innovations in general practice: which interventions are effective? Systematic review	To evaluate the effectiveness of interventions In influencing the implementation of guidelines and adoption of innovations in general practice.	**Inclusion criteria** Studies were included if one or more interventions were used to improve professional behaviour in general practice and if the effect on actual behaviour was measured. RCTs, controlled trials, controlled before and after studies. **Exclusion criteria** Non-randomised controlled trials that did not perform pre-intervention measurement in intervention or control group.	61 "best evidence" studies (143 studies identified) (quantitative) Yes Yes	Narrative Yes (no checklist was used – selection of "best evidence" studies were made) No Unclear	Barriers only [in discussion; quality not relevant]
Davis AD, 1997 Translating guidelines into practice. A systematic review of theoretic concepts, practical experience	To explore the variables affecting physicians' adoption of clinical practice guidelines and describe outcomes of trials of	**Inclusion criteria** Studies of CPG implementation strategies and reviews of such studies were selected.	Unclear No No	Descriptive/ narrative No No	Facilitators and barriers

and research evidence in the adoption of clinical practice guidelines (CPG). Systematic review	educational interventions to change physicians' behaviour or health care outcomes.			Professionals	
Grilli R, 1994 Evaluating the message: the relationship between compliance rate and the subject of a practice guideline.	To explore the relationship between providers' compliance and some key aspects of the clinical messages in practice guidelines.	**Inclusion criteria** Papers had to present compliance rates with practice guidelines developed by official organisations and had to target providers as the audience.	23 No No	Narrative No Yes (diffusion of innovation mentioned in the introduction) Physicians	Barriers only
Management of care					
Lovell A, 2014 Advanced care planning (ACP) in palliative care: a systematic literature review of the contextual factors influencing its uptake 2008-2012.	To identify the contextual factors influencing the uptake of Advanced care planning in palliative care.	**Inclusion criteria** Only primary research reporting on ACP within palliative care was included. Studies on the views of organisations involved in aged and end of life care were also included. **Exclusion criteria** Studies that evaluated a novel intervention, tool or model of ACP were excluded.	27 (half or 13 included studies used qualitative methodology; 3 x mixed methods; 11 x quantitative methods) (10 studies conducted in USA, UK 8, Australia 4, Belgium 2, Netherlands 1, China and Taiwan 2) Yes Yes	Thematic synthesis No Yes (NICE quality appraisal checklist) Quality of the studies varied. Few based their work on explicit theoretical frameworks. PRISMA checklist was used to conduct this review	Facilitators and barriers

				Primary care health care professionals	
Holm AL, 2012 Chronic care model (CCM) for the management of depression: Synthesis of barriers to and facilitators of success.	To identify barriers to, and facilitators of success when implementing the CCM for the management of depression in primary care.	**Inclusion criteria** Published in English, implementation or use of the CCM, and primary care and depression as one of the chronic illnesses covered. **Exclusion criteria** Not using CCM, chronic illnesses not including depression, and reviews (also studies published in books and dissertations)	13 (quantitative and qualitative) Unclear Yes	Thematic analysis Yes (adapted a framework from both quantitative and qualitative research traditions; quantitative: sample size, reliability, validity, and transferability. Qualitative: trustworthiness, credibility, confirmability, dependability and transferrability No Professionals and administrative staff	Facilitators and barriers
Sales AE, 2012 The use of data for process and quality improvement in long term care and home care: a systematic review of the literature.	To determine how the resident assessment instrument minimum data set (RAI) have been used in process or quality improvement activities in the	**Inclusion criteria** Discussed continuing care in a long term care and health care setting; involved some form of intervention relating to quality or process improvement, and used RAI data in the quality or process improvement intervention.	24 (quantitative) Yes Yes	Descriptive/ narrative No No Unclear	Barriers only (in discussion; quality not relevant)

Systematic review	continuing care sector.				
Zhang J, 2012 System barriers associated with diabetes management in primary care. Systematic review	To explore system barriers to diabetes management in primary care and solutions that overcome the system barriers and the role of nurse practitioners in addressing these system barriers.	**Inclusion criteria** English only articles and articles specifically focused on system barriers for diabetes management in primary care settings were included. **Exclusion criteria** None stated.	31 (both systematic reviews and primary studies) Not stated Not given	Unclear Not stated No Unclear	Facilitators and (largely) barriers
Hoare K, 2012 The role of government policy in supporting nurse-led care in general practice in the United Kingdom, New Zealand and Australia: an adapted realist review. Systematic review and realist review	Realist review to examine the theory that clinical governance was the main driver to stimulate practice nurse development. To examine the role of government policy in primary care and its association with nurse-led care in the United Kingdom, New Zealand and Australia between 1998 and 2009.	**Inclusion criteria** Systematic review - the study had to report primary research involving practice nurses or demographical statistics of nurse-led clinics in general practice Realist review – hypothesis clinical governance was the mechanism implemented in the context of the UK's NHS which had the outcome of stimulating the expansion of nurse-led care in general practice. The contexts of general practice in NZA and Australia to investigate if similar quality improvement mechanisms had resulted in	45 (mixed study types including policy documents) Yes Yes	Realist synthesis Realist synthesis – the reviewer reads the paper to search for evidence that may support the initial theory, and so contribute to fuller development of an explanatory model. No quality assessment tools were suitable for the systematic review. No Unclear	Facilitators and barriers

		the outcomes of nurse-led care.			
Nam S, 2011 Barriers to diabetes management: patient and provider factors Systematic review	To summarise existing knowledge regarding various barriers of diabetes management from the perspectives of both patients and clinicians.	**Inclusion criteria** Cross-sectional studies, RCTs, observational studies and qualitative studies. Studies had to be relevant to type 2 diabetes or patient and health care providers' barriers to diabetes management. **Exclusion criteria** Review articles and epidemiological studies were largely excluded, unless they were directly relevant to the themes that were part of this review.	80 Not stated Not given	Narrative synthesis No No Clinicians	Barriers
Addington D, 2010 Facilitators and barriers to implementing quality measurement in primary mental health care. Systematic review	To identify facilitators and barriers to implementing quality measurement in primary mental health care.	**Inclusion criteria** The study need to focus on primary care and refer to a quality improvement tool, or the process of implementing quality measurement, quality indicator, or quality improvement. **Exclusion criteria** None	57 (qualitative case studies, interviews, RCTs, focus groups, cross-sectional qualitative/ quantitative surveys, quasi-experimental studies, prospective cohorts, cluster analyses, controlled before and after trials, audits) Yes	No (content analysis; descriptive) No No GPs, nurses and administrative staff	Facilitators and barriers

			Yes		
Koch T, 2010 Rapid appraisal of barriers to the diagnosis and management of patients with dementia in primary care: a systematic review. Systematic review	To systematically investigate current evidence about the barriers to dementia diagnosis in primary care.	**Inclusion criteria** Studies related to barriers to the recognition of dementia. **Exclusion criteria** Studies about pharmacological interventions (for dementia or Alzheimer's disease), studies related to the validity or usefulness of specific cognitive function tests, studies not related to primary care setting, clinical discussion about dementia diagnoses or care, letters, publications in languages other than English.	11 (6 qualitative, 3 quantitative, 2 mixed methods) Yes Yes	Thematic analysis No No Primary care physicians	Facilitators and barriers
Zwar N, 2006 A systematic review of chronic disease management. Systematic review	To investigate the facilitators and barriers to effective interventions for chronic disease in primary health care (one of the three research questions)	**Inclusion criteria** Systematic reviews, RCTs, controlled clinical trials, controlled before-and-after studies and interrupted time series studies involving adults aged 18 years and over with one or more of the following chronic conditions: hypertension, coronary heart disease, type 2 diabetes, lipid disorders, asthma, chronic obstructive pulmonary disease, arthritis and osteoporosis.	141 studies and 23 systematic reviews Yes Yes	Narrative Yes (Joanna Brigg's institute and EPOC criteria) Yes Unclear	Facilitators and barriers

		Exclusion criteria Studies published before 1990, in a language other than English or pertaining only to a change in patient knowledge.			
Johnston G, 2000 Reviewing audit: barriers and facilitating factors for effective clinical audit. Literature review	To assess the main facilitators and barriers to conducting the audit process.	**Inclusion criteria** Papers which addressed empirical evidence from studies of clinicians' views, and also theoretical discussions were included in this study. **Exclusion criteria** -	93 (qualitative only) Yes Yes (flow chart not given)	Thematic analysis No No Professionals and managers	Facilitators and barriers
Renders CM, 2001 Interventions to improve the management of diabetes mellitus in primary care, outpatient and community settings (Cochrane review). Systematic review	To examine the effectiveness of different interventions, targeted at health professionals or the structure in which they deliver care. To determine which intervention strategy or parts of intervention strategies are the most effective and what do they have in common.	**Inclusion criteria** Population- health care professionals (including physicians, nurses, pharmacists) taking care of non-hospitalised patients with type I or II diabetes in primary care, outpatients and community settings. Type of interventions- organisational, professional and financial interventions; patient oriented interventions that included alongside professional and	41 (RCTs, controlled before and after studies, interrupted time series) Outcomes: Health professional performance, e.g. blood markers, making a follow up, referral, exam of the feet Patient outcomes, e.g. cardiovascular risk factors, hospital admissions,	Narrative Yes (EPOC checklist/ quality criteria) No Unclear (barriers not main objective)	Barriers only

		organisational interventions (all compared to usual care) **Exclusion criteria** Solely patient oriented interventions including patient education, mail order pharmacies, consumer participation in health care organisation	mortality, no. of complications Self-report subjective measures, e.g. patient/ provider satisfaction, quality of life) Yes Yes		
E-health technology					
Gagnon MP, 2014 Barriers and facilitators to implementing electronic prescribing: a systematic review of user groups' perceptions. Systematic review	To identify user groups' perceptions of barriers and facilitators to implementing electronic prescription (e-prescribing) in primary care.	**Inclusion criteria** Studies with an empirical design, either qualitative, quantitative, or mixed-methods. Studies should present a clearly stated data collection process as well as research methods and measurement tools used. Studies focused on the users' (physicians, clinical staff, nurses, pharmacists, pharmacy staff and others such as patients IT staff and managers) experience of e-prescribing implementation. Primary care, including ambulatory or community health care settings. Studies had to provide data on barriers and facilitators to e-	34 publications (28 individual studies) Surveys (42.9%; n=12) and qualitative methods (39.9%; n=11); mixed methods (17.9%; n=5). >1/3 of the studies (35.7%) included a theoretical framework 12 studies (42.9%) exclusively involved physicians, 2 studies targeted exclusively pharmacists, 6 studies included	Use of logical model of health care quality proposed by Donabedian, coupled to the themes proposed by Barber et al.) Yes. Mixed methods appraisal tool (MMAT) Yes. Data extraction developed used both inductive and deductive methods, following theoretical concepts like the technology acceptance model	Facilitators and barriers

		prescribing implementation in their results or discussion sections to be included. **Exclusion criteria** Editorials, comments, position papers, unstructured observations.	physicians and their staff, 3 studies involved pharmacists and their staff, 5 studies include more than one of these groups. Yes Yes	and the diffusion of innovations theory. Professionals and staff	
Hage, 2013 Implementation factors and their effect on e-health service adoption in rural communities: a systematic literature review. Systematic review	To contribute our understanding of the implementation factors that determine successful e-health adoption in rural communities.	**Inclusion criteria** Papers focused on rural context, implementation, e-health content, adoption outcomes. Empirical studies addressing implementation published in peer-reviewed journals. Papers were written in English.	51 (26 quantitative approach, 14 qualitative, 11 mixed approach) Yes Yes	See below. Yes (two checklists used) Use of a theoretical framework for analysis (context, process, content, adoption outcomes) Unclear	Facilitators and barriers
Lau F, 2012 Impact of electronic medical record on physician practice in office settings: a systematic review Systematic review	To examine the impact of electronic medical records (EMR) in the physician office, factors that influenced their success and the lessons learned.	**Inclusion criteria** Studies that were published in English, evaluated use of an EMR in an office-based setting, were based on original data, had physicians as primary end users, focused on clinical functions, reported impact on practice performance, patient	43 (27 controlled and 16 descriptive studies) Yes Yes	No (use of the Clinical Adoption Framework as a conceptual scheme) and vote counting method No	Factors

		outcomes, or physician-patient interactions **Exclusion criteria** Studies were excluded if their EMRs were part of the hospital information systems or were hospital ambulatory clinic settings or if there were only survey studies.		Yes Physicians	
Gagnon MP, 2012 Systematic review of factors influencing the adoption of information and communication technologies (ICT) by healthcare professionals. Systematic review	To review factors that are positively or negatively associated with ICT adoption by healthcare professionals in clinical settings.	**Inclusion criteria** Qualitative, quantitative, or mixed method methodology used to collect original data was described; the intervention for promoting the adoption or the use of a specific ICT in healthcare settings was described; the outcomes measured included barriers and/or facilitators to the adoption of a specific ICT application by healthcare professional, including professionals in training. Studies reported in French, English or Spanish.	101 (quantitative and qualitative) Yes Yes	Narrative synthesis using inductive and deductive methods Yes (Pluye mixed methods review scoring checklist) Yes Professionals (physicians and nurses)	Facilitators and barriers
Pereira JA, 2012 Barriers to the use of reminder/recall (RR) interventions for	To identify providers' perceived barriers to use of reminder/recall measures to address patient under-	**Inclusion criteria** Studies that examined the perceptions of healthcare providers regarding barriers toward implementing either provider-directed RR or	10 (perceptions of family physicians, nurse practitioners, paediatricians, and other immunisation staff) (5 surveys, 1	Thematic analysis Yes (CASP) all studies were moderate-high quality.	Barriers only

immunizations: a systematic review. Systematic review	immunisation and improve coverage.	patient-directed RR interventions for childhood and/or adult immunisations. Surveys, focus groups or interviews. English; contained original data, and described studies using quantitative and/or qualitative methodologies **Exclusion criteria** Reviews, editorials, commentaries, and practice guidelines, conference abstracts.	interview, 2 focus groups, 2 mixed methods) Yes Yes	No Professionals and staff (family physicians, nurses, administrators)	
Saliba V, 2012 Telemedicine across borders: a systematic review of factors that hinder or support implementation.	To systematically identify factors that hinder or support implementation of cross-border telemedicine services worldwide in the last two decades.	**Inclusion criteria** Studies which described the use of telemedicine to deliver cross-border healthcare and described the factors that hinder or support implementation of cross-border telemedicine services. All study designs.	94 (quantitative and qualitative) Yes Yes	Narrative synthesis (using adapted framework developed by a project for the economic and social research council methods programme) Yes Yes Unclear	Facilitators and barriers
Fontaine P, 2010	A systematic review of literature related to the adoption of	**Inclusion criteria** The content dealt with electronic HIE in the US; the	64 (quantitative and qualitative)	Themes emerged from the publications	Facilitators and barriers

Systematic review of health information exchange (HIE) in primary care practices. Systematic review	HIE by ambulatory and primary care practices, with an emphasis on benefits, barriers and the overall value to the practice.	HIE involved at least one stakeholder in an ambulatory office or primary care practice, or described benefits, barriers or concerns relevant to ambulatory practices.	Yes Yes	No No Primary care professionals	
Ludwick DA, 2009 Adopting electronic medical records in primary care: Lessons learned from health information systems implementation experience in seven countries. Systematic review	To identify the current state of knowledge about health information systems (HIS) adoption in primary care. To understand factors and influencers affecting implementation outcomes from previous HIS implementations experiences.	**Inclusion criteria** Peer-reviewed and grey literature published during the period 2000 to the end of 2007 from Canada, the United States, Denmark, Sweden, Australia, New Zealand and the United Kingdom; articles about implementation of health informatics systems **Exclusion criteria** None stated.	86 (study types unknown) Yes Yes	Narrative No Yes (socio-technical perspective) Users including physicians	Facilitators and barriers
Mollon B, 2009 Features predicting the success of computerised decision support system (CDSS) for prescribing: a systematic review of randomized controlled trials.	To determine which features of system design or implementation were associated with the success or failure of prescribing (Rx) CDSS implementation, change in provider	**Inclusion criteria** Reports of RCTs of prescribing CDSS published in English. They only considered systems which intervened before a drug therapy had been chosen by a physician or had the ability to suggest alternate therapies to be a RxCDSS.	41 (quantitative) Yes Yes	Narrative Yes (modified scale adapted from Garg et al) No Unclear	Facilitators only

Systematic review	behaviour, and change in patient outcomes.	Outcomes: implementation, change in provider behaviour, and change in patient outcomes. **Exclusion criteria** Systems whose sole purpose was to offer 'fine tuning' advice on a pre-defined therapy, usually dose modification were not included. Systems primarily focused on diagnosis, vaccination, or nutrition were also excluded.			
Waller R, 2009 Barriers to the uptake of computerised cognitive behavioural therapy (cCBT): a systematic review of the quantitative and qualitative evidence. Systematic review	To systematically examine the barriers to the uptake of cCBT from a wider range of source types that previous reviews, including the NICE guidelines.	**Inclusion criteria** Studies of a variety of research designs and from both primary and secondary care settings on cCBT, defined as interventions where the computer took a lead in decision making and was more than a medium. Data on acceptability, accessibility and adverse consequences were extracted. **Exclusion criteria** -	36 (quantitative and qualitative studies) Yes Yes	Narrative Yes (EPOC, criteria of Mays and Pope, criteria of Crombie) No Professionals and staff	Barriers only
Adaji A, 2008 The use of information technology (IT) to	To review the impact of IT on diabetes management in	**Inclusion criteria** Only original studies which evaluated the use of IT interventions (web based	29 (quantitative and qualitative) Yes	Unclear (narrative) No	Facilitators and barriers

enhance diabetes management in primary care: a literature review. Literature review	primary care and to identify the barriers and facilitators to using IT in this role.	programs, electronic medical records, messaging systems) for diabetes management in medical practice published after 1996 in English were reviewed. RCTs or observational (non RCTs, pre-post studies, post-intervention studies) or qualitative methods. **Exclusion criteria** Studies evaluating the use of IT for other chronic diseases, reviews papers which described other studies and commentary; studies evaluating the use of telemedicine (videoconferencing and telephone based consultations between patients and physicians)	Yes	No Professionals and staff

Fitzpatrick LAD, 2008 Understanding communication capacity – communication patterns and ICT usage in clinical settings. Literature review	To review the literature on inter-clinician communication problems, impacts on clinical workflows, ICT usage and barriers to communication and information systems.	**Inclusion criteria** Studies that discussed inter-clinician communication, patterns of ICT use, the effects of ICT use on workflow and/or the barriers to adopting ICTs in traditional healthcare settings. **Exclusion criteria** Studies that focused on clinician-patient communication.	98 (qualitative and quantitative studies) Yes (no descriptions of screening process) Yes	Narrative No No Unclear	Barriers only
Jarvis-Selinger S, 2008 Clinical telehealth across the disciplines: lessons learned. Literature review	Key lessons learned related to program (technology) adoption and organisational readiness.	**Inclusion criteria** None stated.	225 (quantitative and qualitative) Not clearly described Not given	Unclear No No Unclear	Facilitators and barriers
Jimison H, 2008 Barriers and drivers of health information technology use for the elderly, chronically ill, and underserved. Systematic review	To review the evidence on the barriers and drivers to the use of interactive consumer health information technology (IT) by specific populations, namely the elderly, those with chronic conditions or disabilities, and the underserved.	**Inclusion criteria** Studies of all designs that described the direct use of interactive consumer health IT (a consumer interacts directly with the technology, the computer processes the information in some way, a consumer receives or has access to patient-specific information in return) by at least one of the populations of interest.	52 on barriers; 60 on facilitators (qualitative and quantitative) Yes Yes	Analysis based on frameworks as recommended by Popay et al. Yes (quality rating criteria developed by the US Preventive Services Task Force and the Common Drug Review Process) No	Facilitators and barriers

		Outcomes: technology use, health related behaviours, health service utilisation, disease status, quality of life and functional outcomes.		Not specified	
Orwat C, 2008 Towards pervasive computing in health care – a literature review. Literature review	To provide an overview of recent developments and implementations of pervasive computing systems in health care	**Inclusion criteria** Prototypes, tests, pilot studies and case studies conducted in health care settings, or systems involving prospective end users, clinical trials as well as systems already in routine use. **Exclusion criteria** Experiments in non-medical settings as well as mere descriptions of concepts, designs or architectures.	69 (unclear study types) Yes Yes	Narrative (approach of Cruz-Correia et al was partly adopted) No No Not specified	Facilitators and barriers
Broens TH, 2007 Determinants of a successful telemedicine implementations: a literature study Literature review	To identify the determinants that influence the implementation of telemedicine applications.	**Inclusion criteria** Limited to studies published after the telemed 2004 conference held in London, which they consider to be representative of telemedicine initiatives in Europe. **Exclusion criteria** -	Unclear Yes Not described	Analysis based on the knowledge barriers categorisation of Tanriverdi and Iacono. No Yes (see above) Not specified	Facilitators and barriers
Yarbrough A, 2007	To look at the literature on	**Inclusion criteria**	18 (quantitative and qualitative)	Analysis based on the Technology	Facilitators and barriers

Technology acceptance among physicians: a new take on TAM. Systematic review	physician acceptance of information technology.	English and peer-reviewed publications only **Exclusion criteria** Not directly pertaining to physician IT, physician barriers to technology, the technology acceptance model. Non-physician-specific technology acceptance articles, physician-specific articles, especially the users targeted were not physicians, articles attempting to create typologies of physician users. Case studies of organisations that were purely descriptive in nature and limited to less than two sites were excluded, as were review articles that only summarised findings.	Yes Yes (flowchart not given)	acceptance model (TAM) No Yes Professionals and staff	
Yusof M, 2007 Health information systems adoption: findings from a systematic review. Systematic review	To identify the most important factors of health information system adoption.	**Inclusion criteria** Study design: case study Intervention: any computer based information systems that involves human interaction used in healthcare settings. **Exclusion criteria** Study design: experimental and survey	55 (quantitative and qualitative studies, e.g. documentations, questionnaire, interview, observations) (participants include managers, clerical staff, doctors and nurses) Unclearly described	Qualitative analysis using a theoretical framework (Human, Organisation and Technology-fit framework) Yes (qualitative research appraisal criteria); majority – sound quality	Facilitators and barriers

		All computers or knowledge based training and education systems for professionals (not directly related to clinical care)	Yes	Yes Users including physicians and staff	
Ohinmaa A, 2006 What lessons can be learned from telemedicine programmes in other countries? Literature review	To identify examples of successful telemedicine programmes.	**Inclusion criteria** Articles that showed a scientific basis for successful telemedicine. The review focused on applications benefiting significant segments of the health-care population, rather than those restricted to a targeted population or geographical area. **Exclusion criteria** Programmes from developing countries that were seen to be difficult to implement in the US health care system; articles discussing non-medical applications.	Unclear Unclearly described No	Unclear Unclear No Unclear	Facilitators and barriers
Leatt P, 2006 IT solutions for patient safety – best practices for successful implementation in healthcare. Narrative review	To review the literature on the facilitators and barriers to successful implementation of electronic medical records, electronic medication	**Inclusion criteria** Unclear.	Unclear No Not described	Analysis based on framework by Klein et al. (managerial support, financial resource availability, implementation climate and implementation	Facilitators and barriers

	administration records and computerized provider order entry.			policies and practices) No Yes Unclear	
Peleg M, 2006 Decision support, knowledge representation and management in medicine. Narrative review	To review the literature to find trends in CDSS that were developed over the last few decades and give some indication of future directions in developing successful, usable clinical decision support systems.	**Inclusion criteria** Papers that were published during the past 5 years with the words Decision support systems appearing in the title and used our own knowledge of the field for earlier work.	Unclear No Not described	Unclear No No Unclear	Facilitators only
Shekelle P, 2006 Costs and benefits of health information technology. Evidence report	To examine the barriers that health care providers and health care systems encounter that limit implementation of electronic health information systems.	**Inclusion criteria** Qualitative studies that were primarily focused on barriers and studies that collected quantitative data on barriers were included. **Exclusion criteria** Topic not about health information technology, outcomes not relevant. Studies in which barriers were briefly discussed but were not	20 (quantitative and qualitative studies) Yes Yes	Narrative No No Professionals and staff	Barriers only

		a primary focus were excluded.			
Garg AX, 2005 Effects of computerized clinical decision support systems on practitioner performance and patient outcomes. Systematic review	To review controlled trials assessing the effects of computerized clinical decision support systems (CDSSs) and to identify study characteristics predicting benefit.	**Inclusion criteria** Randomised and non-randomised controlled trials that evaluated the effect of a CDSS compared with care provided without a CDSS on practitioner performance or patient outcomes. **Exclusion criteria** -	100 trials Yes Yes	Narrative No (not on studies of barriers/ facilitators) No Unclear	Facilitators and barriers
Kawamoto K, 2005 Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. Systematic review	To identify features of clinical decision support systems critical for improving clinical practice.	**Inclusion criteria** Studies had to evaluate the ability of decision support systems to improve clinical practice. RCTs. **Exclusion criteria** Less than seven units of randomisation per study arm; study not in English; mandatory compliance with decision support system; lack of description of decision support content or of clinician interaction with system; and score of <5 points on a 10 point scale assessing five potential sources of study bias.	70 (quantitative only) Yes Yes	Descriptive and meta-regression (and frequency) analysis to identify independent predictors of success Yes No Unclear	Facilitators and barriers

Lu YC, 2005 A review and a framework of handheld computer adoption in healthcare.	To review the literature on issues related to adoption of Personal digital assistants (PDA) in health care and barriers to PDA adoption.	**Inclusion criteria** Articles addressing all health care professionals and their uses of PDAs and mobile computing devices were identified. **Exclusion criteria** -	Unclear Unclear Not described	Analysis based on the technology acceptance model No Yes Professionals and staff	Facilitators and barriers
Johnson K, 2001 Barriers that impede the adoption of paediatric information technology. Literature review	To review the literature to better elucidate barrier that are likely to affect the adoption of IT by paediatric professionals.	Not stated.	Unclear No No	Analysis based on framework (modified) No Yes (conceptual framework by Knapp: situational, cognitive, legal and attitudinal) Physicians	Barriers only
Preventative care and public health					
Zheng MY, 2014 Physician barriers to successful implementation of US preventive services task force routine HIV testing recommendations.	Focuses on physicians' barriers to HIV testing.	**Inclusion criteria** Literature related to HIV testing guidelines, physician adherence to HIV testing guidelines and physician barriers to HIV testing for adult primary care setting. Literature was also gathered from the HIV literature	Not stated. (quantitative and qualitative studies) Unclear Not described	No No (no discussion of quality of papers) (analysed using Cabana's model, knowledge,	Barriers only

Literature review		ListServ released by Dr Robert Malow, a well-known resource within the field of HIV/AIDS research. **Exclusion criteria** Articles related to HIV testing exclusively in prenatal, pediatric, and/or emergency settings. Non-US based studies since physicians in other countries may face different and unique barriers.		attitudes and behavioural skills) Physicians	
Child S, 2012 Factors influencing the implementation of fall prevention programmes: a systematic review and synthesis of qualitative studies Meta-ethnography	To identify key factors that act as barriers and facilitators to the effective implementation of evidence-based best practice in relation to the prevention of falls among community-dwelling older people.	**Inclusion criteria** Studies that examined influences on the implementation of fall prevention programmes among community-dwelling older adults and used recognised qualitative methods of data collection and analysis. **Exclusion criteria** Editorials, opinion papers, conference abstracts	19 qualitative studies (6 studies – perspective of health care professionals; 12 from the experiences of community-dwelling older adults; 1 study – perspectives from both patients and health care workers in a falls clinic) Yes Yes	Meta-ethnography No (quality of studies described) Unclear Yes (structured approach to describe quality by Wallace et al.)	Facilitators and barriers
Eisner D, 2011	To identify barriers and facilitators for physicians to	**Inclusion criteria** Articles that addressed screening and prevention	49 (45 descriptive studies; 4 RCTs) Areas covered: infectious	Narrative Yes (CONSORT) (low quality in general)	Facilitators and barriers

Screening and prevention in Swiss primary care: a systematic review Systematic review	participate in any preventive measures	activities in Swiss primary care. Studies which were conducted in settings in which a primary care provider played a key role were also included. **Exclusion criteria** No/implicit GP setting Main prevention aspects other than medical (e.g. economic)	disease, lifestyle changes, cardiovascular risk factors, cancer, HIV, osteoporosis, addiction and others Yes Yes	No GPs	
Johnson M, 2011 Barriers and facilitators to implementing screening and brief intervention for alcohol misuse: a systematic review of qualitative evidence. Systematic review	To synthesise qualitative evidence for barriers and facilitators to effective implementation of screening and brief intervention for alcohol misuse in adults and children over 10 years.	**Inclusion criteria** Studies that addressed screening and/or brief intervention with alcohol users over the age of 10 years. **Exclusion criteria** Studies that focused on educational interventions and school-based interventions due to their inclusion in recent UK guidance. Reports of interventions of >30min in duration, or that were carried out by specialists.	47 qualitative studies Yes Yes	Narrative summary Yes (source of quality checklist unknown) (very good or good quality largely) No Primary care teams (largely GPs and nurses)	Facilitators and barriers
Taylor CA, 2011 Enhancing delivery of health behaviour change interventions in primary care: a meta-synthesis of views and experiences	To systematically find an synthesise qualitative studies that elicited the views and experiences of nurses involved in the delivery of HBC	**Inclusion criteria** Studies using qualitative methods to elicit nurses' views and experiences of delivering HBC interventions, aiming to facilitate adoption of physical activity and/or healthy eating by adult patients (age 16-65y)	9 qualitative studies Yes Yes	Meta-synthesis Yes (CASP tool for qualitative research) (good quality in general) No	Facilitators and barriers

of primary care nurses. Meta-synthesis	interventions in primary care, with a focus on how this can enhance delivery and adherence of structured HBC interventions.	within primary care. Studies were included if they utilised qualitative methods for the collection and analysis of data. This included qualitative studies as components of wider trials. **Exclusion criteria** Not a qualitative study; intervention not delivered by nurses/does not state; not primary care		Primary care nurses	
Vedel I, 2011 Barriers and facilitators to breast and colorectal cancer screening of older adults in primary care: a systematic review Systematic review	To determine the barriers and facilitators to breast and colorectal cancer screening of older adults, from the perspectives of patients and primary care physicians.	**Inclusion criteria** Studies that used a quantitative design that reported barriers and/or facilitators to CRC and breast cancer screening for older adults; the participants included physicians working in primary care and/or older adults in primary care. **Exclusion criteria** Editorials, comments, letters, case reports, reviews, guidelines, consensus statements; studies of treatment approaches or case findings; studies assessing interventions or PCP's actual screening performance or	42 (quantitative and qualitative; questionnaires and 21 on PCP's point of view) Yes Yes	Narrative Yes (STROBE, MOOSE) No Primary care physicians	Facilitators and barriers

		patient-physician communication without information on the decision-making process.			
Stead M, 2009 Factors influencing European GPs' engagement in smoking cessation: a multi-country literature review. Literature review	To explore the extent of GPs' engagement in smoking cessation and the factors that influence their engagement.	**Inclusion criteria** Studies needed to report the extent to which GPs engage in smoking cessation activity or explore factors, of any sort, influencing this engagement. Studies that correlated the relationship between a particular factor and their provision of smoking cessation advice. Studies that explored GP's own perceptions of salient issues that constrained or facilitated their engagement. Qualitative and quantitative. **Exclusion criteria** Discussion and papers that did not report original research.	205 (100 academic and 105 grey), reporting on 188 different studies) Pre-specified categories of influencing factors: GP characteristics, patient characteristics, structural factors, and cessation-specific knowledge and skills. Yes Yes (flow chart not given)	Analysis based on pre-specified categories No No GPs	Facilitators and barriers
Berry JA, 2008 Make each patient count. Overcoming barriers to clinical preventive services. Literature review	To explore barriers to wider implementation of clinical preventive services.	**Inclusion criteria** English language studies from 1987.	Unclear Not described Not described	Descriptive/ narrative No No	Barriers only

				Professionals (physicians and nurse practitioners)	
Durlak JA, 2008 Implementation matters: a review of research on the influence of implementation on program outcomes and the factors affecting implementation. Literature review	To assess the impact of implementation on program outcomes and to identify factors affecting the implementation process.	**Inclusion criteria** The primary focus was on prevention and health promotion programs for children and adolescents related to the following topics: physical health and development, academic performance, drug use, and various social and mental health issues. Qualitative and quantitative studies and only English language articles were included. Studies with control groups and one group pre-post designs were included. Commentaries of several authors based on their extensive research or field experiences were included. **Exclusion criteria** None.	81 qualitative and quantitative studies [The review also assess impact of implementation on outcomes, e.g. high vs. low implementation, well vs. poorly implemented programs – not relevant to this review of review; not extracted] Not described Yes	Analysis based on Wandermann's framework No Yes (Wandersmann's "ecological framework for understanding effective implementation) Unclear	Factors
Hearn LA, 2006 Review of evidence to guide primary health care policy and	To identify key barriers to effective engagement of primary health care (PHC) providers and families in	**Inclusion criteria** RCTs, process, impact, parallel and intuitive evidence were included. Primary care providers included general practitioners,	45 (unclear study types) Yes Yes	Unclear Yes (all selected interventions were appraised and categorised as high,	Barriers only

practice to prevent childhood obesity. Literature review	promoting healthy weight among children aged 2-6 years, and to examine promising interventions to identify policy goals to over these barriers.	practice nurses, community/child/ maternal health nurses, allied health professional (e.g. dieticians, physiotherapists and exercise physiologists), multicultural and indigenous health workers, and health education/promotion specialists. Interventions aimed to reduce risk factors for obesity in children aged 2-6 years, focused on prevention and early intervention, were non-commercial, involved PHC providers as key facilitators of change, encouraged participation of family members, evaluated the intervention outcomes, process and/or acceptability. **Exclusion criteria** -		medium, or low standard using a scoring system with pre-set criteria (secondary appraisal to capture promising interventions), based on the method of Flynn et al.) Yes (various theories described) Primary health care providers	
Nilsen P, 2006 Effectiveness of strategies to implement brief alcohol intervention in primary healthcare.	To evaluate the effectiveness of promoting brief alcohol implementation by healthcare providers in primary health centres and	**Inclusion criteria** The study had to: be based on healthcare providers' practices within PHC settings; include training components for physicians and/or nurses to implement brief intervention; measure	11 (of which 5 are RCTs, 5 non randomised studies, 1 quasi-experimental study) Yes	Descriptive/ narrative No No Professionals	Barriers only [from discussion]

Systematic review	evaluates the results in relation to the implementation strategies employed.	the effectiveness of implementation in terms of material utilisation rate, screening rate, brief intervention rate; measure the effectiveness either before and after or only after the implementation, with or without a control group; be pragmatic (i.e. the procedures were integrated into the routine practice of the PHC office); be published in English, in a peer-reviewed scientific journal. **Exclusion criteria** Studies that involved staff training but relied on additional on-site personnel for administering the screening of patients were not deemed naturalistic enough to warrant inclusion in this systematic review.	Yes		
Integration of new role					
Sangster-Gormley E, 2011 Factors affecting Nurse practitioner role implementation in	To review the literature about the Canadian experience with nurse practitioner role implementation and	**Inclusion criteria** Published and unpublished Canadian NP implementation studies between 1997 and July 2010 were included.	10 published studies and two provincial papers (of which 5 papers are in primary care, and only these results are extracted)	Thematic analysis No No	Facilitators and barriers

Canadian practice settings: an integrative review. Integrated review	to identify influencing factors at the practice setting level.	Qualitative and quantitative studies of implementation or integration of the NP role in acute, primary health and long-term care settings. **Exclusion criteria** Early studies of NP role implementation prior to legislation and regulation of the role. Role development studies were excluded. Discussion papers, theoretical papers and studies of extended or expanded nursing roles were also excluded. **Definition** Role implementation refers to the process used to establish the NP role in a practice setting and is a component of role integration	(quantitative and qualitative) Yes Yes	Unclear	
DiCenso A, 2010 Factors enabling advanced practice nursing role integration in Canada. Scoping review	To develop a better understanding of advanced practice nursing role, their current use, and the individual, organisational and health system factors that influence their	**Inclusion criteria** Data from the literature were synthesised from 1990 onwards, to identify enablers to role development and implementation across the different types of advanced practice nurses: clinical nurse specialists, primary healthcare	468 (largely primary studies, essays, editorials) Yes (study screening/ selection) Yes (flow diagram)	Descriptive/ narrative No (scoping review) No Advanced practice nursing, e.g. nurse practitioners,	Facilitators and barriers

	effective integration in the Canadian healthcare system.	nurse practitioners and acute care nurse practitioners.		primary health care nurse practitioners, advanced practice nurse	
Clarin OA, 2007 Strategies to overcome barriers to effective nurse practitioner and physician collaboration. Systematic review	To review common barriers to effective NP and physician collaboration to identify the strategies to overcome these obstacles.	**Inclusion criteria** English articles published within the past 10 years; published worldwide; descriptive studies showing inter-professional relationships of NPs and physicians; stories of collaboration. Settings: acute care and primary practice **Exclusion criteria** Articles on nurses and physician collaboration and involving NP collaboration with other health care members aside from physicians.	12 (6 based in primary care setting) (unclear study types) No No	Unclear No No Physicians and nurse practitioners	Barriers only
Halcomb E, 2004 Australian nurses in general practice based heart failure management: implications for innovative collaborative practice.	To describe the current and potential role of the practice nurse in heart failure (HF) management.	**Inclusion criteria** Only articles which focused on the development of the practice nurse role and nursing interventions or the role of the practice nurse in the management of HF were included in the review. **Exclusion criteria**	12 (survey) No No	Descriptive/ narrative No (quality was discussed in the main text) No	Facilitators and barriers

Narrative review		Articles that examined the role of general practice in chronic disease management or the use of evidence-based guidelines in general practice.		GPs and nurse practitioners	
Prescribing behaviour					
Mason A, 2008 New medicines in primary care: a review of influences on general practitioner prescribing. Systematic review (updated review)	To explore the determinants of uptake, the causes of geographical variations and the influence of price, costs and financial incentives on prescribing behaviour.	**Inclusion criteria** Studies need to evaluate factors affecting the uptake of new medicines in primary care; quantitative and qualitative study designs were included. **Exclusion criteria** Not about new medicines, not about factors affecting prescribing, reviews, focused on secondary care, articles that were unobtainable.	28 (quantitative and qualitative) No Yes	Analysis based on Bonair and Persson's framework No Yes GPs	Facilitators and barriers
Others					
Davies SL, 2011 A systematic review of integrated working between care homes and health care services. Systematic review	To evaluate the different integrated approaches to health care services supporting older people in care homes, and identify barriers and facilitators to integrated working.	**Inclusion criteria** Interventions designed to develop, promote or facilitate integrated working between care home or nursing home staff and health care practitioners. Interventions that involved staff going in to provide education/training to care home/nursing home staff were included as long as there	17 (10 quantitative, 1 mixed methods, 2 process evaluations, 3 qualitative, 1 action research) Yes Yes	Framework analysis Yes (cochrane) No Unclear	Facilitators and barriers

		was some description of joint working or collaboration. For a study to be included there had to be evidence of at least one of the following: Clear evidence of joint working, joint goals or care planning, joint arrangements covering operational and strategic issues, shared or single management arrangements, joint commissioning at macro and micro levels Studies also had to report at least one of the outcomes pre-defined in the protocol **Exclusion criteria** Studies where staff were employed specifically for the purpose of the research without consideration of how the findings might be integrated into ongoing practice			
Xyrichis A, 2008 What fosters or prevents inter-professional teamworking in primary and	To explore the factors that inhibit or facilitate inter-professional teamworking in primary care and community care.	**Inclusion criteria** Papers from non-acute health-care areas such as primary care and community care, as well as from countries outside the UK.	10 (survey, qualitative studies) Yes Yes	Thematic analysis) Yes (unclear source; limitations were discussed, per study)	Facilitators and barriers

community care? A literature review. Literature review		**Exclusion criteria** Articles not relevant with the topic under investigation, not written in English, dated prior to 1994, non-research articles and papers that were not published in accessible journals		No Primary care staff	
Baker R, 2010 Tailored interventions to overcome identified barriers to change: effect on professional practice and health care outcomes. Cochrane review (update)	To assess the effectiveness of interventions tailored to address identified barriers to change on professional practice or patient outcomes.	**Inclusion criteria** RCTs that studied the effect of tailored interventions to address identified barriers (undertaken before the design and delivery of the intervention) to change on professional practice. Studies had to involve a comparison that did not receive a tailored intervention (no intervention/intervention that is not tailored to identified barriers, or intervention targeted at both individual and social/organisational barriers vs. intervention target at only individual barriers). Barriers may be identified by methods including observation, focus group discussions, interviews or surveys of the involved	26 (of which 15 trials were based in primary or community care, 7 in hospital/specialist care, 3 in both, 1 in nursing home) Yes Yes	Descriptive Criteria described by EPOC for RCTs and the EPOC data collection checklist Yes (a number of theories were described) Unclear	Barriers only

	healthcare professionals, and/or through analysis of the organisation/system in which care is provided.	

Appendix 4: Systematic review 1: Themes by interventions

	Primary themes	Secondary themes	Sources	Example quotations from included reviews[1]	Domain[2]					
					G	M	E	PU	I	PR
External Context										
	Policy	Presence and form of policy	(Novins et al., 2013; Ogundele, 2011; Lovell & Yates, 2014; Gagnon et al., 2014; Gagnon et al., 2012; Broens et al., 2007; Yarbrough & Smith, 2007; Lau et al., 2012; Fontaine et al., 2010; Child et al., 2012; Hoare et al., 2012; Sangster-Gormley et al., 2011; Dicenso et al., 2010)	B: A lack of a national mandate within countries to coordinate fall prevention interventions (Child et al., 2012) F: Legislative mandates are also potent motivators (Fontaine et al., 2010)	√	√	√	√	√	
		Presence of stated goals and objectives	(Johnston et al., 2000; Eisner et al., 2011; Leatt et al., 2006)	B: Lack of clear national objectives (Eisner et al., 2011) F: Convey a clear statement of the goals for and anticipated benefits of electronic medical records implementation (Leatt et al., 2006)		√	√	√		
		Fit with local or national agenda	(Durlak & DuPre, 2008; Dicenso et al., 2010; Addington et al., 2010)	B/F: Compatibility (contextual appropriateness, fit, congruence, match) – extent to which the intervention fits with an organisation's mission, priorities and values (Durlak & DuPre, 2008)		√		√	√	
		Presence of regulatory framework	(Hage et al., 2013; Hoare et al., 2012; Sangster-Gormley et al., 2011; Johnston et al., 2000; Lau et al., 2012; Fontaine et al., 2010; Jarvis-Selinger et al., 2008; Leatt et al., 2006; Garg et al., 2005; Halcomb et al., 2004)	B: Restrictive regulatory framework (Sangster-Gormley et al., 2011) F: Federal mandates and a common framework that provides standards and procedures that allow systems		√	√		√	

				to exchange information, regardless of whether both support highly coded data (Lau et al., 2012)						
		Presence of code of practice	(Johnston et al., 2000; Fontaine et al., 2010; Broens et al., 2007; Yarbrough & Smith, 2007; Johnson et al., 2011; Lau et al., 2012; Leatt et al., 2006; Halcomb et al., 2004)	F: New practice standards, guidelines and routines must be established for how work gets done (Leatt et al., 2006)		√	√	√	√	
	Infrastructure		(Parsons et al., 2003; Lovell & Yates, 2014; Johnston et al., 2000; Pereira et al., 2012; Hearn et al., 2006; Hoare et al., 2012; Halcomb et al., 2004; Novins et al., 2013; Gagnon et al., 2014; Lau et al., 2012; Mollon et al., 2009; Lu et al., 2005; Zwar et al., 2006a)	B: Inadequate employment contracts, practice facilities and functioning of the primary care team (Halcomb et al., 2004) F: Mechanism of support and infrastructure to support health care professionals (Halcomb et al., 2004)	√	√	√	√	√	
	Economic and financing		(Zwolsman et al., 2012; Johnston et al., 2000; Hoare et al., 2012; Sangster-Gormley et al., 2011; Dicenso et al., 2010; Lau et al., 2012)	B: Lack of investment by health authorities (Zwolsman et al., 2012)	√	√	√		√	
	Incentives	Financial awards	(Lovell & Yates, 2014; Davis & Taylor-Vaisey, 1997; Langberg et al., 2009; Zwolsman et al., 2012; Mickan et al., 2011; Kendall et al., 2009; Dulko, 2007; Cabana et al., 1999; Wensing et al., 1998; Zhang, A, & Neidlinger, 2012; Koch et al., 2010; Gagnon et al., 2014; Ludwick & Doucette, 2009; Jimison et al., 2008; Orwat et al., 2008; Yarbrough & Smith, 2007; Shekelle et al., 2006; Zheng, Suneja, Chou, & Arya, 2014; Child et al., 2012; Eisner et al., 2011; Vedel et al., 2011; Johnson et al., 2011; Stead et al., 2009; Berry et al., 2008; Hoare et al., 2012; Dicenso et al., 2010; Halcomb et al., 2004; Mason, 2008; Baker et al., 2010; Xyrichis & Lowton,	B: No financial gain in using evidence based medicine (Zwolsman et al., 2012) F: Other incentive schemes include quality and outcomes framework, which offers incentive payments linked to several prescribing targets; risk-sharing schemes (Mason, 2008)	√	√	√	√	√	√

			2008; Novins et al., 2013; Addington et al., 2010; Gagnon et al., 2012; Lau et al., 2012; Fontaine et al., 2010; Mollon et al., 2009; Peleg & Tu, 2006; Zwar et al., 2006a)							
		Non-financial awards	(Kendall et al., 2009; Hoare et al., 2012; Novins et al., 2013; Langberg et al., 2009; Davis & Taylor-Vaisey, 1997; Addington et al., 2010; Gagnon et al., 2014; Gagnon et al., 2012; Mollon et al., 2009; Ohinmaa, 2006; Taylor et al., 2011; Johnson et al., 2011)	B: Lack of incentives to change practice (Kendall et al., 2009) F: Access to training are important incentives for general practitioners (Johnson et al., 2011)	√	√	√	√	√	
	Dominant paradigm		(Ludwick & Doucette, 2009; Child et al., 2012; Mason, 2008; Baker et al., 2010; Novins et al., 2013; Addington et al., 2010; Hage et al., 2013; Sangster-Gormley et al., 2011)	B/F: NICE (The National Institute for Health and Care Excellence) and other guidelines (Mason, 2008)	√	√	√	√	√	√
	Public awareness		(Saliba et al., 2012; Dicenso et al., 2010; Johnston et al., 2000; Broens et al., 2007)	B: Inadequate public awareness of advanced practice nursing roles (Dicenso et al., 2010) F: Widespread dissemination is important to create awareness among stakeholders, either by impersonal channels or mass media, to motivate the introduction and usage of telemedicine (Broens et al., 2007)		√	√		√	
	Stakeholder buy-in		(Zhang et al., 2012; Hage et al., 2013; Gagnon et al., 2012; Yusof et al., 2007; Ohinmaa, 2006; Lu et al., 2005; Eisner et al., 2011; Hoare et al., 2012; Sangster-Gormley et al., 2011; Novins et al., 2013; Addington et al., 2010; Leatt et al., 2006; Taylor et al., 2011; Dicenso et al., 2010)	B: Conflict potential: Lack of consensus, decision power, and commitment among key stakeholders. It includes the inadequate distribution of decision making power (or ownership) among stakeholders (Hage et al., 2013)	√	√	√	√	√	

				F: Board members are aligned with implementation plan (Addington et al., 2010)						
	Technological advances		(Johnston et al., 2000; Garg et al., 2005)	B/F: Those responsible for Clinical Decision Support System implementation are typically administrators, information technology managers, and clinicians, all of whom are increasingly pushed by technology (Garg et al., 2005)		√	√			
Organisation	Culture	Organisational planning and readiness	(Novins et al., 2013; Mickan et al., 2011; Johnston et al., 2000; Gagnon et al., 2014; Hage et al., 2013; Lau et al., 2012; Saliba et al., 2012; Fontaine et al., 2010; Ludwick & Doucette, 2009; Jarvis-Selinger et al., 2008; Leatt et al., 2006; Taylor et al., 2011; Johnson et al., 2011; Durlak & DuPre, 2008; Sangster-Gormley et al., 2011; Xyrichis & Lowton, 2008; Zwolsman et al., 2012; McKenna et al., 2004; Wensing et al., 1998; Holm & Severinsson, 2012; Zhang et al., 2012; Fitzpatrick et al., 2008; Broens et al., 2007; Ohinmaa, 2006; Shekelle et al., 2006; Davies & Goodman, 2011; Dicenso et al., 2010)	B/F: Receptiveness of the whole organisation (Jarvis-Selinger et al., 2008)	√	√	√	√	√	
		Leadership	(Kendall et al., 2009; Johnston et al., 2000; Gagnon et al., 2014; Shekelle et al., 2006; Durlak & DuPre, 2008; Hoare et al., 2012; Dicenso et al., 2010; Xyrichis & Lowton, 2008; Novins et al., 2013; Ogundele, 2011; Holm & Severinsson, 2012; Zhang et al., 2012; Addington et al., 2010; Hage et al., 2013; Gagnon et al., 2012; Lau et al., 2012; Mollon et al., 2009; Jarvis-	B: Lack of organisational, nursing and physician leadership and support frequently reported as a barrier to role implementation for all types of advanced practice nurse roles (Dicenso et al., 2010)	√	√	√	√	√	

			Selinger et al., 2008; Broens et al., 2007; Leatt et al., 2006; Garg et al., 2005; Sangster-Gormley et al., 2011; Davies & Goodman, 2011)							
		Hierarchy structure	(Johnston et al., 2000; Yusof et al., 2007; Sangster-Gormley et al., 2011)	B/F: Hierarchical structure in the setting (Sangster-Gormley et al., 2011)		√	√		√	
	Processes and systems		(Zwolsman et al., 2012; Ogundele, 2011; Cabana et al., 1999; Gagnon et al., 2014; Gagnon et al., 2012; Pereira et al., 2012; Fontaine et al., 2010; Ludwick & Doucette, 2009; Fitzpatrick et al., 2008; Jimison et al., 2008; Broens et al., 2007; Yarbrough & Smith, 2007; Yusof et al., 2007; Shekelle et al., 2006; Garg et al., 2005; Kawamoto et al., 2005; Lu et al., 2005; Eisner et al., 2011; Durlak & DuPre, 2008; Holm & Severinsson, 2012; Lau et al., 2012; Saliba et al., 2012; Mollon et al., 2009; Adaji et al., 2008; Orwat et al., 2008; Peleg & Tu, 2006)	B: Even when the practitioners have access, guidelines are often insufficiently integrated into current behavioural, organisational and communication routines (Ogundele, 2011) F: Process - Work process was the most important factor of this theme (24 elements). When e-prescribing was integrated, work process was facilitated and work flow was improved (Gagnon et al., 2014)	√	√	√	√		
	Relationships	Inter-professional	(Parsons et al., 2003; Addington et al., 2010; Johnston et al., 2000; Gagnon et al., 2014; Gagnon et al., 2012; Pereira et al., 2012; Saliba et al., 2012; Durlak & DuPre, 2008; Hoare et al., 2012; Clarin, 2007; Halcomb et al., 2004; Mason, 2008; Xyrichis & Lowton, 2008; Novins et al., 2013; Mickan et al., 2011; Holm & Severinsson, 2012; Leatt et al., 2006; Taylor et al., 2011; Sangster-Gormley et al., 2011; Dicenso et al., 2010)	B/F: The organisational aspect of professional interaction, including team spirit, relation between different health professionals (Gagnon et al., 2014)	√	√	√	√	√	√
		Professional and patients	(Parsons et al., 2003; Nam et al., 2011; Gagnon et al., 2012; Pereira et al., 2012; Lau et al., 2012; Leatt et al., 2006; Johnson et al., 2011)	B/F: Interaction: patient-physician encounters (Lau et al., 2012)	√	√	√	√		
	Resources		(Davies & Goodman, 2011; Zwolsman et al., 2012; Mickan et al., 2011;	B: The lack of resources such as time, money and personnel	√	√	√	√	√	√

			Ogundele, 2011; Lineker & Husted, 2010; Kendall et al., 2009; Langberg et al., 2009; Dulko, 2007; McKenna et al., 2004; Parsons et al., 2003; Cabana et al., 1999; Lovell & Yates, 2014; Holm & Severinsson, 2012; Sales et al., 2012; Zhang et al., 2012; Addington et al., 2010; Berry et al., 2008; Koch et al., 2010; Renders et al., 2001; Johnston et al., 2000; Hage et al., 2013; Gagnon et al., 2012; Pereira et al., 2012; Fontaine et al., 2010; Ludwick & Doucette, 2009; Waller & Gilbody, 2009; Adaji et al., 2008; Gagnon et al., 2014; Fitzpatrick et al., 2008; Jarvis-Selinger et al., 2008; Jimison et al., 2008; Orwat et al., 2008; Broens et al., 2007; Yarbrough & Smith, 2007; Leatt et al., 2006; Ohinmaa, 2006; Shekelle et al., 2006; Garg et al., 2005; Johnson, 2001; Zheng et al., 2014; Child et al., 2012; Eisner et al., 2011; Taylor et al., 2011; Vedel et al., 2011; Stead et al., 2009; Durlak & DuPre, 2008; Hearn et al., 2006; Nilsen et al., 2006; Hoare et al., 2012; Zwar et al., 2006a; Sangster-Gormley et al., 2011; Dicenso et al., 2010; Halcomb et al., 2004; Mason, 2008; Baker et al., 2010)	constitutes a significant barrier (Holm & Severinsson, 2012) F: Administrative support, adequate resources and manpower, dedicated or protected time (Johnston et al., 2000)						
	Skill mix	Clarity about responsibility/role	(Holm & Severinsson, 2012; Addington et al., 2010; Johnston et al., 2000; Gagnon et al., 2014; Pereira et al., 2012; Yusof et al., 2007; Johnson et al., 2011; Durlak & DuPre, 2008; Sangster-Gormley et al., 2011; Dicenso et al., 2010; Halcomb et al., 2004; Xyrichis & Lowton, 2008; Lau et al., 2012)	B: Lack of clarity pertaining to the responsibility inherent in the role of care manager (often a nurse) when it comes to promoting the patient's self-management ability (Holm & Severinsson, 2012) F: Procedures that contain clear roles and responsibilities relative to task		√	√	√		

				accomplishments (Durlak & DuPre, 2008)						
		Division of labour	(Koch et al., 2010; Johnston et al., 2000; Fontaine et al., 2010; Jarvis-Selinger et al., 2008; Broens et al., 2007; Yusof et al., 2007; Johnson et al., 2011; Xyrichis & Lowton, 2008; Holm & Severinsson, 2012; Zhang et al., 2012; Hage et al., 2013; Lau et al., 2012; Ludwick & Doucette, 2009; Leatt et al., 2006; Taylor et al., 2011; Dicenso et al., 2010)	B: Lack of organisation and skill mix among support staff (Johnston et al., 2000) F: Different skill mix (interdisciplinary approach) (Ludwick & Doucette, 2009)		√	√	√	√	
	Involvement	Support from team members and management	(Zwolsman et al., 2012; Cabana et al., 1999; Zhang et al., 2012; Johnston et al., 2000; Gagnon et al., 2014; Saliba et al., 2012; Jimison et al., 2008; Johnson et al., 2011; Durlak & DuPre, 2008; Sangster-Gormley et al., 2011; Dicenso et al., 2010; Xyrichis & Lowton, 2008; Gagnon et al., 2012; Lau et al., 2012; Leatt et al., 2006; Taylor et al., 2011; Davies & Goodman, 2011)	B: Lack of managerial support (Johnson et al., 2011) F: Organisational support and management (Gagnon et al., 2012)	√	√	√	√	√	
		Collaborative working	(Zhang et al., 2012; Addington et al., 2010; Johnston et al., 2000; Gagnon et al., 2014; Pereira et al., 2012; Durlak & DuPre, 2008; Hearn et al., 2006; Novins et al., 2013; Holm & Severinsson, 2012; Nam et al., 2011; Hage et al., 2013; Broens et al., 2007; Leatt et al., 2006; Sangster-Gormley et al., 2011; Dicenso et al., 2010; Davies & Goodman, 2011)	B: Lack of team approach to change (Addington et al., 2010) F: Collaborative process is characterised by non-hierarchical relationships among participants, mutual trust and open communication, shared responsibilities for competing important tasks and efforts to reach consensus when disagreements arise (Durlak & DuPre, 2008)	√	√	√	√	√	
		Shared vision	(Johnston et al., 2000; Pereira et al., 2012; Taylor et al., 2011; Durlak & DuPre, 2008; Sangster-Gormley et al., 2011; Holm & Severinsson, 2012;	B/F: Shared vision (shared mission, consensus, commitment, staff buy-in) – extent to which organisational		√	√	√	√	

			Addington et al., 2010; Ludwick & Doucette, 2009; Leatt et al., 2006; Dicenso et al., 2010; Xyrichis & Lowton, 2008)	members are united regarding the value and purpose of the innovation (Durlak & DuPre, 2008)						
Professional	Role	Professionalism	(Zwolsman et al., 2012; Dulko, 2007; Cabana et al., 1999; Lovell & Yates, 2014; Addington et al., 2010; Johnston et al., 2000; Gagnon et al., 2012; Garg et al., 2005; Pereira et al., 2012; Hoare et al., 2012; Sangster-Gormley et al., 2011; Dicenso et al., 2010; Xyrichis & Lowton, 2008; Davis & Taylor-Vaisey, 1997; Gagnon et al., 2014; Halcomb et al., 2004)	B: Fear of loss of autonomy (Dulko, 2007) F: General practitioners provided practice nurses with considerable autonomy in managing clients with chronic conditions with defined practice guidelines and protocols (Halcomb et al., 2004)	√	√	√	√	√	
		Sense of self-efficacy	(Kendall et al., 2009; McKenna et al., 2004; Cabana et al., 1999; Lovell & Yates, 2014; Zhang et al., 2012; Addington et al., 2010; Nam et al., 2011; Koch et al., 2010; Gagnon et al., 2014; Zheng et al., 2014; Johnson et al., 2011; Durlak & DuPre, 2008; Mason, 2008; Baker et al., 2010; Novins et al., 2013; Davies & Goodman, 2011)	B/F: Sense of self-efficacy (Novins et al., 2013)	√	√	√	√		√
		Peer influences	(Zwolsman et al., 2012; McKenna et al., 2004; Gagnon et al., 2012; Gagnon et al., 2014)	B/F: The opinion/ attitudes of colleagues about evidence-based medicine (Zwolsman et al., 2012)	√		√			
		Authority /influence	(McKenna et al., 2004; Lovell & Yates, 2014; Zhang et al., 2012; Johnston et al., 2000; Mason, 2008)	B: “Not having enough authority to change patient care procedures” (nurses) (McKenna et al., 2004)	√	√				√
	Underlying philosophy of care	Personal style	(Nam et al., 2011; Koch et al., 2010; Saliba et al., 2012; Shekelle et al., 2006; Lu et al., 2005; Johnson, 2001; Zheng et al., 2014; Pereira et al., 2012; Johnson et al., 2011; Sangster-Gormley et al., 2011)	B/F: Physician personality and philosophy (Sangster-Gormley et al., 2011)		√	√	√	√	

		Relationship between professional and patient	(Mickan et al., 2011; Cabana et al., 1999; Nam et al., 2011; Koch et al., 2010; Berry et al., 2008; Gagnon et al., 2014; Ludwick & Doucette, 2009; Lu et al., 2005; Zheng et al., 2014; Taylor et al., 2011; Stead et al., 2009; Mason, 2008)	B/F: Perception of inconsistency of recommendations with patient values and preferences (Mickan et al., 2011)	√	√	√	√		√
	Attitudes to change	Attitudes and beliefs (general)	(Zwolsman et al., 2012; Mickan et al., 2011; Ogundele, 2011; Lineker & Husted, 2010; Kendall et al., 2009; Dulko, 2007; McKenna et al., 2004; Parsons et al., 2003; Cabana et al., 1999; Wensing et al., 1998; Lovell & Yates, 2014; Sales et al., 2012; Addington et al., 2010; Nam et al., 2011; Koch et al., 2010; Renders et al., 2001; Berry et al., 2008; Johnston et al., 2000; Gagnon et al., 2014; Saliba et al., 2012; Ludwick & Doucette, 2009; Waller & Gilbody, 2009; Adaji et al., 2008; Fitzpatrick et al., 2008; Jimison et al., 2008; Yarbrough & Smith, 2007; Yusof et al., 2007; Leatt et al., 2006; Ohinmaa, 2006; Shekelle et al., 2006; Garg et al., 2005; Johnson, 2001; Zheng et al., 2014; Pereira et al., 2012; Eisner et al., 2011; Vedel et al., 2011; Johnson et al., 2011; Stead et al., 2009; Durlak & DuPre, 2008; Hearn et al., 2006; Nilsen et al., 2006; Clarin, 2007; Mason, 2008; Baker et al., 2010; Novins et al., 2013; Davis & Taylor-Vaisey, 1997; Holm & Severinsson, 2012; Lau et al., 2012; Broens et al., 2007; Gagnon et al., 2012; Taylor et al., 2011; Halcomb et al., 2004; Davies & Goodman, 2011)	B: Staff attitudes to advanced care planning have adversely affected uptake (Lovell & Yates, 2014) F: Agreement with the particular information and communication technologies (general attitude) (Gagnon et al., 2012)	√	√	√	√	√	√
		Motivation and priority	(Kendall et al., 2009; Langberg et al., 2009; Cabana et al., 1999; Berry et al., 2008; Johnston et al., 2000; Gagnon et	B: Physicians may not have the motivation to change. Results suggest that close to	√	√	√	√		

			al., 2012; Lu et al., 2005; Zheng et al., 2014; Eisner et al., 2011; Vedel et al., 2011; Johnson et al., 2011; Hearn et al., 2006; Nilsen et al., 2006; Baker et al., 2010)	half of physicians surveyed were in a pre-contemplation stage and not ready to change behaviour (Cabana et al., 1999)						
		Prior experience	(Zwolsman et al., 2012; Ludwick & Doucette, 2009; Zheng et al., 2014; Novins et al., 2013; Johnston et al., 2000; Broens et al., 2007; Johnson et al., 2011; Sangster-Gormley et al., 2011)	B/F: Users' previous experiences with health information system affected their experience with a new system both positively and negatively (Ludwick & Doucette, 2009)	√	√	√	√	√	
		Workload/competing demands	(Zwolsman et al., 2012; Holm & Severinsson, 2012; Addington et al., 2010; Nam et al., 2011; Johnston et al., 2000; Gagnon et al., 2012; Saliba et al., 2012; Ludwick & Doucette, 2009; Adaji et al., 2008; Orwat et al., 2008; Yusof et al., 2007; Pereira et al., 2012; Johnson et al., 2011; Sangster-Gormley et al., 2011; Dicenso et al., 2010; Mollon et al., 2009)	B: As the professionals seemed overburdened with papers and administrative tasks, they had difficulty allocating time to help people with depression (Holm & Severinsson, 2012)	√	√	√	√	√	
		Perception of time	(Novins et al., 2013; Addington et al., 2010; Gagnon et al., 2014; Mollon et al., 2009; Zwolsman et al., 2012; Mickan et al., 2011; McKenna et al., 2004; Parsons et al., 2003; Cabana et al., 1999; Wensing et al., 1998; Lovell & Yates, 2014; Holm & Severinsson, 2012; Koch et al., 2010; Berry et al., 2008; Gagnon et al., 2012; Ludwick & Doucette, 2009; Adaji et al., 2008; Fitzpatrick et al., 2008; Jimison et al., 2008; Yarbrough & Smith, 2007; Yusof et al., 2007; Zheng et al., 2014; Child et al., 2012; Vedel et al., 2011; Johnson et al., 2011; Nilsen et al., 2006)	B: "Having insufficient time on the job to implement new ideas" (nurses) (McKenna et al., 2004) F: Saves clinicians time or requires minimal time to use (Mollon et al., 2009)	√	√	√	√		

	Competencies		(Zwolsman et al., 2012; Mickan et al., 2011; Lineker & Husted, 2010; Kendall et al., 2009; Dulko, 2007; McKenna et al., 2004; Parsons et al., 2003; Cabana et al., 1999; Lovell & Yates, 2014; Addington et al., 2010; Nam et al., 2011; Koch et al., 2010; Renders et al., 2001; Johnston et al., 2000; Gagnon et al., 2012; Fontaine et al., 2010; Waller & Gilbody, 2009; Adaji et al., 2008; Fitzpatrick et al., 2008; Jimison et al., 2008; Broens et al., 2007; Yarbrough & Smith, 2007; Shekelle et al., 2006; Lu et al., 2005; Johnson, 2001; Zheng et al., 2014; Pereira et al., 2012; Eisner et al., 2011; Taylor et al., 2011; Vedel et al., 2011; Johnson et al., 2011; Stead et al., 2009; Durlak & DuPre, 2008; Berry et al., 2008; Hearn et al., 2006; Nilsen et al., 2006; Clarin, 2007; Halcomb et al., 2004; Mason, 2008; Novins et al., 2013; Gagnon et al., 2014; Saliba et al., 2012; Lau et al., 2012; Ludwick & Doucette, 2009; Jarvis-Selinger et al., 2008; Orwat et al., 2008; Leatt et al., 2006; Child et al., 2012; Sangster-Gormley et al., 2011; Davies & Goodman, 2011)(Dicenso et al., 2010)	B: Non-existent or inadequate training (Gagnon et al., 2012) F: Electronic medical record (EMR) implementation was found to be most effective when training for EMR system users was adequate, timely, tailored to meet the specific needs and experience of the users and available on an ongoing, as-needed basis (Leatt et al., 2006)	√	√	√	√	√	√
Intervention	Nature and characteristics	Complexity	(Mickan et al., 2011; Dulko, 2007; Cabana et al., 1999; Grilli & Lomas, 1994; Addington et al., 2010; Renders et al., 2001; Johnston et al., 2000; Pereira et al., 2012; Vedel et al., 2011; Kendall et al., 2009; Davis & Taylor-Vaisey, 1997; Peleg & Tu, 2006)	B: Confusing and complex recommendations (Mickan et al., 2011) F: Not overly complex (Kendall et al., 2009)	√	√	√	√		
		Evidence of benefit	(Mickan et al., 2011; Kendall et al., 2009; McKenna et al., 2004; Parsons et al., 2003; Cabana et al., 1999; Zhang et al., 2012; Berry et al., 2008; Johnston et	B: Lack of evidence regarding benefits of Information Technology (Yarbrough & Smith, 2007)	√	√	√	√	√	√

			al., 2000; Gagnon et al., 2012; Yarbrough & Smith, 2007; Lu et al., 2005; Johnson, 2001; Zheng et al., 2014; Halcomb et al., 2004; Mason, 2008; Baker et al., 2010; Davis & Taylor-Vaisey, 1997; Addington et al., 2010; Lau et al., 2012; Saliba et al., 2012; Mollon et al., 2009; Jarvis-Selinger et al., 2008; Broens et al., 2007; Vedel et al., 2011; Dicenso et al., 2010; Fontaine et al., 2010)	F: Improved quality of care, e.g. better health outcomes, reduce medical errors (Fontaine et al., 2010)						
		Applicability and relevance	(Zwolsman et al., 2012; Kendall et al., 2009; McKenna et al., 2004; Cabana et al., 1999; Grilli & Lomas, 1994; Johnston et al., 2000; Gagnon et al., 2014; Gagnon et al., 2012; Yusof et al., 2007; Shekelle et al., 2006; Broens et al., 2007; Hearn et al., 2006; Dicenso et al., 2010; Dulko, 2007; Addington et al., 2010; Hage et al., 2013; Saliba et al., 2012; Peleg & Tu, 2006)	B: Evidence has a limited scope/focus or limited to particular populations (Kendall et al., 2009)	√	√	√	√	√	
		Clarity	(Lovell & Yates, 2014)(4;9;18;19;26;43;53;60)(Dulko, 2007)	B: Uncertainty about when to initiate advanced care planning discussions – timing (Lovell & Yates, 2014) F: Good clarity (Dulko, 2007)	√	√	√		√	
		Costs	(Addington et al., 2010; Orwat et al., 2008; Hage et al., 2013)	B: Generating indicators is costly (Addington et al., 2010)		√	√			
		Cost-effectiveness	(Fontaine et al., 2010; Shekelle et al., 2006; Garg et al., 2005; Eisner et al., 2011; Mason, 2008; Johnston et al., 2000; Lau et al., 2012; Broens et al., 2007; Lu et al., 2005)	B: Cost-effectiveness relation perceived as unfavourable (Eisner et al., 2011) F: Improved cost-effectiveness and efficiency (Johnston et al., 2000)		√	√	√		√
		Practicality and utility	(Zwolsman et al., 2012; Mickan et al., 2011; Ogundele, 2011; Kendall et al., 2009; Cabana et al., 1999; Davis & Taylor-Vaisey, 1997; Lovell & Yates, 2014; Renders et al., 2001; Johnston et	B/F: Ease of use of the system (Kendall et al., 2009)	√	√	√	√		

			al., 2000; Gagnon et al., 2014; Hage et al., 2013; Gagnon et al., 2012; Lau et al., 2012; Pereira et al., 2012; Ludwick & Doucette, 2009; Fitzpatrick et al., 2008; Jarvis-Selinger et al., 2008; Orwat et al., 2008; Broens et al., 2007; Yusof et al., 2007; Leatt et al., 2006; Shekelle et al., 2006; Garg et al., 2005; Kawamoto et al., 2005; Lu et al., 2005; Eisner et al., 2011; Hearn et al., 2006; Novins et al., 2013; Dulko, 2007; Addington et al., 2010; Mollon et al., 2009; Jimison et al., 2008; Peleg & Tu, 2006; Vedel et al., 2011)							
		Adaptability	(Broens et al., 2007; Durlak & DuPre, 2008; Novins et al., 2013; Hage et al., 2013; Ludwick & Doucette, 2009)	B/F: Adaptability of interventions to local circumstances (program modification, reinvention, flexibility), extent to which the proposed program can be modified to fit provider preferences, organisational practices, and community needs, values, and cultural norms (Durlak & DuPre, 2008)	√		√			
		IT compatibility	(Kendall et al., 2009; Addington et al., 2010; Johnston et al., 2000; Gagnon et al., 2012; Gagnon et al., 2014; Jarvis-Selinger et al., 2008; Shekelle et al., 2006; Kawamoto et al., 2005; Lu et al., 2005; Holm & Severinsson, 2012)	B: Interoperability - Inadequate interfacing with other IT systems (Gagnon et al., 2014) F: IT is current or resources available for upgrading (Addington et al., 2010)	√	√	√			
	Implementability	Complexity of implementation	(Kendall et al., 2009; Eisner et al., 2011; Gagnon et al., 2012)	B: Too complex project organisation (Eisner et al., 2011) F: Do not require a great deal of time or effort to implement (Kendall et al., 2009)	√		√	√		
		Benefit/harm of implementation	(Yarbrough & Smith, 2007; Leatt et al., 2006; Johnson, 2001; Gagnon et al.,	B: Implementation results in lower provider productivity and			√			

			2014; Lau et al., 2012; Fontaine et al., 2010; Jarvis-Selinger et al., 2008)	inconsistent error reduction (Yarbrough & Smith, 2007) F: More efficient workflow, e.g. less time spent handling lab results, improved access to clinical data, streamlined referral processes, reduced staff time (Fontaine et al., 2010)						
		Resources requirements	(Kendall et al., 2009; Ludwick & Doucette, 2009; Broens et al., 2007; Yarbrough & Smith, 2007; Lu et al., 2005; Novins et al., 2013; Holm & Severinsson, 2012; Jarvis-Selinger et al., 2008)	B: Too costly to implement (Kendall et al., 2009)	√	√	√			
	Safety and data privacy		(Mickan et al., 2011; Cabana et al., 1999; Lovell & Yates, 2014; Johnston et al., 2000; Gagnon et al., 2014; Jimison et al., 2008; Orwat et al., 2008; Broens et al., 2007; Vedel et al., 2011; Mason, 2008; Zheng et al., 2014; Johnson, 2001; Lu et al., 2005; Shekelle et al., 2006; Leatt et al., 2006; Yarbrough & Smith, 2007; Jarvis-Selinger et al., 2008; Fitzpatrick et al., 2008; Waller & Gilbody, 2009; Ludwick & Doucette, 2009; Fontaine et al., 2010; Pereira et al., 2012; Saliba et al., 2012; Gagnon et al., 2012; Dicenso et al., 2010)	B: Concerns over data protection and security (Waller & Gilbody, 2009) F: Benefit of anonymity for sensitive health topics (Jimison et al., 2008)	√	√	√	√	√	√

Appendix 5: Systematic review 2: Classification of the EPOC taxonomy

EPOC intervention category	Strategy	Definition
Professional	Audit and feedback	Summary of clinical performance of health care over a specified period of time. The summary may also include some recommended actions
	Educational meetings	Conferences, workshop sessions, lectures
	Educational outreach visits	Use of a trained individual to visit the providers in their practice settings to provide information or recommendations with the intent of changing practice.
	Local opinion leaders	Use of educationally influential individuals nominated by peers
	Passive printed educational materials	Distribution of printed guideline materials, or publications
	Reminders (computerised and non-computerised)	Reminders provided verbally, on paper or on a computer screen, targeted at health care professionals and/or staff.
Organisation	Revision of professional roles	Change in roles among health professionals, e.g. nurse-led telephone counselling that was formerly provided by doctors
	Multidisciplinary teams	Collaborative working between health professionals of different disciplines
	Skill mix changes	Changes in numbers or types of staff
	Continuity of care	Includes more than one episodes of care for in- or out-patient (e.g. follow up arrangement, case management)
	Formal integration of services	Bringing all services together at one time
	Structural interventions	E.g. changes to the site of service delivery, changes in infrastructure (e.g. facilities, equipment, staff organisational structure)
Financial	Targeted financial incentives for health professionals and healthcare organisations, e.g. pay for performance or target payment, fee for service	Pay for performance – incentives/ reimbursements based on how well the individuals or organisation perform (i.e. achieving a measurable action or achieving a predetermined target) Fee for service – fixed fee for each service
Regulatory	Interventions that aim to change health services delivery or costs by	

	regulation or law, e.g. changes in medical liability	
The following interventions are excluded: • Patient-oriented interventions, e.g. patient incentives • Reminders targeted at patients • Mass media • Clinical decision support systems		

Appendix 6: Systematic review 2: An example of how benchmark review was compared with the non-benchmark reviews

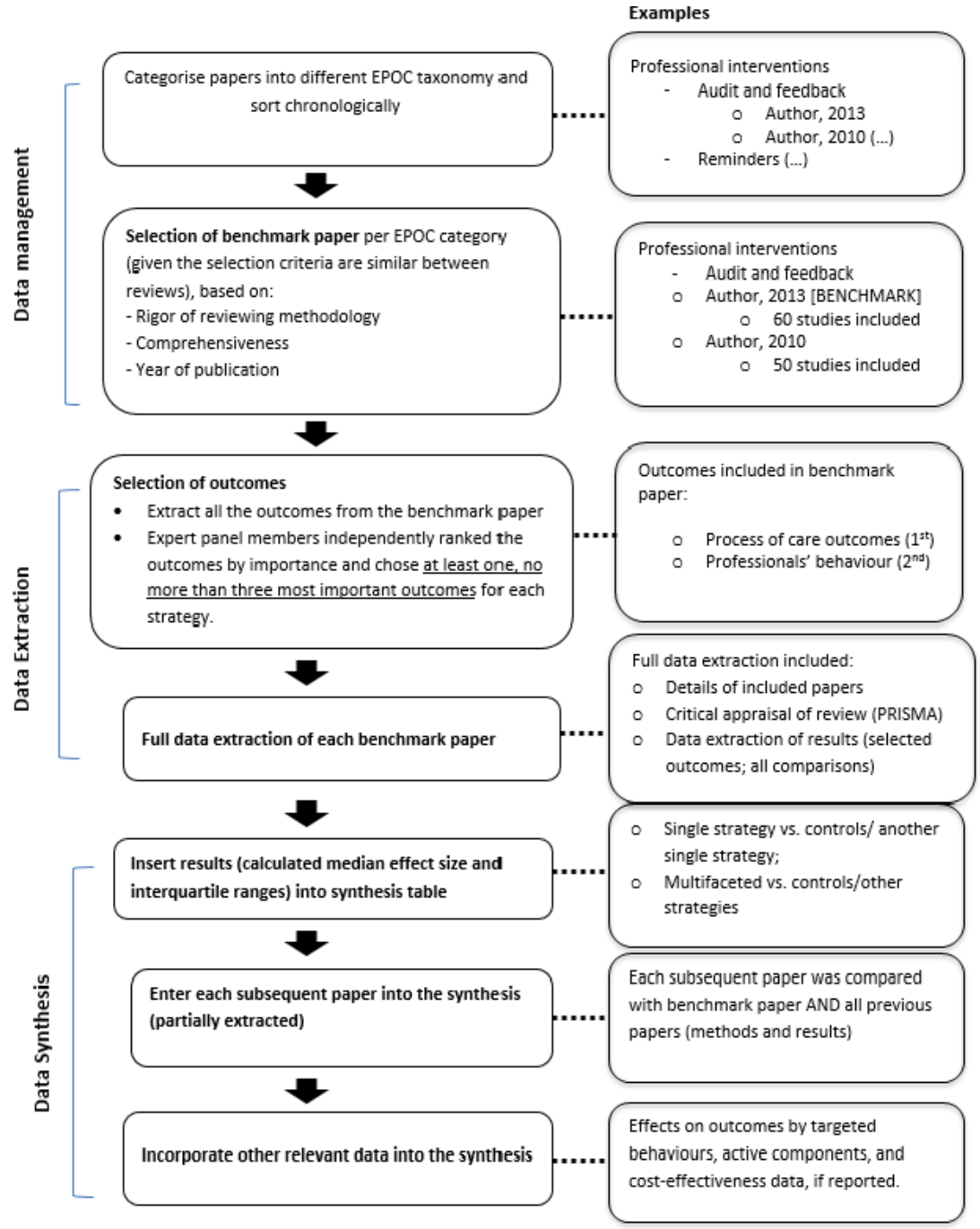
Educational meeting					
Benchmark review: Forsetlund L, 2009	Continuing medical education (CME) meetings and workshops	Mixed health care settings (largely general practice)	General management of various health conditions, prescribing, preventive care, screening behaviour)	Largely physicians	Overall: **small to moderate** improvements in professional practice (compliance with desired practice) Educational meetings alone vs. no intervention: • Dichotomous: adjusted RD in compliance with desired practice, ranged from -2 to 29.3% (median improvement of **6%**) [24 trials]. • Continuous: adjusted relative % change range from 0-50%, with a median of **10%**. Multifaceted intervention with educational meetings as a component vs. no intervention: • Dichotomous: adjusted RD in compliance with desired practice, ranged from -2 to 36.2% (median improvement of **6%**) [30 trials]. *Comment(s): studies often did not provide adequate descriptions of the interventions, making it difficult to classify them. Review only included studies with low/moderate risk of bias.* Authors' conclusion: The effect of educational meeting alone or combined with other interventions is likely to be similar to be small and similar to other types of CME, e.g. A&F, educational outreach. Strategies to increase attendance at educational meetings, using combined interactive and didactic formats, and focusing on serious outcomes may increase the effectiveness of educational meetings.

					The more complex the behaviour the smaller the effect would be for educational meetings.
Subsequent reviews: Thomas 2006	CME	Primary care	Improving care of older patients (e.g. management of osteoporosis, breast examination, dementia)	Primary care physicians	Deviations from the benchmark review in terms of: • PICO/inclusion and exclusion criteria: population: older patients. • Results and conclusion: Educational interventions most likely to result in physician behaviour involve multiple educational efforts, written materials or toolkits combined with feedback, individual educational visits, or small group training and strong communication channels between instructors and learners [13 studies]. *Comment(s): narrative synthesis; quality appraisal of studies X; target pop: geriatrics*
Cauffman JG, 2002	CME	Primary care	Any	Family physicians/ general practitioners	Deviations from benchmark review in terms of : • PICO/inclusion and exclusion criteria: no quality filter. • Results and conclusion: The most effective educational strategies used multiple interventions, two-way communications, printed and graphic materials in person, and locally respected health personnel as educators. Statistically significant findings more often related to physician performance than to patient health outcomes. *Comment(s): narrative synthesis; quality appraisal X; total N=20 RCTs*
Davies 1999	Formal didactic and/or	Primary/ community care	Preventive care (cancer screening,	Physicians	Deviations from the benchmark review in terms of: • PICO/inclusion and exclusion criteria: no quality filter.

	interactive CME		smoking cessation) and management of health conditions		• Results and conclusion: Some evidence show interactive CME sessions that enhance participant activity and provide the opportunity to practise kills can affect change in professional practice [total N: 14 trials]. Didactic sessions (lectures with minimal interaction/discussion) do not appear to be effective in changing physician performance [3 trials]. • Questions remain regarding formal CME, including group size, the role of the learning/practice environment, the clinical dimensions of care, the assessment of learner needs, barriers to change. *Comment(s): narrative synthesis; quality appraisal of studies X.*
Davis DA, 1992	CME	Largely primary care	Management of medical conditions	Largely family physicians	Deviations from the benchmark review in terms of: • PICO/inclusion and exclusion criteria: no quality filter. • Results and conclusion: CME using practice-enabling (facilitating the desired change in the practice site) or reinforcing strategies (by reminders and feedback) consistently improve physician performance [50 RCTs]. *Comment(s): narrative synthesis; quality appraisal of studies X.*
Waddell DL, 1991	Continuing education	Nursing practice (mixed health care settings)	Unclear	Nurses	Deviations from the benchmark review in terms of: • PICO/inclusion and exclusion criteria: all study designs; no quality filter; overall effect size calculated

					• Results and conclusion: CME positively affects nursing practice, with an overall average effect size of 0.73, using Cohen's d [34 studies]. *Comment(s): lack of descriptions of included studies; quality appraisal of studies X.*
Beaudry JS, 1989	CME	Unclear	Unclear	Physician	Deviations from the benchmark review in terms of: • PICO/inclusion and exclusion criteria: all study designs except pre and post test only designs; no quality filter; meta-analysis conducted (effect size calculated) • Results and conclusion: CME showed positive effects for physician performance (ES=0.55; SD=0.45) [41 studies] *Comment(s): lack of descriptions of included studies; quality appraisal of studies X*

Appendix 7 : Systematic review 2: Flow diagram summarising reviewing methods



Appendix 8: Systematic review 2: Characteristics of included studies

First author, year Title	Aims and objectives	• Number and type of included studies • Outcomes	Synthesis method Quality assessment? (Yes/no)	Type of implementation strategy (strategies)	Summary of findings/ conclusion(s)
Guideline implementation					
Unverzagt S, 2014 Strategies for guideline implementation in primary care focusing on patients with cardiovascular disease: a systematic review.	To understand and compare different implementation strategies concerning guidelines targeting primary or secondary prevention and treatment of CVD.	54 RCTs (54 compared single strategies and 30 multifaceted strategies to usual care) Outcome: physician adherence	Yes (OR with their 95% CI) Yes (Cochrane risk of bias tool)	Any (reminders, audit and feedback, education)	The strongest benefit of a single implementation strategy was found due to organisational change (OR 1.96; 95% CI 1.4 to 2.75; I^2=93%), followed by provider education (OR 1.69, 95% CI 1.23 to 2.32; I^2=92%) and provider reminder systems (OR 1.30, 95% CI 1.17 to 1.45; I^2=34%). Multifaceted interventions showed almost similar effect measures.
Okelo SO, 2013 Interventions to modify health care provider adherence to asthma guidelines: a systematic review	To assess the effect of interventions to improve health care providers' adherence to asthma guidelines on health care processes and clinical outcomes.	68 Half were RCTs (n=35) Outcome: provider adherence to guidelines	No Yes (Cochrane risk of bias tool)	Any (audit and feedback, educational only, financial, multicomponent, and information only)	There was moderate evidence for increased prescriptions of controller medications for feedback and audit and low-grade evidence for organisational change and multifaceted interventions.
Brusamento 2012	To evaluate the effectiveness of	7 studies assessed the effectiveness of	No	Any	Mixed effects: positive effect on all or most outcomes (4 studies

Assessing the effectiveness of strategies to implement clinical guidelines for the management of chronic diseases at primary care level in EU member states: a systematic review.	strategies to implement clinical guidelines for chronic disease management in primary care.	single strategy; 17 studies assessed the effectiveness of multifaceted interventions) Outcomes: performance indicators on process of care (including prescription behaviour) and/or indicators on patients' health outcomes.	Yes (Cochrane risk of bias)	(feedback, PEM, educational (interactive workshops, training), outreach, multifaceted)	each), partially effective (8 studies), no effects (9 studies). Effect size varied across studies; therefore it was not possible to determine the most successful Strategy. Multifaceted interventions were only slightly more effective compared to those implementing a single intervention.
Lineker SC, 2010 Educational interventions for implementation of arthritis clinical practice guidelines in primary care: effects on health professional behaviour.	To evaluate the influence of educational programs designed to implement clinical practice guideline for osteoarthritis and rheumatoid arthritis in primary care.	7 (6 RCTs and 1 before and after study) Outcome: behavioural outcomes	No Yes (Modified Philadelphia Panel grading system)	Educational (professional)	Educational outreach [2 trials] by trained physician educators may improve physician prescribing for osteoarthritis (OA), and peer-facilitated workshops [4 studies] with nurse case-management support may decrease referral to orthopaedics. Interprofessional workshops facilitated by peers may improve referral patterns for both OA and rheumatoid arthritis.
Medves J, 2010 Systematic review of practice guideline	To synthesise the literature relevant to guideline implementation and implementation	88 (of which 28 were RCTs)	No Yes JBI meta-analysis of	Any (PEM, Educational meetings, local consensus processes, local	Distribution of educational materials: 44/60 studies reported significant findings Educational meetings (discussion of teaching and

dissemination and implementation strategies for healthcare teams and team-based practice.	strategies for team based, collaborative practice.	Outcome: any objective measure of change in provider behaviour	statistics assessment and review instrument	opinion leaders, A&F)	learning sessions): 47/63 studies reported significant findings Local consensus processes: 23/36 studies reported significant findings Educational outreach visits: 8/12 studies reported significant findings Local opinion leaders: 13/16 studies reported significant findings Audit & feedback: 38/46 reported significant findings Reminders: 24/28 studies reported significant findings.
Langberg JM, 2009 Interventions to promote the evidence-based care of children with attention deficit-hyperactivity disorder (ADHD) in primary-care settings.	To review the efficacy of intervention models that designed to improve physician use of the evidence-based recommendation for evaluating and treating children with ADHD.	9 (2 observational, 1 RCT, 1 cluster RCT, 5 interrupted time series) Outcomes reported by included studies: physician behaviour, satisfaction, and child outcomes	No No	Any (educational, practice facilitation)	Education and ancillary services interventions and education and office system modification interventions, have been shown to improve ADHD practices.
Dulko D, 2007 Audit and feedback as a clinical practice	To evaluate the effectiveness of audit and feedback as a guideline	16 Outcomes: process of care, clinical	No No	Audit and feedback	Educational materials with A&F may increase effectiveness but evidence is limited. Single intervention could be as

guideline implementation strategy: a model for acute care nurse practitioners.	implementation strategy.	endpoints, clinical practice recommendations			effective in changing practice as multifaceted, particularly when baseline adherence to recommended practice is low.
Grimshaw JM, 2004 Effectiveness and efficiency of guideline dissemination and implementation strategies.	To estimate the effectiveness of guideline dissemination and implementation strategies to promote improved professional practice. [Additional analyses were carried out - economic evaluations and cost analyses, estimating the feasibility and likely resource requirements of guideline dissemination and implementation strategies in UK settings (survey)]	235 (of which 110 were cluster RCT, 20 patient RCT, 7 CCT, 10 patient CCT, 40 controlled before after studies, 39 interrupted time series) Outcomes: data were abstracted on each type of endpoint (dichotomous and continuous); where studies reported >1 measure of each endpoint, the primary measured or median measure was abstracted.	No (meta-regression was planned but this was not possible) Yes (EPOC methodological quality criteria)	Any	Reminders (as single intervention): moderate improvements in process of care (across different settings and targeted behaviours) (median absolute improvement: 14.1%; 14 cluster RCTs); Outreach visits (usually a component of multifaceted intervention): modest effects (median absolute improvement: 6%; 13 cluster randomised comparisons); Educational materials and A&F: modest effects (less robust) (8.1% vs. 7%, respectively). The addition of educational materials to other interventions did not seem to increase effectiveness.
McKenna H, 2004 Barriers to evidence based practice in primary	To examine evidence-based practice in primary and review the barriers encountered by	Unclear Unclear	No No	Yes (not stated as objective)	Educational materials: no significant impact on desire to use evidence in practice Local opinion leader: mixed effect

care: a review of the literature.	professionals when attempting to introduce evidence into practice.				A&F: moderately effective.
Tooher R, 2003 Implementation of pressure ulcer guidelines: what constitutes a successful strategy?	What strategies are effective in implementing evidence-based guidelines and recommendations for the prevention and/or management of pressure ulcers? What are the characteristics of sustainable implementation of these strategies?	20 Outcomes: process of care	No No	Any	Active strategies (particularly targeted educational sessions) were associated with better outcomes than those achieved with passive strategies (e.g. mailed educational materials distributed directly to staff or sent to their employing institute). Settings where there is institutional and management support, active monitoring of adherence to guidelines, show positive outcomes.
Bauer MS, 2002 A review of quantitative studies of adherence to mental health clinical practice guidelines.	To review all published peer-reviewed reports that provide quantitative information on rates of adherence to specific mental health guidelines – particularly what are adherence rates in clinical trials of guideline implementation strategies?	41 (of which 26 were cross sectional studies) Outcomes: Adherence outcomes	No No (no formal checklist)	Any	Successful interventions tend to be multifaceted and intensive, and they typically involve the addition of resources/access, system re-design (4/6 positive studies). Computer reminders appear to be more effective than paper based reminders (1 study). Academic detailing and/or educational methods +/- continuous quality improvement feedback methods: negative (2 studies).

Gross PA, 2001 Implementing practice guidelines for appropriate antimicrobial usage.	To determine which implementation methods appear to improve the outcome of appropriate antimicrobial use.	40 (Upper respiratory tract infections, LRTIs, urinary tract infections, HIV infections, wound infections etc.) Outcomes: Any (including antibiotic prescribing, adherence to guidelines)	No No	Any	Multifaceted implementation methods were most successful. Individual implementation methods that appeared to be effective were academic detailing, feedback from nurses or physicians, local adaptation of a guideline, small-group interactive sessions. Early involvement of the relevant personnel and involvement of all the stakeholders was critical to successful implementation. Ineffective: didactic education, mailed educational materials.
Wensing M, 1998 Implementing guidelines and innovations in general practice: which interventions are effective?	To evaluate the effectiveness of interventions In influencing the implementation of guidelines and adoption of innovations in general practice.	61 "best evidence" studies (143 studies identified) Effective: better results compared with control group/condition for most or all outcomes Partly effective: better results for some outcomes but not for all of them Ineffective: no better results for most or all outcomes	No Yes (no checklist was used – selection of "best evidence" studies were made)	Any	Some but not all multifaceted interventions are effective in inducing change in general practice. Social influence (e.g. individual instruction, peer review groups) and management support (resources, incentives) can improve the effectiveness of information transfer, but information linked to performance (feedback, reminders) does not necessarily do so.

		Outcomes: professional behaviour (e.g. compliance with protocol, medical production)			
Davis AD, 1997 Translating guidelines into practice. A systematic review of theoretic concepts, practical experience and research evidence in the adoption of clinical practice guidelines.	To explore the variables affecting physicians' adoption of clinical practice guidelines and describe outcomes of trials of educational interventions to change physicians' behaviour or health care outcomes.	Unclear Outcomes: process of care (professionals' performance such as changes in prescribing patterns) and health care outcomes	No No	Any	The interventions were shown to be weak (didactic, traditional continuing medical education and mailings), moderately effective (audit and feedback, especially concurrent, targeted to specific providers and delivered by peers or opinion leaders) and relatively strong (reminder systems, academic detailing and multiple interventions).
Conroy M, 1995 Clinical guidelines: their implementation in general practice.	To review research evidence and current opinion pertaining to clinical guideline implementation.	Unclear Outcomes: unclear	No Yes (standard methodological criteria was used where possible)	Any	Individualised educational packages & feedback: significant impact on clinical practice Academic detailing: most successful when the educators are known to and respected by the target group. Opinion leaders (postgraduate education tutors within the medical community) (persuasion setting): play an important role in convincing other GPs to

					become active in the process, play a key role in shaping local consensus regarding new technologies and thereby in encouraging and blocking new behaviour. Printed educational materials alone: weak effect Interventions that used enabling and/or reinforcing methods (facilitation in the practice setting and use of reminders and feedback) are more likely to change doctor behaviour. Mailed CEM programme: no significant effect; CEM & information dissemination alone: little or no effect.
Grimshaw JM, 1993 Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations.		59 Outcomes: process of care outcomes (e.g. compliance with desired practice, x-ray use)	No No	Any	Specific education intervention - probability of being effective: high Continuing education - probability of being effective: above average Mailing targeted groups - probability of being effective: below average.
Lomas J, 1991 Words without action? The production,	To review the methods used for dissemination and their impact on behaviour.	19 Outcomes: unclear	No	Any	Mailed materials – ineffective.

dissemination, and impact of consensus recommendations.					
Quality of care and disease management					
Comino EJ, 2012 A systematic review of interventions to enhance access to best practice primary health care for chronic disease management, prevention and episodic care.	To examine effective strategies to enhance access to best practice processes of PHC in three domains: chronic disease management, prevention and episodic care. *also cost-effectiveness	75 Outcomes: access to best practice	No Yes (Quality assessment tool for quantitative studies, Effective Public health practice project) Study quality was ranked as high in 31% of studies, medium (61%0 and low (85).	Practice reorganisation, workforce development, financial incentives	Multiple strategies were more frequently observed in chronic disease management domain, reflecting the complex arrangements needed to support consistent multi-disciplinary care. Single strategies were more frequently observed for preventive and episodic care. It is important to consider the impact of a change in access directed at one specific area on other types of service. Multiple linked strategies targeting different levels of the health care system are most likely to improve access to best practice primary health care.
Gual A, 2011 Implementing alcohol disorders treatment throughout the community.	To look for relevant articles concerning screening, brief interventions and referral to treatment of patients with hazardous or harmful alcohol use, with a special focus on the primary healthcare	23 Outcomes: unclear	No No	Any	Team-based learning appears a promising strategy to help maintain newly learned clinical skills. Training alone does not lead to sustained increase of screening and counselling rates.

	implementation of these effective interventions.				
Koch T, 2011 Dementia diagnosis and management: a narrative review of changing practice.	To identify and appraise empirical studies of interventions designed to improve the detection and management of dementia of primary care practitioners.	15 (14 RCTs and one qualitative study) Outcomes: Primary outcomes defined by study authors	No (narrative) Yes (Pedro checklist)	Any	The quality of the studies varied considerably. Educational interventions are effective when learners are able to set their own educational agenda. Practice-based workshops appeared to improve the detection rate but not the management.
Nam S, 2011 Barriers to diabetes management: patient and provider factors.	To summarize existing knowledge regarding various barriers of diabetes management from the perspectives of both patients and clinicians.	80 Outcomes: any	No No	Any (implementation strategies not primary objective)	Computerised reminders and performance improvement feedback: statistically improvement [1 RCT] Computerised reminders alone: no improvement [1 RCT]
Perry M, 2011 Effects of educational interventions on primary dementia care: a systematic review.	To determine the effects of educational interventions about dementia, directed at primary care providers (PCP).	5 studies (4 cluster RCT and one CBA) Outcomes: quality of dementia care at primary care provider level and patient level.	No (narrative synthesis) Yes (EPOC criteria)	Educational (professional)	Overall, small-moderate positive effects. Educational interventions alone are not sufficient to improve adherence to dementia guidelines. Education would need to be combined with other interventions (e.g. financial reimbursement). Educational interventions that require active participation (e.g. small group workshop,

					interactive seminar) improve detection of dementia.
Boonacker C, 2010 Interventions in health care professionals to improve treatment in children with upper respiratory tract infections (URTIs).	To analyse which strategies are used to promote evidence based interventions in the management of children with URTIs. To assess the effectiveness of these interventions, and when more are effective – which works best. To analyse the costs associated with these interventions.	10 (of which 7 were cluster RCTs, 3 were non-RCTs or controlled before after studies) Outcomes: none stated.	No Yes (Cochrane Collaboration's tool for assessing risk of bias)	Any	Collaborative protocol development and educational materials reduced antibiotic prescription rates by 40% (OR 0.60, 95% CI 0.43 to 0.83). Collaborative protocol development alone improved compliance. Active interventions is more effective than passive dissemination: Educational sessions & printed materials vs. printed material or no intervention: moderate effect (28%, 95% CI 4 to 51%; 29%, 95% CI 5 to 53%).
Glynn LG, 2010 Self-monitoring and other pharmacological interventions to improve the management of hypertension in primary care.	To determine the effectiveness of interventions to improve control of blood pressure in patients with hypertension.	72 Outcomes: clinical endpoints	Yes (meta-analysis- pooled using the weighted mean difference approach) No	Any	Educational directed to physicians alone [10 RCTs] appears unlikely to influence control of blood pressure (small reduction in SBP (-2mmHg, 95% CI=-3.5 to -0.6mmHg)). Organisational interventions [9 RCTs) appear to have favourable results in terms of reduction in blood pressure (range from individual RCTs: -12 to -3mmHg in SBP). Reminders (postal/ computer-based) were associated with an improvement

					in the follow up of hypertensive patients [8 RCTs].
Akbari A, 2008 Interventions to improve outpatient referrals from primary care to secondary care.	To estimate the effectiveness and efficiency of interventions to change outpatient referral rates or improve outpatient referral appropriateness.	17 studies Outcomes: objectively measured provider performance in a health care setting (e.g. referral rates or appropriateness of referral) or health outcomes	No Yes	Any	Ineffective strategies: • passive dissemination of local referral guidelines [2 studies] • Feedback of referral rates [1 study] • Discussion with an independent medical advisor [1 study] Effective strategies: • Dissemination of guidelines with structured referral sheets [4/5 studies]; • Involvement of consultants in educational activities [2/3 studies]; • Financial interventions: modest reduction (unclear significance and unit of analysis error) in referral rates [3/4 studies].
Smolders M, 2008 Knowledge transfer and improvement of primary and ambulatory care for patients with anxiety.	To summarise current evidence on the effectiveness of different knowledge translation and change interventions for improving primary and ambulatory anxiety care to provide guidance to	24 (23 RCTs and 1 ITS) Outcomes: management and outcome of anxiety, and costs and resource use.	Yes (meta-analysis) and qualitative descriptive analysis Yes (Cochrane checklist was cited in the paper)	Any	Minimal effect: passive dissemination and conventional educational strategies (e.g. A&F, education) Multifaceted educational strategies combined with organisational interventions are more likely to be effective.

	professionals and policy-makers in mental health care.				
Thomas DC, 2006 Continuing medical education, continuing professional development, and knowledge translation: improving care of older patients by practicing physicians.	To learn the extent to which continuing medical education programs were effective in altering physician behaviour in the care of older people.	13 studies Outcomes: Not specified	No	Any	Educational interventions most likely to result in physician behaviour involve multiple educational efforts, written materials or toolkits combined with feedback, individual educational visits, or small group training and strong communication channels between instructors and learners [13 studies].
Zwar N, 2006 A systematic review of chronic disease management.	To investigate the facilitators and barriers to effective interventions for chronic disease in primary health care (one of the three research questions).	141 studies Outcomes: Objective measurements of health professional performance, e.g. adherence to disease specific guidelines, patient level measures e.g. blood pressure or self-report measures with known validity and reliability, as well as	No Yes (Joanna Brigg's institute and EPOC criteria)	Any	Strategies that were found to effective in assisting health care professionals adhere to disease management guidelines included audit and feedback, distribution of educational material, educational meetings and educational outreach visits.

		patient/ provider satisfaction, economic measures.			
Gilbody S, 2003 Educational and organisational interventions to improve the management of depression in primary care A systematic review.	To systematically evaluate the effectiveness of organisational and educational interventions to improve the management of depression in primary care settings.	36 studies (29 RCTs and non-RCTs, 5 controlled before-and-after studies, and 2 interrupted time-series studies) Outcomes: Management and outcome of depression, health-related quality of life and direct/ indirect costs	No (narrative synthesis) No checklist. Authors stated data on methodological quality were extracted.	Educational and organisational	Simple passive guideline implementation and educational strategies (e.g. clinical education, audit and feedback or academic detailing, educational meetings) with no organisational support were generally ineffective. Effective strategies were those with complex interventions that incorporated clinician education and an enhanced role of nurse.
Renders CM, 2001 Interventions to improve the management of diabetes mellitus in primary care, outpatient and community settings (Cochrane review).	To examine the effectiveness of different interventions, targeted at health professionals or the structure in which they deliver care. To determine which intervention strategy or parts of intervention strategies are the most effective and what do they have in common.	41 (RCTs, controlled before and after studies, interrupted time series) Outcomes: Health professional performance, e.g. blood markers, making a follow up, referral, exam of the feet Patient outcomes, e.g. CVD risk factors, hospital admissions,	No Yes (EPOC checklist/ quality criteria)	Any	Education & reminder, A&F, outreach visits improved diabetes care in all studies [8 studies] Computerised reminders for providers and A&F (alone or combination of both) improved process outcomes [6 studies].

		mortality, no. of complications Self-report subjective measures, e.g. patient/ provider satisfaction, QoL			
Technology implementation					
Gagnon MP, 2009 Interventions for promoting information and communication technologies (ICT) adoption in healthcare professionals.	To assess the effectiveness of interventions to promote the adoption of ICT by health care professionals.	10 (9 were RCTs, 1 was ITS) Mixed settings Outcomes: Objective measures of the adoption or use of the ICT applications by health care professionals	Yes (relative risk differences/ standardised mean differences were calculated when possible) Yes (EPOC checklist)	Any	Multifaceted interventions (didactic meeting & educational materials & outreach; financial intervention) showed significant positive effect on ICT adoption [3 studies]. Single interventions such as educational meetings, group training, one-on-one training sessions, providing training materials: mixed effects.
Preventative care and public health					
Schichtel M, 2013 Educational interventions for primary healthcare professionals to promote the early diagnosis of cancer: a systematic review.	Examine the evidence of effectiveness of educational interventions for primary healthcare professionals to promote early diagnosis of cancer.	21 RCTs (18 individual, 3 practice level) Outcomes: Majority of outcomes were chosen ante hoc, including e.g. detection rates of early cancer diagnosis	No Yes (checklist) Theory no.	Educational (professional)	Academic detailing and local opinion leader had some effect but may require substantial financial resources and personnel but did not lead to greater outcome measures than comparable and likely cheaper interventions. Less intensive interventions focusing on more didactic educational methods like

					seminars, lectures or printed material increased outcomes only marginally or made no difference. Didactic teaching as a single method may not be an effective educational intervention to change practice. Academic detailing and local opinion leader had some effect but may require substantial financial resources and personnel but did not lead to greater outcome measures than comparable and likely cheaper interventions.
van Cleave J, 2012 Interventions to improve screening and follow-up in primary care: a systematic review of the evidence.	To evaluate the evidence of practice-based interventions to increase the proportion of patients receiving recommended screening and follow up services in paediatric primary care.	23 (9 pre-post comparisons, 5 randomised trials, 3 post-intervention comparisons with controls, 3 post-intervention cross-sectional studies, 3 time series data) Outcomes: Screening or follow up care related outcomes	No No (grouped studies using hierarchy of study design quality and reported elements of potential bias)	Any	Mixed effects: EMR reminders Highly effective: nurse-driven protocol for screening Improvement tended to be greater if: Pre-intervention screening was low or non-existent The focus of the intervention was narrowed to a specific screening test or a specific area. Multifaceted interventions implemented through a learning collaborative structure.
Arroyave AM, 2011	To determine whether specific elements or groups of elements	11 RCTs Outcomes:	No	Yes	Interventions that work around the physicians were the most effective at increasing the use of

Organizational change: a way to increase colon, breast and cervical cancer screening in primary care practices.	that were related to effective interventions could be identified. To determine if interventions were adopted by the practices and the extent to which practices bought into the intervention.	Change in the proportion of individuals receiving cancer screening services	Qualitative data was analysed by using a framework to facilitate abstraction of information. For quantitative data, clinical importance of a change in screening: large change >15%; moderate change 5-15%; none ≤5%		screening services (e.g. having a non-physician staff such as nurse with redefined role to offer support, such as reminding and counselling, administrative tasks). Organisational change interventions should be implemented tailored to the primary care practice style.
Goodwin V, 2011 Implementing the evidence for preventing falls among community-dwelling older people: a systematic review.	To synthesise the effectiveness of methods to implement falls prevention programmes with community-dwelling older people.	15 (non RCT, cross-sectional studies, cohort, surveys, process evaluation, case series) Outcomes: None specified (any)	No (narrative) Yes Cochrane risk of bias tools	Any	There is evidence to support active training support of healthcare professionals in order to implement falls prevention evidence into clinical practice (6 studies).
Williams EC, 2011 Strategies to implement alcohol screening and brief intervention in primary care	To summarise the literature on screening and brief intervention (BI) implementation in primary care settings according to the domains and sub-	17 publications from 8 implementation programs Outcomes: rates of screening or screen-positive patients who	No No	Any	The highest screening rate (93%) was found in program which used more elements of the inner setting (e.g. culture, implementation climate including organisational incentives and rewards, goals

settings: a structured literature review.	domains of the Consolidated Framework for Implementation Research (CFIR) and compare rates of SBI reported with regard to implementation strategies tested.	received a brief intervention			and feedback, available resources, networks and communication) and process of implementation (e.g. opinion leaders, champions, internal implementation leaders, planning) domains than the other implementation programs and reported use of the most strategies relating to the outer setting domain (e.g. cosmopolitanism, external policies and incentives).
Gould DJ, 2010 Interventions to improve hand hygiene compliance in patient care.	To assess the short and longer-term success of strategies to improve hand hygiene compliance.	4 studies (1 RCT, 1 CCT, 2 CBAs) Outcomes: rates of observed hand hygiene compliance	No Yes	Any	Education intervention – mixed effects [2 studies]; multifaceted interventions with the application of social marketing theory or staff involvement (in the change process) appear to have an effect but there is insufficient evidence to draw a firm conclusion.
Holden DJ, 2010 Systematic review: enhancing the use and quality of colorectal cancer (CRC) screening.	To summarise evidence on factors that influence CRC screening and strategies that increase the appropriate use and quality of CRC screening and CRC screening discussions.	93 studies Outcomes: None stated.	No Yes (approach devised for the AHRQ effective health care program)	Physician reminders, system-level interventions	Physician-reminder intervention: minimal effect

Thomas RE, 2010 Interventions to increase influenza vaccination rates of those 60 years and older in the community.	To assess effects of interventions to increase influenza vaccination rates in those 60 or older.	44 RCTs (of which 18 were cluster RCTs) (high income countries) Outcomes: Rates of vaccination against influenza in people aged 60 or older.	Yes (only for some outcomes) Yes	Any	Reminders [4 trials; GRADE: moderate] Conclusion: not effective Organisational interventions Facilitators working with physicians and healthcare teams [4 RCTs; GRADE: moderate] Conclusion: maybe effective Financial incentives [2 RCTs; both at high risk of bias; GRADE: low] Pooled OR 2.22, 95% CI 1.77 to 2.77 Conclusion: positive effects.
Vernon SW, 2010 Interventions to promote breast cancer screening with mammography: a systematic review and meta-analysis.	The effectiveness of various intervention strategies was examined in a meta-analysis of studies that reported estimates of repeat screening for intervention and control groups.	25 (any) Outcomes: repeat mammography outcomes	Yes Unclear	Any	The summary OR for the 8 heterogeneous reminder-only studies was the largest observed (pooled OR= 1.79, 95% CI 1.41 to 2.29) and was statistically significantly greater than the pooled ORs for the homogeneous group of 17 studies that used the more intensive strategies of education/motivation or counselling (OR=1.27, 95% CI 1.17 to 1.37).
Howe A, 2006 Effectiveness of educational interventions in primary care	To evaluate educational interventions in primary care mental health.	18 studies Outcomes: Any	No Yes	Educational (professional)	All the studies with statistically significant outcomes used one or more of the following: • Personalised material based on the performance of the clinicians'

mental health: a qualitative systematic review.					• Data from the clinicians' own patients • A practice face-to-face interaction • Follow up cycle with personalised data feedback Other components appear to contribute to the effectiveness: • Clear goals • Repeated intermittent activities and reminders over time • Some learner selection of material and opportunity for practitioners to draw their own conclusions. • Interventions should be multifaceted.
Nilsen P, 2006 Effectiveness of strategies to implement brief alcohol intervention in primary healthcare.	To evaluate the effectiveness of promoting brief alcohol implementation by healthcare providers in primary health centres and evaluates the results in relation to the implementation strategies employed.	11 (of which 5 are RCTs, 5 non randomised studies, 1 quasi-experimental study) Outcomes: None stated	No No	Any	Intervention effectiveness (material utilisation, screening and brief intervention rates) generally increased with the intensity of the intervention effort, i.e. the amount of training and/or support provided. The overall effectiveness was modest.
Hulscher MEJL, 2006	To assess the effects of interventions to improve the delivery	55 (37 RCTs, 18C-RCTs) Outcomes:	No Yes (EPOC checklist)	Any	Effective interventions (e.g. education, reminders, multifaceted intervention): small to moderate effect

Interventions to implement prevention in primary care.	of preventive services in primary care.	Any objective measure of professional performance or patient health outcomes.			Education vs. no intervention, absolute change of effect =-4% and 31%. Physician reminders vs. no intervention, range 5 to 24%. Multifaceted interventions vs. no intervention, -3 to 64%.
Town R, 2005 Economic incentives and physicians' delivery of preventive care.	To examine the impact of financial incentives on provider preventive care delivery.	6 (Type of payment: increased fixed fee for service (FFS), n=2, performance bonus, n=2; increased FFS/performance bonus, n=2) Outcomes: None stated	No No	Financial	No effect was found. Small rewards may not motivate doctors to change their preventive care routines. The success of a financial intervention is likely to be inversely associated with the complexity of the tasks it seeks to have the physicians undertake. Incentives may buy a temporary priority, but sustained change in the delivery of preventive care may require addressing the underlying mechanisms that can reinforce the desired behaviours in a more permanent way.
Anderson P, 2004 How can we increase the involvement of primary health care in the treatment of tobacco	To test the effectiveness of educational and practice base strategies to increase the involvement of primary health-care practitioners in the	24 programmes identified in 19 trials (16 RCTs, 2 CTTs, 1 ITS) Outcomes: None stated.	Yes (meta-analysis) Yes (EPOC checklist)	Any	Characteristics that explain variability: Outreach more effective than (>) non-outreach; Multifaceted > single interventions; Educational + practice based intervention > either alone;

dependence? A meta-analysis.	treatment of tobacco dependence.				Programmes directed at trainee physicians > established physicians All of the above factors contributed 22% of the effect size.
Harvey EL, 2002 An updated systematic review of interventions to improve health professionals' management of obesity.	To determine the existence and effectiveness of interventions to improve health professionals' management of obesity or the organisation of care for overweight and obese people.	18 (of which 10 are RCTs) Outcomes: Objective measure of provider performance or patient outcomes, cost data	No Yes (EPOC quality assessment criteria)	Any	Reminders: some improvement (unclear significance)
Kupets R, 2001 Strategies for the implementation of cervical and breast cancer screening of women by primary care physicians.	To determine the most effective strategies for the implementation of breast and cervical cancer screening.	14 RCTs Outcomes: Any.	No No	Yes (patient-based strategies data not extracted)	Physician-based computerised reminders appear to be the most effective approach in the implementation of cervical and breast cancer screening. Evidence suggested there is no additive effect of A&F with computer reminders with respect to the delivery of preventive services [1 study].
Snell JL, 1996 Increasing cancer screening: a meta-analysis.	To identify effective office-based interventions for increasing cancer screening.	Unclear Outcomes: Compliance with screening	Yes No	Any	Office-based interventions targeted at physicians increased compliance with cancer screening (d=+0.1894, 95% CI +0.16 to 0.18). The effect size was greater as the number of

					interventions increased up to 3 interventions (not a linear relationship). Greater success was fond for interventions targeting physician both during and outside the patient visit. A multifaceted approach to changing physician behaviour seems to be best.
Mandelblatt J, 1995 Effectiveness of interventions to enhance physician screening for breast cancer.	To review research articles assessing the effectiveness of interventions to enhance physician breast cancer screening behaviour.	20 controlled trials Outcomes: Use of screening	Yes (effect size was calculated) No	Any	Physician reminders and A&F each significantly increased use of mammography and clinical breast exam by 5-20% in university setting. The magnitude of effects appeared to be similar for computerised and non-computerised reminders. Physician education had a positive impact on outcomes (6-14%) Reminders were more cost-efficient than A&F.
Gill PS, 1999 Changing doctor prescribing behaviour.	To identify interventions that affect prescribing behaviour and to derive conclusions for practice and further research.	79 (randomised and non-randomised design) Outcomes: Any	No Yes	Any	Distribution of educational materials: least effective, 43% of interventions showed positive findings (95% CI 13 to 78%; 3/7 studies); A&F (most common single intervention): 52% of interventions showed positive findings (95% CI 34 to 66%; 17/33 studies);

					Outreach: 50% of interventions showed positive findings (95% CI 10 to 90%; 2/4 studies); Multifaceted: 49% of interventions showed positive findings (95% CI 20 to 80%; 21/43 studies)
Beilby JJ, 1997 Trials of providing costing information to general practitioners: a systematic review.	To determine if providing GPs with costing information can change their clinical behaviour and reduce medical costs.	6 studies Outcomes: Any	No No	Any	Computerised feedback on drug costs increased generic prescribing; and academic detailing decreased inappropriate prescribing of target drugs.
Pippalla RS, 1995 Influencing the prescribing behaviour of physicians: a metaevaluation.	To conduct a meta-evaluation on published studies aimed at changing the prescribing behaviours of physicians.	26 studies Outcomes: Any	No No	Any	Interventions through one to one meetings showed the greatest impact on physicians' prescribing behaviour change when compared to other treatments, followed by mailed printed materials and printed individual feedback; group lectures seem to have the least impact on prescribing behaviour.
Soumerai SB, 1989 Improving drug prescribing in primary care: a critical analysis of the experimental literature.	To review studies of non-regulatory measures to improve physician prescribing, such as printed educational materials, A&F, reminders,	44 studies (of which 20 were inadequately designed) Outcomes: Any	No No	Any	The use of mailed educational materials alone, such as drug bulletins, protocols/guidelines has little or no detectable effects on actual prescribing behaviour. Well-designed educational materials appear to be an

	academic detailing etc.		important component of other strategies. Small group discussions conducted by senior physicians in academic primary care practices improved the use of antibiotics and hypertension treatment and control [2 studies]. Ongoing computerised reminder systems could be effective in preventing physicians from omitting essential preventive measures for several diseases, e.g. hypertension [4 adequately controlled studies]. Ongoing feedback reports of physician-specific prescribing performance may be effective in improving certain types of prescribing practices, e.g. use of generic drug in academic group practice setting [1 RCT]; Brief one to one educational outreach visits by specially trained clinical pharmacists or physician counsellors are effective in substantially reducing inappropriate prescribing of a wide range of drugs [3 controlled trials]
Collaborative working			

Franx G, 2013 Implementation strategies for collaborative primary care mental health models.	To review the literature and to generate an overview of strategies currently used to implement such models in daily practice.	18 (2 RCTs, 1 quasi trial, 5 qualitative studies and a range of observational studies with a mixed methods design. Outcomes: Any	No (narrative synthesis) No	Educational, community and stakeholder engagement strategies, organisational, financial strategies	There were fewer studies on implementation strategies. Stakeholder engagement and buy-in of stakeholders is crucial to all strategies. Evidence-based quality improvement strongly builds on buy-in of clinical leaders, by creating partnerships between experts and clinicians during implementation, starting with the adaptation of the collaborative model to the local context, capacity and financial possibilities.
Xyrichis A, 2008 What fosters or prevents inter-professional teamworking in primary and community care? A literature review.	To explore the factors that inhibit or facilitate interprofessional teamworking in primary care and community care.	10 studies Outcomes: Any	No (thematic analysis) Yes (unclear source; limitations were discussed, per study)	Audit and feedback	Audit – regular appraisals could offer a range of incentives including a chance to discuss problems, consider appropriate solutions to improve team functioning, praise individuals for their contribution, and provide support where needed. Regular team feedback on team performance and the competitive nature of relations are contextual factors influencing team effectiveness.
Not specific to any topic/ health condition					
Baskerville NB, 2012 Systematic review and meta-analysis	To examine the overall effect size of practice facilitation and to explore possible moderating factors.	23 randomised and non- randomised trials and prospective cohorts	Yes Meta-analysis and meta-regression (random	Organisational	Practice facilitation included A&F, interactive consensus building, goal setting and reminders, tailoring, and use of tools such as flow sheets,

of practice facilitation within primary care settings.		Outcomes: the change in evidence-based practice behaviour/ overall effect size of practice facilitation (standardised mean difference)	effects) and descriptive Yes (PEDro method)		meetings, group visits, educational tools, etc. An overall effect size of 0.56 (95% CI 0.43 to 0.68) is found, which favours practice facilitation, compared to controls. Tailoring (to the context and needs of the practice) (p=0.05), the intensity of practice facilitation* (p=0.03) and the number of intervention practices per facilitator (as the number of practices per facilitator increases, the overall effect of facilitation diminishes) (p=0.04) modified evidence-based guideline adoption.
Giguère A, 2012 Printed educational materials: effects on professional practice and healthcare outcomes.	To assess the effect of printed educational materials on the practice of healthcare professionals and patient health outcomes.	45 (14 RCTs and 31 ITS) Outcomes: professional practice (risk difference and standardised mean difference)	Yes Median absolute risk difference and SMD were calculated Yes (EPOC rating)	Printed educational materials	Overall, small beneficial effect on professional practice [total N: 45 studies].
Ivers N, 2012 Audit and feedback: effects on professional	To assess the effects of A&F on the practice of health care professionals and patient outcomes and to examine factors	140 RCTs (after excluding studies with high risk of bias, 49 studies reporting dichotomous outcomes are	Yes. Dichotomous: adjusted risk difference (difference after-before),	Audit and feedback	Overall: small to moderate effect

practice and health care outcomes.	that may explain variation in the effectiveness of A&F.	included, or 21 studies reporting continuous outcomes are included) Outcomes: Objectively measured provider performance or patient health outcomes	Continuous: adjusted change relative to the control group (post-intervention difference in means – baseline difference in means/ baseline control group mean) Subgroup analysis and exploration of heterogeneity: meta-regression. Revised EPOC criteria and GRADE		
Rawl SM, 2012 Interventions to promote colorectal cancer (CRC) screening: an integrative review.	To evaluate trials of CRC screening interventions.	33 RCTs Outcomes: Any.	No Yes (modified transparent reporting of evaluations with nonrandomised designs/ TREND criteria)	Any	Overall, several provider or system interventions were effective (significant effects), especially when combined with foregoing patient-directed interventions. Such interventions included academic detailing, screening reminders and prompts, audit and feedback, and shared

					responsibility for CRC screening [3 RCTs].
Flodgren G, 2011a Local opinion leaders: effects on professional practice and health care outcomes.	To assess the effectiveness of the use of local opinion leaders in improving professional practice and patient outcomes.	18 trials Outcomes: Objectively measured professional performance and patient outcomes	Yes Adjusted RD (improvement in compliance with desired practice) was calculated Yes (EPOC risk of bias checklist)	Local opinion leaders	Opinion leader alone or in combination with other interventions may promote evidence-based practice.
Parmelli E, 2011 The effectiveness of strategies to change organisational culture to improve healthcare performance.	To determine the effectiveness of strategies to change organisational culture in order to improve healthcare performance.	0 Outcomes: Objective measures of professional performance, patient outcomes, organisational performance (e.g. measures of organisational culture), economic outcomes	- -	Organisational	No studies were identified.
Scott A, 2011 The effect of financial incentives on the quality of health care provided by	To identify: the different types of financial incentives that have improved quality; the characteristics of patient populations	7 (3 cluster RCTs, 2 CBAs, 1 controlled ITS, 1 ITS) Quality of care outcomes: patient	No Yes (EPOC risk of bias guideline)	Financial	Overall, different financial interventions had positive, but modest and variable effects on a minority of the measures of quality of health care. Poor study design led to substantial risk of bias in most studies.

primary care physicians.	for whom quality of care has been improved by financial incentives; the characteristics of PCPs who have responded to financial incentives.	reported outcome measures (self-report health status, quality of life, patient satisfaction and experience with the process of care), clinician behaviours (e.g. prescribing, test-ordering, referrals, treatment or advice provided), and intermediate clinical and physiological measures (e.g. HBa1c, blood pressure, cholesterol).			There is insufficient evidence to support or not support the use of financial incentives to improve the quality of primary health care. Incentive schemes should be more carefully designed before implementation.
Baker R, 2010 Tailored interventions to overcome identified barriers to change: effect on professional practice and health care outcomes.	To assess the effectiveness of interventions tailored to address identified barriers to change on professional practice or patient outcomes.	26 (of which 15 trials were based in primary or community care, 7 in hospital/specialist care, 3 in both, 1 in nursing home) Outcomes: Objectively measured professional performance in a health care setting;	Yes. Meta-regression. Criteria described by EPOC for RCTs and the EPOC data collection checklist	Tailored interventions	Interventions tailored to prospectively identified barriers are more likely to improve professional practice, compared to no intervention or passive dissemination of guidelines.

		studies that measured knowledge/ performance in a test situation were excluded.			
Flodgren G, 2010 Interventions to change the behaviour of health professionals and the organisation of care to promote weight reduction in overweight and obese adults.	To assess the effectiveness of strategies to change the behaviour of health professionals and the organisation of care to promote weight reduction in overweight and obese people.	6 RCTs Outcomes: Objective measure of provider performance (e.g. patient's body weight), cost data	Yes Yes (EPOC checklist)	Any	One study found evidence of a change in clinicians' behaviour: those receiving the educational intervention were more likely to discuss weight, record weight, record a target weight, and have a dietary target than those in the control group. One poor quality study reported that reminders led to significantly more diet advice being given or diet being reviewed over 2 years.
Gardner B, 2010 Using theory to synthesise evidence from behaviour change interventions: the example of audit and feedback.	To demonstrate the feasibility and potential benefits of theory-based approach with an analysis based on a Cochrane review assessing the effectiveness of A&F interventions (Jamtvedt et al., 2006)	61 RCTs Outcomes: Any	Yes Use of theory based coding and coding for potential covariates. Meta-analysis and meta-regression Revised EPOC criteria	Audit and feedback	Effects of feedback, performance targets and action plans: the adjusted OR of compliance with desired practice ranged from 0.58 to 24.98 (median=1.35; interquartile range = 1.02-1.80). A random effects model produced a significant effect of A&F, adjusted OR=1.43, 95% CI 1.28 to 1.61) (moderate heterogeneity, I^2=61%). Insufficient data to examine

					using feedback in conjunction with targets and action plans is more effective than feedback alone.
van Herck P, 2010 Systematic review: effects, design choices, and context of pay-for-performance (P4P) in health care.	To provide an overview of how P4P affects clinical effectiveness, access and equity, coordination and continuity, patient-centeredness, and costs-effectiveness To summarise evidence-based insights about how such P4P effects are affected by the design choices made during the P4P design, implementation and evaluation process To analyse the mediating effect on P4P program is introduced	128 (111 in a primary care setting, 30 in a hospital setting, 13 in both settings) 9 randomised studies, 18 used a concurrent-historic comparison design without randomisation, 3 used a concurrent comparison design, 20 interrupted time series design, 19 used before and after design, 59 cross-sectional studies, 8 applied economic modelling Outcomes: Not specified.	No Yes An appraisal tool based on 9 validated appraisal tools and reporting statements	Financial	The clinical effectiveness of P4P ranged from negative or absent, to positive (1-10%) or very positive (>10%). P4P most frequently failed to affect acute care. In chronic care, diabetes was the condition with the highest rates of quality improvement due to P4P implementation. Positive results were also reported for asthma and smoking cessation. This contrasts with finding no effect with regard to coronary heart disease. One study reported a declining trend in improvement rate for non-incentivized measures of asthma and CHD after a performance plateau was reached [total N=128 studies].
Forsetlund L, 2009 Continuing education meetings and workshops;	To assess the effects of educational meetings on professional practice	81 trials [final N = 44 after excluding studies with high risk of bias]	Yes Adjusted risk difference and % change relative to the	Educational (professional)	Overall: small to moderate improvements in professional practice (compliance with desired practice).

effects on professional practice and health care outcomes.	and healthcare outcomes.	Outcomes: Objectively measured health professional practice behaviours or patient outcomes	control mean after the intervention were calculated; univariate meta-regression Yes (EPOC checklist)		
Shojania KG, 2009 The effects of on-screen, point of care computer reminders on processes and outcomes of care.	To evaluate the effects on processes and outcomes of care attributable to on-screen reminders delivered to clinicians at the point of care.	28 studies Outcomes: Process adherence outcomes and clinical outcomes (dichotomous or continuous)	Yes Yes (EPOC checklist)	Computer reminders	Overall: small to modest improvements in process adherence.
Bywood PT, 2008 Strategies for facilitating change in alcohol and other drugs (AOD) professional practice: a systematic review of the effectiveness of reminders and feedback.	To evaluate the effectiveness of reminders and feedback to bring about professional practice change.	15 studies Outcomes: Not specified.	No Yes (EPOC checklist)	Reminders and feedback	Reminders and feedback were found to be effective in prescribing and preventive care. Findings were less consistent for disease management, adherence to guidelines and diagnosis (mixed effects).

Dexheimer JW, 2008 Prompting clinicians about preventive care measures: a systematic review of randomized controlled trials.	To examine whether the amount of computerized reminder systems for preventive care have changed as clinicians increasingly utilize electronic health record systems when providing patient care.	28 RCTs (only 8 papers (13%) of the papers were about online reminders) Outcomes: Not specified.	No Yes (quality checklist)	Reminders	The average increase for paper-based, computerised reminders, combined strategies in delivering preventive care measures ranged between 12 and 14% (paper-based: **14%**, SD=15, range -18 to 46; computer generated: **12%**, SD=13, range -24 to 59; computerised: **13%**, SD=18, range -8 to 60) [total N: 61 RCTs]. Computer-generated prompts were the most commonly implemented reminders (34 studies). Cardiac care (20%, SD=11) and smoking cessation (23%, SD=16) reminders were most effective, followed by blood pressure, cholesterol and vaccination.
O'Brien MA, 2008 Educational outreach visits: effects on professional practice and health care outcomes.	To assess the effects of outreach visits on health professional practice or patient outcomes.	69 RCTs (only included studies with low or moderate risk of bias with baseline measures) Outcomes: Objectively measured professional performance	No Yes (EPOC checklist)	Educational outreach visits (professional)	Overall: small to moderate effects on professional practice, but the effect is variable.

Petersen LA, 2006 Does pay for performance improve the quality of health care?	To assess the effect of explicit financial incentives for improved performance on measures of health care quality.	17 studies Outcomes: Not specified.	No Yes (Downs and Black quality assessment)	Financial	Some positive effects of financial incentives at the physician level, the provider group level and the health care payment system level.
Nagykaldi Z, 2005 Practice facilitators: a review of the literature.	To review the literature on practice facilitators and describe their origin, training, funding, roles, methods they use, and their impact on patient care outcomes in primary care.	47 studies Outcomes: Not specified.	No Yes (PEDro)	Organisational	Many prospective, uncontrolled studies and a few RCTs have documented the effectiveness of practice facilitators but usually in combination with other interventions.
Cauffman JG, 2002 Randomized controlled trials of continuing medical education: what makes them most effective?	To determine which educational interventions effectively influence physician performance.	20 RCTs Outcomes: Any.	No No	Educational (professional)	The most effective educational strategies used multiple interventions, two-way communications, printed and graphic materials in person, and locally respected health personnel as educators. Statistically significant findings more often related to physician performance than to patient health outcomes.
Horrocks S, 2002 Systematic review of whether nurse practitioners	To determine whether nurse practitioners can provide care at first point of contact equivalent to doctors	34 (11 trials and 23 observational studies)	Yes Yes (EPOC risk of bias)	Organisational	Meta-analysis showed that nurse practitioners undertook significantly more investigations (pooled ORs=1.22, 95% CI 1.02 to 1.46) (n=5) (heterogeneity

working in primary care can provide equivalent care to doctors.	in a primary care setting.	Outcomes: patient satisfaction, health status, costs and process of care.			p=0.18) and had longer consultations than doctors (weighted MD = 3.67, 95% CI 2.05 to 5.29) (heterogeneity p=<0.00001) (n=5). No significant difference in the number of prescriptions made, number of referrals and return consultations.
Qureshi N, 2002 A systematic review of educational outreach visits for non-prescribing interventions in general practice.	To determine the effectiveness of educational outreach visits (EOV) for non-prescribing interventions in general practice.	7 (of which 6 were RCTs) Outcomes: Information on professional performance	No Yes (EPOC criteria)	Educational outreach (professional)	Educational outreach visit has a positive effect on the process of care but its clinical relevance remains unclear.
Weingarten SR, 2002 Interventions used in disease management programmes for patients with chronic illness – which ones work? Meta-analysis of published reports.	To systematically evaluate the published evidence regarding the characteristics and effectiveness of disease management programme.	102 studies	Yes Unclear	Any	Provider feedback (32/118 programmes). Pooled effect size 0.17, 95% CI 0.10 to 0.25. Reminders (pooled effect size 0.22, 95% CI 0.1 to 0.37) Education of healthcare providers (47/118 programmes) Provider education (pooled effect size 0.35, 95% CI 0.19 to 0.51) Disease management for depression had the highest % of programmes with significant benefit (9/14). Programmes with provider education components significantly

					improved provider adherence to guidelines.
Gosden T, 2001 Impact of payment method on behaviour of primary care physicians: a systematic review	To review the impact of payment systems on the behaviour primary care physicians.	6 studies Outcomes: Not specified	No Yes	Financial	Some evidence to suggest how a physician is paid does affect his/her behaviour.
Chaix-Couturier C, 2000 Effects of financial incentives on medical practice: results from a systematic review of the literature and methodological issues.	To identify all financial incentives that had been proposed, described, or used regardless of their initial objective and to assess the results of these incentives on costs, process or outcomes of care.	89 studies Outcomes: Not specified	No Yes (EPOC)	Financial	Any form of fund holding or capitation decreased the total volume of prescription by 0-24%, and hospital days by up to 80% compared with fee-for-service. In areas when more services need be provided, fee-for-service could be appropriate, whereas capitation or fund-holding may be used to reduce spending for an over-serviced population. Financial incentives can be used to reduce the use of health care resources, improve compliance with practice guidelines or achieve a general health target. It may be effective to use incentives in combination depending on the target set for a given health care programme.
Giuffrida A, 2000	To evaluate the impact of target payments on	2 studies	No	Financial	The studies identified in the review are not of sufficient

Target payments in primary care: effects on professional practice and health care outcomes.	the professional practice of primary care physicians and health care outcomes.	Outcomes: Objective measurement of patient outcomes, health services utilisation, health care costs, equity of care and primary care physicians satisfaction with working environment.	Yes		quality to suggest whether target payment was effective in improving quality of care.
Davies A, 1999 Impact of formal continuing medical education. Do conferences, workshops, rounds and other traditional continuing education activities change physician behaviour or health care outcomes?	To review, collate, and interpret the effect of formal CME interventions on physician performance and health care outcomes.	14 RCTs Outcomes: objective determination of health professional performance in the workplace and/or health care outcomes.	Yes No	Educational (professional)	Some evidence show interactive continuing medical education sessions that enhance participant activity and provide the opportunity to practise kills can affect change in professional practice [total N: 14 trials]. Didactic sessions (lectures with minimal interaction/discussion) do not appear to be effective in changing physician performance.
Freudenstein U, 1999 Recommendations for future studies: a systematic review of educational	To determine whether educational interventions targeted specifically at primary care were effective, extract information about the resources	26 (18 RCTs, 1 interrupted time series, 7 controlled before and after studies) Outcomes:	No Yes (Cochrane methodological criteria for selection of	Educational (professional)	Educational interventions involving primary care physicians (such as small group teaching, educational visit, mailed guidelines, newsletter, audio visual materials, facilitated group meetings oh

interventions in primary care settings.	used for educational interventions, categorise the ways in which the target groups for educational interventions were identified.	Not specified	retrieved studies)		physicians and facilitator attached to individual practice) can be effective in changing clinical behaviour.
Balas EA, 1996 The clinical value of computerised information services: a review of 98 randomised clinical trials.	To review all randomised clinical trials addressing the efficacy of clinical information systems.	98 RCTs Outcomes: Process of care	No Yes	Reminders	Physician reminders are effective and are active ingredients of computer systems.
Balas EA, 1996 Effect of physician profiling on utilization meta-analysis of randomized clinical trials.	To assess the clinical effect of peer-comparison feedback intervention (profiles) in changing practice patterns.	12 RCTs Outcomes: Not specified	Yes Yes	Feedback	Overall OR= 1.09, 95% CI 1.045 to 1.14 Profiling has a statistically significant, but minimal effect on the utilisation of clinical procedures.
Oxman AD, 1995 No magic bullets: a systematic review of 102 trials of interventions to improve professional practice.	To determine the effectiveness of different types of interventions in improving health professional performance and health outcomes.	102 randomised or quasi randomised trials Outcomes: Objective measurements of health professional performance or health outcomes	No No	Any	Dissemination-only strategies, such as conferences or the mailing or unsolicited materials, demonstrated little or no changes in health professional behaviour when used alone. More complex interventions, such as the use of outreach visits, or local opinion leaders, A&F and reminders ranged from

					ineffective to highly effective but were most often moderately effective (-20% to +50% in the incidence of appropriate performance).
Yano EM, 1995 Helping Practices reach primary goals.	To review programs to enhance the quality and economy of primary care.	36 studies Outcomes: Improvement in performance, access, health outcomes	No Yes	Any	Computer generated reminders, A&F, social influence-based methods (academic detailing, expert review) fostered preventive and economic care. Nurse implementation of prevention (screening) protocols increased their performance.
Austin SM, 1994 Effect of physician reminders on preventive care: meta-analysis of randomized clinical trials.	To assess the clinical value of the physician reminder, in increasing compliance for selected preventive health care measures.	4 RCTs Outcomes: Change in the process and/or outcome of patient care.	Yes (meta-analysis) No	Reminders	Meta-analysis indicated that physician reminders are effective intervention and can improve compliance for screening and vaccination preventive care procedures.
Davis DA, 1992 Evidence for the effectiveness of CME A review of 50 randomized controlled trials.	To assess the impact of diverse continuing medical education on physician performance and health care outcomes.	50 RCTs Outcomes: Objective assessments of physician performance or health care outcomes	No No	Educational (professional)	CME using practice-enabling (facilitating the desired change in the practice site) or reinforcing strategies (by reminders and feedback) consistently improve physician performance
Mugford M, 1991	To establish what is known about the role	36 studies	No	Feedback	Feedback of information most probably influences clinical

Effects of feedback of information on clinical practice: a review	of feedback of information in changing clinical practice.	Outcomes: Not specified.	No		practice if it is part of an overall strategy which targets decision makers who have already agreed to review their practice and it's likely to have a more direct effect on practice if presented close to the time of decision making.
Waddell DL, 1991 The effects of continuing education on nursing practice: a meta-analysis.	To determine the extent to which CME has had a positive effect on nursing practice	Unclear Outcomes: Not specified	Yes No	Educational (professional)	CME positively affects nursing practice, with an overall average effect size of 0.73, using Cohen's d.
Beaudry JS, 1989 The effectiveness of continuing medical education (CME): a quantitative analysis.	Is there consistent evidence that CME is an effective means for improving physician knowledge and performance?	41 studies Outcomes: Not specified	Yes No	Educational (professional)	CME showed positive effects for physician performance (ES=0.55; SD=0.45)

Appendix 9 : Systematic review 2: Quality assessment of benchmark papers

Author, year	**Quality checklist used (e.g. PRISMA)?**	**Clear <u>title</u> and <u>abstract</u> with structured summary?**	**<u>Introduction</u>** **Clear rationale and objectives?**	**<u>Methods</u>** **1. Clear eligibility criteria** **2. Information sources and search** **3. Study selection** **4. Data extraction process** **5. Risk of bias in individual studies** **6. Summary measures (if applicable)** **7. Adequately described quantitative data synthesis (if applicable)** **8. Risk of bias across studies** **9. Additional analyses (if applicable)**	**<u>Results</u>** **1. Study selection** **2. Study characteristics** **3. Risk of bias within/across studies** **4. Results of individual studies** **5. Quantitative synthesis of results (if applicable)** **6. Additional analyses (if applicable)**	**<u>Discussion</u>** **1. Summary of evidence** **2. Limitations** **3. Conclusions**	**Comments**
Baskerville NB, 2012	√ Modified version of the physio-therapy evidence based database	√	√	1. √ 2. √ 3. √ 4. X 5. √ 6. √ 7. √ 8. X	1. √ 2. √ 3. √ (not across studies) 4. √ 5. √ 6. √	1. √ 2. √ 3. √	Practice facilitation studies contained different intervention components, settings, outcomes and measures. There is evidence of publication bias.

	(PEDro) method (12 criteria)			9. √			
Giguère, 2012	√ (EPOC checklist)	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. √ 7. √ 8. √ 9. √	1. √ 2. √ 3. √ 4. √ 5. √ 6. √	1. √ 2. √ 3. √	Quality of the evidence across studies (GRADE) was graded low as the studies included had unclear sequence generation, unclear addressing of incomplete outcome data and imprecision of the observed effect
Ivers N, 2012	√ Revised EPOC criteria and GRADE	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. √ 7. √ 8. √ 9. √	1. √ 2. √ 3. √ 4. √ 5. √ 6. √	1. √ 2. √ 3. √	Quality of the evidence across studies (GRADE) was graded moderate. Excluded studies at high risk of bias. Across studies, the median effect size was weighted by the number of health professionals involved in the trial reported to ensure that very small trials did not contribute the same

							to the overall estimate as larger trials. The summary statistics in the meta-analyses reported as weighed median adjusted RD or weight median adjusted change relative to baseline control are weighted by the number of health professionals,
Flodgren G, 2011	√ (EPOC checklist)	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. √ 7. √ 8. √ 9. √	1. √ 2. √ 3. √ 4. √ 5. √ 6. √	1. √ 2. √ 3. √	Quality of the evidence across studies (GRADE) was graded low.
Scott, 2011	√ (Cochrane EPOC risk of bias)	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. N/A 7. N/A 8. √	1. √ 2. √ 3. √ 4. √ 5. N/A 6. N/A	1. √ 2. √ 3. √	Results need to be interpreted with caution due to, for example: Majority of the significant effect is found on one outcome out of a

				9. N/A			range of quality measures used in each study; there were significant heterogeneity in terms of types of financial incentives used, contexts in which they were implements and types of outcome measures. The RCTs were randomised at the medical group/clinical practice level, but quality of care was analysed at the patient level (non-randomised). There was a lack of information about how payments to physician groups were distributed or used within the groups. The evidence was generally of low quality. Where few theory-linked components

							can be identified across interventions, little can be revealed about the effectiveness of these components because models may be underfitted due to insufficient statistical power. This problem can be compounded where there are insufficient data to control for study-level covariates.
Baker R, 2010	√ EPOC checklist	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. √ 7. √ 8. √ 9. √	1. √ 2. √ 3. √ 4. √ 5. √ (meta-regression) 6. √	1. √ 2. √ 3. √	Quality of the evidence across studies (GRADE) was graded moderate. There is wide variation in effectiveness between studies and between targeted behaviours within single studies, from lack of effect to relatively large effect. It may be explained

							by the variety of barriers identified and addressed in the studies, the variety of clinical settings and targets behaviours; there is also a lack of consistency in the methods used within the tailored strategy.
Forsetlund L, 2009	√ (EPOC checklist)	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. √ 7. √ 8. √ 9. √	1. √ 2. √ 3. √ 4. √ 5. √ 6. √	1. √ 2. √ 3. √	Quality of the evidence across studies (GRADE) was graded moderate.
Shojania KG, 2009	EPOC checklist	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. √ 7. √ 8. X 9. √	1. √ 2. √ 3. √ (not across studies) 4. √ 5. √ 6. √	1. √ 2. √ 3. √	Heterogeneity of the interventions and the variable degree with which they were reported, including limited descriptions of key intervention features of the reminders and the systems through

							which they were delivered. Limited descriptive detail of complex interventions and the resulting potential for substantial heterogeneity among included interventions in systematic reviews
O'Brien MA, 2007	√ (EPOC)	√	√	1. √ 2. √ 3. √ 4. √ 5. √ 6. √ 7. √ 8. X 9. √	1. √ 2. √ 3. √ (not across studies) 4. √ 5. √ 6. √	1. √ 2. √ 3. √	

Appendix 10: Systematic review 2: Summary of the effects of single strategies (professional-, organisational- and context-levels) and multifaceted strategies on adherence to desired practice

Strategy	**Benchmark review Author, year (reference)**	**Outcome**	**Benchmark review results - Single strategy alone vs. no strategy**	**Benchmark review - Details**	**Benchmark review - Overall conclusion**	**Benchmark review - Other comparisons**	**Benchmark reviews vs. other (non-benchmark) reviews** **Overall results consistent with other relevant reviews[1]?**
Professional-level strategies							
Audit and feedback (A&F)	Ivers N et al., 2012	Compliance with desired practice	**D**[1,2]: Median absolute risk difference (RD) [3,5]= 3% (IQR 1.8 to 7.7%)	26 RCTs [661 clusters/groups of health providers and 605 health professions]; low-moderate risk of bias	Small (range: small to modest)	A&F with or without other strategies vs. no strategy: **D**[2]: Median RD [3,5]= 4.3% (IQR 0.5 to16.0%) [49 RCTs]	Yes (Gardner, Whittington, McAteer, Eccles, & Michie, 2010; Dulko, 2007; Mugford, Banfield, & O'Hanlon, 1991; Unverzagt, Oemler, Braun, & Klement, 2014; Okelo et al., 2013; Schichtel, Rose, & Sellers, 2013; Medves et al., 2010; Akbari et al., 2008; Grimshaw et al., 2004; McKenna et al., 2004; Weingarten et al., 2002; Gross & Pujat, 2001; Gill et al., 1999; Yano, Fink, Hirsch, Robbins, & Rubenstein, 1995; Bywood, Lunnay, & Roche, 2008; Xyrichis & Lowton, 2008; Zwar et al., 2006b; Davis & Taylor-Vaisey, 1997; Balas et al., 1996b)

			C[2]: Median percentage change relative to baseline control[3] = 1.3% (IQR=1.3 to11%)	13 RCTs; low-moderate risk of bias	Not applicable	A&F with or without other strategies vs. no strategy: Median percentage change relative to baseline control[3] = 1.3% (IQR=1.3 to 28.9%) [21 RCTs]	
Physician reminder	Shojania et al., 2009 Computer reminder (delivered at the point of care)	Improvement in process adherence	**D**[1,2]: Median RD[4]= 5.7% (IQR 2.0 to 24%)	18 RCT/ quasi-randomised design	Modest (range: small to large)	Computer reminders with other strategies vs. other strategies alone: **D**[2]: Median RD[4]= 1.9% (IQR 0.0 to 6.2%) [n trials not reported]	Yes (Bywood et al., 2008; Dexheimer, Talbot, Sanders, Rosenbloom, & Aronsky, 2008; Balas et al., 1996a; Austin, Balas, Mitchell, & Ewigman, 1994; Unverzagt et al., 2014; Schichtel et al., 2013; Van et al., 2012; Nam et al., 2011; Glynn, Murphy, Smith, Schroeder, & Fahey, 2010; Medves et al., 2010; Grimshaw et al., 2004; Hulscher, Wensing, van der Weijden, & Grol, 2006; Bauer, 2002; Weingarten et al., 2002; Kupets & Covens, 2001; Beilby & Silagy, 1997; Conroy & Shannon, 1995; Mandelblatt & Kanetsky, 1995; Yano et al., 1995; Soumerai, McLaughlin, & Avorn, 1989; Harvey, Glenny, Kirk, & Summerbell,

							2002; Vernon, McQueen, Tiro, & del Junco, 2010; Holden, Jonas, Porterfield, Reuland, & Harris, 2010)
			C[2]: not reported		Not applicable	**C**[2]: not reported.	
Educational outreach visits (EOV)	O'Brien et al., 2007	Professional practice	**D**[1,2]: Median RD[4,5] = 5% (IQR 3 to 6.2%)	19 RCT; low-moderate risk of bias	Small (range: small to modest)	EOV with or without other strategies vs. no strategy: **D**[2]: Median RD[4,5] = 5.6% (IQR 3 to 9%) [28 RCTs]	Yes (Grimshaw et al., 2004; Qureshi, Allen, & Hapgood, 2002; Freudenstein & Howe, 1999; Schichtel et al., 2013; Koch & Iliffe, 2011; Lineker & Husted, 2010; Medves et al., 2010; Anderson & Jane-Llopis, 2004; Gross & Pujat, 2001; Gill et al., 1999; Beilby & Silagy, 1997; Conroy & Shannon, 1995; Yano et al., 1995; Soumerai et al., 1989; Davis & Taylor-Vaisey, 1997)
			C[2]: Median adjusted change = 23% (IQR 12 to 39%)	15 RCTs; low-moderate risk of bias	Not applicable	**C**[2]: Median adjusted change = 21% (IQR 11 to 41%) [17 RCTs]	
Educational meetings and workshops (including continuing medical education)	Forsetlund et al., 2009	Compliance with desired practice	D[1,2]: Median RD[3,5] = 6% (IQR 2.9 to 15.3%)	19 RCTs; low-moderate risk of bias	Modest (range: small to moderate)	Educational meetings with or without other strategies vs. no strategy: D[2]: Median RD[3,5] = 6% (IQR 1.8 to 15.9%) [30 RCTs]	Yes (Unverzagt et al., 2014; Schichtel et al., 2013; Thomas et al., 2006; Cauffman et al., 2002; Davies, O'Brien, Freemantle, & Wolf, 1999; Freudenstein & Howe, 1999; Waddell,

							1991; Beaudry, 1989; Davis, Thomson, Oxman, & Haynes, 1992; Gual & Sabadini, 2011; Glynn et al., 2010; Lineker & Husted, 2010; Medves et al., 2010; Perry et al., 2011; Hulscher et al., 2006; Gilbody, Whitty, Grimshaw, & Thomas, 2003; Weingarten et al., 2002; Oxman, Thomson, Davis, & Haynes, 1995; Flodgren et al., 2010; Pippalla, Riley, & Chinburapa, 1995; Nilsen et al., 2006; Gould, Moralejo, Drey, & Chudleigh, 2010; Goodwin, Jones-Hughes, Thompson-Coon, Boddy, & Stein, 2011; Zwar et al., 2006b; Davis & Taylor-Vaisey, 1997)
			C[2]: Median adjusted % change relative to the control group 10% (IQR 8 to 32%)	5 RCTs	Not applicable	C[2]: Median adjusted % change relative to the control group 10% (IQR 9 to 24%) [8 RCTs]	
Local opinion leaders	Flodgren et al., 2011a	Compliance with desired practice	D[1,2]: Median RD[4,5] = 9% (IQR -15 to +38%)	5 RCT; high risk of bias	Modest and variable (range from negative, no effect, to small and	Local opinion leaders alone or together with other strategies vs. no intervention or other strategies alone	Mostly consistent: mixed effects (Schichtel et al., 2013; Medves et al., 2010; McKenna et al., 2004; Conroy & Shannon,

					large effects) Unclear due to inconsistent and limited evidence.	D[2]: Median RD[4,5] = 12% (IQR 6 to 14.5%) [15 RCTs]	1995; Soumerai et al., 1989; Davis & Taylor-Vaisey, 1997)
			C[2]: not reported			C[2]: not reported	
Printed educational materials (majority studies disseminated passively)	Giguère et al., 2012	Professional practice	**D**[1,2]: Median RD[4]= 2% (IQR -0.6 to 29%)	7 studies; low quality	Small and variable (range: negative, no effect, to small and large effects)		Mixed but mostly consistent. (Freudenstein & Howe, 1999; Schichtel et al., 2013; Medves et al., 2010; Akbari et al., 2008; Smolders et al., 2008; Grimshaw et al., 2004; McKenna et al., 2004; Gross & Pujat, 2001; Gill et al., 1999; Conroy & Shannon, 1995; Oxman et al., 1995; Grimshaw & Russell, 1993; Soumerai et al., 1989; Pippalla et al., 1995; Nilsen et al., 2006; Lomas, 1991; Davis & Taylor-Vaisey, 1997)
			C[2]: SMD 13% (IQR 16 to 196%)	3 studies; low or very low quality			
Organisational-level strategies							
Revising professional roles	No benchmark review identified.	(Arroyave, Penaranda, & Lewis, 2011; Van et al., 2012; Franx, Dixon, Wensing, & Pincus, 2013; Horrocks, Anderson, & Salisbury, 2002; Yano et al., 1995; Gilbody et al., 2003)					

Facilitation	Baskerville et al., 2012	Compliance with desired practice	SMD[2] = 0.56 (95% CI, 0.43 to 0.68) (*z* = 8.76; *P* <.001) (I^2=20%) OR=2.76 (95% CI 2.18 to 3.43) (non-significant heterogeneity, p=0.19)	20 RCTs and 3 CCTs [1,398 participants]; high quality	Effective (consistent)	Not applicable	Yes (Franx et al., 2013; Nagykaldi, Mold, & Aspy, 2005; Thomas, Russell, & Lorenzetti, 2010; Langberg et al., 2009)
Context-level strategies							
Financial strategies	Scott et al., 2011	Professional behaviours	<u>All types of financial incentives, provided by primary care physicians</u> Uncertain (no combined/ overall effect size) Authors' conclusion: different financial interventions had positive but modest and variable effects on a small number of outcome measures of quality of health care [7 studies]	7 studies	Variable High uncertainty	Not applicable	Yes. Some subsequent reviews presented positive results and some showed no effect or mixed results. (Van et al., 2010; Petersen, Woodard, Urech, Daw, & Sookanan, 2006; Town, Kane, Johnson, & Butler, 2005; Gosden et al., 2001; Chaix-Couturier, Durand-Zaleski, Jolly, & Durieux, 2000; Giuffrida et al., 2000; Thomas et al., 2010; Akbari et al., 2008; Okelo et al., 2013; Franx et al., 2013)
Regulatory strategies	None identified.		Not applicable	Not applicable			Not applicable

Others							
Multifaceted strategies	No benchmark review identified.	Multifaceted strategies likely to be more effective (Thomas et al., 2006; Cauffman et al., 2002; Howe, Ashton, & Hooper, 2006; Tooher, Middleton, & Babidge, 2003; Bauer, 2002; Renders et al., 2001; Smolders et al., 2008; Williams et al., 2011; Hulscher et al., 2006; Snell & Buck, 1996; Rawl, Menon, Burness, & Breslau, 2012; Anderson & Jane-Llopis, 2004; Gagnon et al., 2009; Franx et al., 2013; Comino et al., 2012; Boonacker, Hoes, Dikhoff, Schilder, & Rovers, 2010; Gill et al., 1999; Davis & Taylor-Vaisey, 1997; Gilbody et al., 2003) Multifaceted less or just as effective/ unclear (Ivers et al., 2012; Unverzagt et al., 2014; Okelo et al., 2013; Shojania et al., 2009; O'Brien et al., 2007; Forsetlund et al., 2009; Dulko, 2007; Flodgren et al., 2011; Brusamento et al., 2012; Grimshaw et al., 2004)					
Tailored strategies to identified barriers	Baker et al., 2010	Compliance with desired practice	Pooled adjusted OR[2] = 1.54 (95% CI 1.16 to 2.01) from the Bayesian analysis Pooled OR = 1.52 (95% CI 1.27 to 1.82) p<0.001 from the classical analysis	12 RCTs [2,189 participants] (moderate quality)	Not applicable	Not applicable	No other review identified

Appendix 11: Systematic review 2: Features appeared to be associated with successful implementation

Strategy	Active features/ characteristics	Inactive features/ characteristics
Printed educational materials	• Tailoring • Purpose (e.g. increase or decrease in, modification of behaviour) • Type of targeted behaviour • Clinical area • Format **based on very limited evidence and box plots presented only.*	• Mode, • Frequency, • Duration of delivery are not associated with improvement in outcomes **due to the lack of variability, not able to assess the importance of these characteristics to determine PEM effectiveness.*
Educational strategies	• Mixed interactive and didactic formats High attendance at educational meetings • Low complexity of the targeted behaviour • Tailoring • Relevance or identify needs with a facilitator • Interaction/ active participation • Facilitate and (small) team based • Training support • Management support • Clear goals • Led by senior colleagues/ superior • Intensity and frequency • Programmes directed at trainee physicians • Focus on serious outcomes	• Didactic sessions/ lectures alone • Seminar based sessions • High complexity of the targeted behaviour • Minimal interaction/ discussion • Passive strategies (e.g. mailed educational materials) • Programmes directed at established physicians
Educational outreach visits	• Most effective when the educators are known to and respected by the target group.	No data reported.
Audit and feedback (A&F)	• Source- ($p<0.001$) supervisor/senior colleague • Format - ($p=0.02$) feedback provided both verbally and written • Measurable targets and action plan ($p<0.001$) • Timing – concurrent feedback, presented close to the time of decision making	• Effect size was not influenced by the number of implementation strategies in addition to A&F. A&F alone vs. A&F in a multifaceted intervention: not significant; Dichotomous: estimated absolute different in adjusted RD=3.3%, $p=0.27$)

	• Active • Tailoring • Part of an overall strategy • Low/ non-existent baseline	
Practice facilitation	• Tailoring to the context and needs of the practice (SMD=0.62, 95% CI=0.48 to 0.75) (p=0.05) • Higher intensity of the intervention (average number of contacts by the average meeting time in hours) (p=0.03) • Smaller number of practices per facilitator (p=0.004)	• No tailoring (SMD=0.37, 95% CI=0.16 to 0.58) • Lower intensity of the intervention • Larger number of practices per facilitator
Financial strategies	• Larger size of payment • Clear goal • Low complexity of task • Concurrent or intermittent payment • Sustainability of new behaviour - Incentives may only buy temporary priority • Positive effect was greater for initially low performers (low baseline performance, more room for improvement) compared to already high performers • Involvement of stakeholders in target selection and incentive program development • Context (national level gave more uniform results than fragmented programmes) • Design choices (process indicators gave higher improvement than outcome measures) • High awareness of the existence of an incentive program • Incentives based on financial rewards only showed more positive effects	• Size of payment - Small rewards may not motivate doctors to change their behaviour or practices. • High complexity of task • End of year payment (infrequent performance feedback) • Continuing adding additional funding or payment in the long term is not effective. • Low awareness of the existence of an incentive program • Incentives based on a competitive approach (reward for high performers, as well as penalty for low performers)
Local opinion leaders	• Multidisciplinary opinion leader teams	• Single opinion leaders

Appendix 12 : Systematic review 2: Mapping of reviews identified in our systematic review of reviews to the ERIC refined compilation of strategies for implementing change

Strategies	P/O/C/IP[1]	Systematic review(s) on effectiveness? (Y/N)
Access new funding	C	N
Alter incentive/ allowance structure	C	Y
Change accreditation or membership requirements	C	N
Change liability laws	C	N
Create or change credentialing and/or licensure standards	C	N
Develop disincentives	C	Y (implicit)
Develop resource sharing agreement	C	N
Fund and contract for the clinical innovation	C	N
Increase demand	C	N
Making billing easier	C	N
Mandate change	C	N
Place innovation on fee for service lists	C	Y
Use capitated payments	C	Y
Use other payment schemes	C	Y
Use advisory boards and workgroups	C	N
Assess for readiness and identify barriers and facilitators	O	Y (Implicit)
Build a coalition	O	N
Capture and share local knowledge	O	N
Centralise technical assistance	O	N
Change physical structure and equipment	O	N
Change service sites	O	N
Conduct local needs assessments	O	N
Create a learning collaborative	O	N
Start a dissemination organisation	O	N
Create new clinical teams	O	N
Identify and prepare champions	O	N
Recruit, designate and train for leadership	O	N
Identify early adopters	O	N
Obtain formal commitments	C/O	N
Involve executive boards	C/O	N
Organise clinician implementation team meetings	O	N
Revise professional roles	O	Y
Promote network weaving	O	N
Use an implementation advisor	O	N
Facilitation	O	Y
Providing ongoing consultation	O/P	N
Audit and provider feedback	P	Y

Conduct educational meetings	P	Y
Conduct local consensus discussions	P	Y
Develop educational materials	P	Y
Inform local opinion leaders	P	Y
Making training dynamic	P	Y
Remind clinicians	P	Y
Shadow other experts	P	N
Provide clinical supervision	P	N (developing countries only)
Visit other sites	P/O	Y (educational outreach)
Use train-the-trainer strategies	P/O	N
Model and simulate change	IP	N
Conduct cyclical small tests of change	IP	N
Develop a formal implementation blueprint	IP	N
Develop an implementation glossary	IP	N
Promote adaptability	IP	N
Purposely re-examine the implementation	IP	N
Stage implementation scale up	IP	N
Develop academic partnership	Others	N
Work with educational institutions	Others	N
Tailor strategies	Others	Y
Use data experts	Others	N

Appendix 13 : Study invitation letter/ email

Managing/ implementing change in General Practice

We are studying *how different practices manage and implement change*, and are asking you for your help to do this.

As you are aware, general practices in England are being overwhelmed with rapid complex changes; at the same time, there is top-down pressure to adopt new or modified ways of delivering care (use of "innovations/ new interventions").

Why your participation is important

The findings of this study will be used to:

- Demonstrate how practices are responding to this challenge and how they innovate or implement change
- Illustrate some of the difficulties you and your practice face and describe strategies associated with success

We hope that this information can be used by NHS policy makers, CCGs and others to understand the realities of change and acknowledge the pressures GPs face, as well as sharing good practice.

What would it mean for your practice?

- A researcher would sit in and observe a series of practice activities (e.g. practice meetings) and keep notes.
- **No** patient identifiable data will be recorded.
- Some staff members (e.g. practice managers, nurses, GPs, reception staff) will be invited to take part in a short interview (each interview will be approximately 15-20 minutes). These interviews are voluntary.
- Each practice could be reimbursed **up to £480***, as a gesture of appreciation for the time given to the research (this includes access to meetings and interviews).
- If you do take part, your practice will **not** be identified in any reports or journal articles. All data will be anonymised and kept confidential.
- **Taking part in this research will not make extra work for the practice.**

**The level of reimbursement will depend upon the overall involvement of practice staff.*

If you are interested in taking part, an initial visit to your practice or a telephone meeting will be arranged.

Funding and ethics

The study is being carried out by researchers at University College London (UCL) and is funded by the National Institute for Health Research School for Primary Care Research (NIHR SPCR). This study has been reviewed and approved by UCL Research Ethics Committee.

If you need further information please contact:
Ms Rosa Lau, researcher (email: r.lau@ucl.ac.uk)

Your views and experience are important. Thank you for considering taking part in this study.

UCL Research Department of Primary care and Population Health, e-Health Unit
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Appendix 14 : Participation information sheet and consent form – observation study

CONSENT FORM 11.11.2014 (Version 1)

Participant Identification Number:

Study Title: Exploring how multiple complex interventions are implemented in general practice - Observation study.

Please initial box

1. I confirm that I have read and understand the participant information sheet dated 11.11.2014 (version 1) for the above study. I have had the opportunity to consider the information, ask questions and have had answered satisfactorily. ☐
2. I understand that participating in the study involves providing researchers with information through observations. ☐
3. I understand that all information that I provide while taking part in this study will be kept confidential and stored securely in accordance with the Data Protection Act 1998. ☐
4. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐
5. I understand that I can decline to answer any question that I am asked. ☐
6. I understand that my name and identity will not be used in any publications or discussions and my name will not be on any transcripts resulting. ☐
7. I agree to take part in this study. ☐

Name of participant: _____

Signature of participant: _____ Date: _____

Name of researcher taking consent	Signature	Date
_____	_____	_____

You will be given a copy of your signed consent form to keep for your records.

Appendix 15: Practice form

FACT SHEET – PRACTICE

[Note: Please complete as much as you can. Any additional information would be very helpful.]

NAME OF PRACTICE

_____

CCG LOCALITY

_____

LOCATION

_____

1. TYPE OF PRACTICE
   - ☐ Inner city
   - ☐ Suburban
   - ☐ Rural practice

2. TEACHING PRACTICE
   - ☐ Yes
   - ☐ No

3. IS THE PRACTICE ETHNICALLY DIVERSE?
   - ☐ Yes
   - ☐ No

Additional information (e.g. largely white/ Asian/ Black):

_____

4. SOCIO-ECONOMIC STATUS OR LEVEL OF DEPRIVATION, e.g. The index of multiple deprivation 2010 or IMD deciles (if this information is available)

_____

5. PRACTICE SIZE

   _____

6. TURNOVER OF STAFF (in the past 5 years)

   _____

7. TURNOVER OF PATIENTS (in the past year)

_____

8. ORGANISATIONAL STRUCTURE

TEAM SIZE: _____

Clinical

No. GP partner(s): _____ No. F/T: _____ No. P/T_____

No. Salaried GP(s): _____ No. F/T: _____ No. P/T_____

No. Locum GP(s): _____ No. F/T: _____ No. P/T_____

No. trainee GP(s): _____ No. F/T: _____ No. P/T_____

No. Nurse practitioner(s): _____ No. F/T: _____ No. P/T_____

No. Specialist nurse(s): _____ No. F/T: _____ No. P/T_____

No. Practice nurse(s): _____ No. F/T: _____ No. P/T_____

Non-clinical

No. Practice manager(s): _____ No. F/T: _____ No. P/T_____

No. Receptionist(s): _____ No. F/T: _____ No. P/T_____

Others (if applicable):

_____

_____

_____

Additional information (if any)

9. TOTAL NUMBER OF SESSIONS

Name of GP	Number of sessions per week

10. TYPE OF MEETINGS

Meeting (e.g. general staff meeting)	Details (e.g. every Monday 1-2pm)

11. INTERVENTION(S) TO BE IMPLEMENTED AND INFO ABOUT THE INTERVENTION(S)

- What is it?
- Type (national, LES/DES, CCG, practice level change)
- Timeframe
- Any relevant docs?

Appendix 16: Observation guide

Exploring how multiple complex interventions are implemented in general practice: observation study.

Observation guide – 11.11.2014 (Version 1)

Date:

Time:

Location:

Activity:

Type of observation (participant/ non-participant):

1. **Space/ setting (e.g. layout, busy, calm, friendly, level of organisation/clear procedures, level of autonomy)**
   Describe what I see and hear in the setting and how I feel about what is taking place.
   Draw and describe the room arrangement (e.g. layout, objects).

2. **Actors/ people (e.g. who is present)**
   Describe their appearances (e.g. age, gender, role/ profession) and assign each person a unique ID.

3. **Describe the organisation routines and procedures**

4. **Descriptions of the activity (e.g. what is it, its purpose, duration, how it happens, outcomes)**

- *Physical behaviour (e.g. how people use their body and voices to communicate different emotions, what people do, who does what, who interacts with whom, who is not interacting)*
- *Verbal behaviours and interactions (e.g. who speaks to whom and for how long; level of involvement, who initiates, tone of voice, emotions, profession of speakers, dynamics of interaction, reactions)*
- *Personal space (e.g. how close people stand to one another – suggest about their relationships)*
- *People who stand out (e.g. who receives more attention from others, what differentiates them from other; whether people consult them or they approach other people)*
- *Time – sequence of events*
- *My impressions/ feelings (e.g. my role during observation)*

Appendix 17: Interview topic guide

INTERVIEW TOPIC GUIDE/QUESTIONS version 1.0 – GPs/Practice managers

[Before turning on the recorder]

[Opening]

- Introduce myself and the session

[Hello, my name is _____, a researcher from Dept of Primary Care at University College London. Thank you for agreeing to take part in an interview in this project.]

- Go through the participant info sheet and briefly introduce participant to the subject of this short interview

[The aim is to understand the context and how the practice implements change, as well as the challenges and successes of adopting and implementing different types of interventions. We want to take this time to talk to you about your views and experiences of implementing change, particularly around the different approaches for improving patient access.]

- Ask for permission to audio record this interview

[This interview will be audio taped so that we have an accurate record of your thoughts. Please be assured that the tapes and your transcript will be anonymised. Nobody in your practice will have access to any of your responses nor be able to connect your responses to you personally.]

[The interview should take around 20 minutes. This interview will cover various topics including…]

- Go through consent form and sign
- Complete a fact sheet (which asks a number of general questions about you)
- Explain that I want to hear their thoughts so please do not hesitate to share whatever they believe might be related to any of the topics.
- If the question is not clear, let me know and I will try to rephrase and ask in a different way.
- Ask if the participant has any questions before the interview starts.

[Turn on the recorder]

Topic areas to be covered:

A. <u>Views on access</u>

[Ask all]

Now, I would like to start the interview by asking you to share your views on 'patient access'.

1. **What is your understanding of the term 'patient access'?**

   Probes:
   - What are the most important aspects of access?
   - What's good access?

2. **What has the practice done in the past or is currently doing to improve access?**

   Probes:
   - Appts, telephone, DNAs, online
   - Who is driving the changes? E.g. patients, practice members, CCG
   - Any learning from other practices or sharing of ideas within CCG/networks/NHSE
   - Examples
   - Challenges

Check to see if you have understood what was said or to get more information

[Now we've talked about your views on patient access, I just want to ask you some questions about evidence.]

B. ROLE OF EVIDENCE

3. **What is your understanding of the term "evidence" and what does it mean to you personally?**

   Probes
   - How important is evidence in your everyday work?
   - How do you use evidence (with reference to access)? Ask them to give an example if possible.
   - What is useful/ not useful evidence (with reference to access)?

[Now I want to move on to implementing or managing change in general terms]

C. IMPLEMENTING/ MANAGING CHANGE

4. **Health care policy and the NHS, e.g. contracts, QOF are changing constantly.**
   a) **To what extent do you feel you can have influence (control) over changes that go on in your practice?**

   Probes
   - Influences from NHS England, CCG, GP network, new primary care co-commissioning (CCG x NHSE)
   - Example

b) What is the impact of these changes on your everyday work?

Probes:
- Fitting "new" work into existing workflow
- In terms of how they work together or communicate with each other as a practice - strategies

5. The General Practice Forward View was published last week, what's your view on it?

[Closure]

[So we've talked about your views about access, different things that the practice is doing to improve access, the role of evidence and issues related to implementing/ managing change.]

[Do you have any other comments about what we have discussed, or about the research as a whole, before we close the interview? Is there anything you feel we haven't covered here that you feel we should give attention to?]

[Turn off the recorder]

- Thank the participant for their time.

Note down the following:

- Participant characteristics (physical appearance, talkative, shy etc.)
- Any notable events during the interview (my behaviour or participants' behaviour)
- My perceptions of the person, my thoughts/emotions
- Any changes I want to make to the topic guide

If I have time:

D. <u>NAMED GP</u>

6. What is your understanding of Named GP?

Probes
- What is it, purpose, driving force (*notice if there is any mention of continuity of care or it being part of the Avoiding Unplanned Admission scheme)
- Views – usefulness, benefits, does everyone need a named GP
- How <u>easy/ hard</u> is it for the patient to see the same GP? How <u>important</u> is it?
- <u>Other ways</u> of ensuring consistency – doctors book in pt to come back and see you or advise pt to book with same doc every time?

- [Receptionist/ admin only: what did you have to do to allocate/ inform each patient]
- (time permitting) Were you here when named GP was implemented? What do you remember from that process? Impact on workload.

E. APPOINTMENT STRUCTURE (GP/ NURSE AVAILABILITY)

7. Based on the data I have gathered from observing meetings and speaking to staff, I noticed that the way in which you develop the appointments structure is very complex – it goes through different iterations and stages of testing.

Practice manager only: Explain what I understand about their current appointment structure (e.g. length of consultation, urgent (same day)/ routine (advanced booking) slots, triage by doctors/ receptionists, extended hours, patient involvement) and verify with practice manager.

a. What are the key challenges?

Probes:

- Contingency plans (staff sick leave, holidays)
- Do they actively review patterns of demand? (eg auditing of filled appointments, extras, DNAs)
- Are there discussions at team meetings? Does whole team get involved?
- Changes driven by PM/partners due to influence from CCG/NHSE?
- What are pressures on PM/partners – financial incentives? How do they feel about that?
- Who is driving the changes?

F. TELEPHONE SERVICES (exclude consultations)

Based on observations:

When a patient calls, the call is just usually about 1) making an appointment 2) test results 3) prescription requests (also sometimes new patient registrations, brief advice sometimes).

8. Do you (receptionists) triage, if so, how do you (they) judge what is urgent/routine?

Probes:

- What training do they receive?
- Patient response to triage by non-clinician

G. ONLINE SERVICES (exclude consultations)

Based on data already collected, your practice is currently offering 1) online appointment booking and/or 2) repeat prescriptions and/or 3) view test results and/or 4) summary care records and/or 5) use of social media for information provision and getting patient feedback

9. What are your views on these online services?

Probes

- Usefulness/ benefits
- Driving force
- Impact on your work
- Challenges
- (time permitting) Were you here when online services were implemented? What do you remember from that process? Were there any issues?

INTERVIEW TOPIC GUIDE/QUESTIONS version 1.0 – Receptionists/admin

[Before turning on the recorder]

- Introduce myself and the session

[Hello, my name is _____, a researcher from Dept of Primary Care at University College London. Thank you for agreeing to take part in an interview in this project.]

- Go through the participant info sheet and briefly introduce participant to the subject of this short interview

[The aim is to understand the context and how the practice implements change, as well as the challenges and successes of adopting and implementing different types of interventions. We want to take this time to talk to you about your views and experiences of implementing change, particularly around the different approaches for improving patient access.]

- Ask for permission to audio record this interview

[This interview will be audio taped so that we have an accurate record of your thoughts. Please be assured that the tapes and your transcript will be anonymised. Nobody in your practice will have access to any of your responses nor be able to connect your responses to you personally.]

[The interview should take around 20 minutes. This interview will cover various topics including…]

- Go through consent form and sign
- Complete a fact sheet (which asks a number of general questions about you)
- Explain that I want to hear their thoughts so please do not hesitate to share whatever they believe might be related to any of the topics.
- If the question is not clear, let me know and I will try to rephrase and ask in a different way.
- Ask if the participant has any questions before the interview starts.

[Turn on the recorder]

Topic areas to be covered:

H. <u>Views on access</u>

Now, I would like to start the interview by asking you to share your views on 'patient access'.

10. What is your understanding of the term 'patient access'?

Probes:

- What are the most <u>important aspects</u> of access?

- What's good access?

11. What has your practice done in the past or is currently doing to improve access?

Probes:

- Appts, telephone, DNAs, online
- Who is driving the changes? E.g. patients, practice members, CCG
- Any learning from other practices or sharing of ideas within CCG/networks/NHSE
- Examples
- Challenges

Check to see if you have understood what was said or to get more information

[I have identified a number of things that practices are doing and I am particularly interested in getting your views on 4 of them: 1) appointment structure, 2) telephone services, 3) online services and 4) named GP. I will start with appointment structure]

I. APPOINTMENT STRUCTURE (GP/ NURSE AVAILABILITY)

12. Based on the data I have gathered from observing meetings and speaking to staff, I noticed that the way in which you develop the appointments structure is very complex – it goes through different iterations and stages of testing.

Practice manager only: Explain what I understand about their current appointment structure (e.g. length of consultation, urgent (same day)/ routine (advanced booking) slots, triage by doctors/ receptionists, extended hours, patient involvement) and verify with practice manager.

a. What are the key challenges?

Probes:

- Who is driving the changes
- Contingency plans (staff sick leave, holidays)
- Do they actively review patterns of demand? (eg auditing of filled appointments, extras, DNAs)
- Are there discussions at team meetings? Does whole team get involved?
- Changes driven by PM/partners due to influence from CCG/NHSE?
- What are pressures on PM/partners – financial incentives? How do they feel about that?
- Who is driving the changes?

J. TELEPHONE SERVICES (exclude consultations)

Based on observations:

When a patient calls, the call is just usually about 1) making an appointment 2) test results 3) prescription requests (also sometimes new patient registrations, brief advice sometimes).

13. Do you (receptionists) triage, if so, how do you (they) judge what is urgent/routine?

Probes:

- What training do they receive?
- Patient response to triage by non-clinician

14. What do you do if patient's test results are not normal?

Probes:

- Who informs the patients? Doctors or receptionists?
- How? Letter or call?
- Any instructions from doctors?

K. ONLINE SERVICES (exclude consultations)

Based on data already collected, your practice is currently offering 1) online appointment booking and/or 2) repeat prescriptions and/or 3) view test results and/or 4) summary care records and/or 5) use of social media for information provision and getting patient feedback

15. What are your views on these online services?

Probes

- Usefulness/ benefits
- Driving force
- Impact on your work
- Challenges
- (time permitting) Were you here when online services were implemented? What do you remember from that process? Were there any issues?

[Now I would like to ask a few questions about Named GP.]

L. NAMED GP

16. What is your understanding of Named GP?

Probes

- What is it, purpose, driving force (*notice if there is any mention of continuity of care or it being part of the Avoiding Unplanned Admission scheme)
- Views – usefulness, benefits, does everyone need a named GP
- [Receptionist/ admin only: what did you have to do to allocate/ inform each patient]
- How easy/ hard is it for the patient to see the same GP? How important is it?
- Other ways of ensuring consistency – doctors book in pt to come back and see you or advise pt to book with same doc every time?
- (time permitting) Were you here when named GP was implemented? What do you remember from that process? Impact on workload.

[Now I want to move on from "access", to implementing or managing change in general terms]

M. IMPLEMENTING/ MANAGING CHANGE

17. Health care policy and the NHS, e.g. contracts and QOF are changing constantly. What is the impact of these changes on your everyday work?

Probes
- Fitting "new" work into existing workflow
- In terms of how they work together or communicate with each other as a practice

[Closure]

[So we've talked about your views about access, different things that the practice is doing to improve access, the role of evidence and issues related to implementing/ managing change.]

[Do you have any other comments about what we have discussed, or about the research as a whole, before we close the interview? Is there anything you feel we haven't covered here that you feel we should give attention to?]

[Turn off the recorder]

- Thank the participant for their time.

Note down the following:

- Participant characteristics (physical appearance, talkative, shy etc.)
- Any notable events during the interview (my behaviour or participants' behaviour)
- My perceptions of the person, my thoughts/emotions
- Any changes I want to make to the topic guide

INTERVIEW TOPIC GUIDE/QUESTIONS version 1.0 – CCG commissioners/ NHSE

[Have printed copies of PIS and consent form]

Thank you for agreeing to speak to me and take part in the interview.

Just want to briefly introduce myself, I am a researcher from UCL based at the Royal Free. I am doing a piece of work looking at implementing change in general practice. I have been spending a couple of months in a few GP practices, trying to understand what they are doing to improve patient access.

Did you have a chance to read through the participant information sheet? I want to take this time to talk to you about your views on a few questions around patient access.

This interview will last around 20 minutes or so. It will be recorded to make sure we have an accurate record of your thoughts. Your transcript or the written version of the interview will be anonymised. [Nobody will have access to any of your responses nor be able to connect your responses to you personally.]

Check if participant has completed the consent form.

Before we start the interview, can I ask you a few general questions about your background?

- What is your current role and main responsibilities?
- Your current role at the CCG?
- How long have you been working in NHSE or CCG primary care commissioning/ service development?

[Ask if I can start the interview]

Questions to cover in the interview:

1. What do you think are the main issues of access at the GP practice level?

2. Who is currently taking the responsibility to improve patient access (decide what to implement)?

3. Who should have a role in improving patient access?

4. Having spent a period of time in a few GP practices, I found that every one of them is implementing different things to improve patient access, e.g. online services, extended hours, changing the telephone system, tweaking the appointment structure, GP triage, telephone consultation etc. There are also some CCG pilots, such as the GP access hub pilot.

INFORMATION ONLY: when there is no same-day appointment availability at the patient's practice, the patient is redirected to go to this particular GP practice, or the 'GP hub'.

a. What do you think is the best approach to maximising the effectiveness of patient access?

5. What is the role of commissioners / CCGs / NHS England in patient access?

6. Last question, can GP practices influence decision making at the CCG level?
    a. Should the CCG involve individual practices in decision making?
    b. How can this be achieved?

I have finished all the questions. Thank you so much. Do you have anything else you would like to share, and or anything you feel I haven't asked.

Appendix 18 : Participation information sheet and consent form – interview study

CONSENT FORM 11.11.2014 (Version 1)

Participant Identification Number:

Study Title: Exploring how multiple complex interventions are implemented in general practice - Interview study.

Please initial box

1. I confirm that I have read and understand the participant information sheet dated 11.11.2014 (version 1) for the above study. I have had the opportunity to consider the information, ask questions and have had answered satisfactorily. ☐
2. I understand that participating in the study involves providing researchers with information through interviews. ☐
3. I understand that all information that I provide while taking part in this study will be kept confidential and stored securely in accordance with the Data Protection Act 1998. ☐
4. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐
5. I understand that I can decline to answer any question that I am asked. ☐
6. I understand that my name and identity will not be used in any publications or discussions and my name will not be on any transcripts resulting. ☐

Name of participant: _____

Signature of participant: _____ Date: _____

Name of researcher taking consent	Signature	Date
_____	_____	_____

You will be given a copy of your signed consent form to keep for your records.

Appendix 19 : Participant fact sheets

FACT SHEET – GPs/PM

NAME OF PARTICIPANT

_____

ORGANISATION

_____

HOW LONG HAVE YOU BEEN WORKING IN THIS ORGANISATION?

_____YEARS _____MONTHS_____

JOB TITLE

_____

MAIN ROLE/ RESPONSIBTILITES

_____
__

OTHER ROLES (or involved in other activities e.g. CCG governing body/ locality, joint primary care co-commissioning, GP network/ federation, medicine management lead)

_____
_

YEARS OF EXPERIENCE SINCE QUALIFICATION OR TRAINING

_____
_____

BACKGROUND/ SPECIAL INTEREST

_____

FACT SHEET – Reception/ admin staff

NAME OF PARTICIPANT

_____

ORGANISATION

_____

HOW LONG HAVE YOU BEEN WORKING IN THIS ORGANISATION?

_____YEARS _____MONTHS_____

JOB TITLE

_____

MAIN ROLE/ DUTIES

_____
____

YEARS OF EXPERIENCE SINCE QUALIFICATION OR TRAINING

_____
_____

Appendix 20 : Published papers

Lau et al. Implementation Science (2016) 11:40
DOI 10.1186/s13012-016-0396-4

Implementation Science

SYSTEMATIC REVIEW Open Access

Achieving change in primary care—causes of the evidence to practice gap: systematic reviews of reviews

Rosa Lau[1*], Fiona Stevenson[1], Bie Nio Ong[2], Krysia Dziedzic[2], Shaun Treweek[3], Sandra Eldridge[4], Hazel Everitt[5], Anne Kennedy[6], Nadeem Qureshi[7], Anne Rogers[6], Richard Peacock[8] and Elizabeth Murray[1]

Abstract

Background: This study is to identify, summarise and synthesise literature on the causes of the evidence to practice gap for complex interventions in primary care.

Design: This study is a systematic review of reviews.

Methods: MEDLINE, EMBASE, CINAHL, Cochrane Library and PsychINFO were searched, from inception to December 2013. Eligible reviews addressed causes of the evidence to practice gap in primary care in developed countries. Data from included reviews were extracted and synthesised using guidelines for meta-synthesis.

Results: Seventy reviews fulfilled the inclusion criteria and encompassed a wide range of topics, e.g. guideline implementation, integration of new roles, technology implementation, public health and preventative medicine. None of the included papers used the term "cause" or stated an intention to investigate causes at all. A descriptive approach was often used, and the included papers expressed "causes" in terms of "barriers and facilitators" to implementation. We developed a four-level framework covering external context, organisation, professionals and intervention. External contextual factors included policies, incentivisation structures, dominant paradigms, stakeholders' buy-in, infrastructure and advances in technology. Organisation-related factors included culture, available resources, integration with existing processes, relationships, skill mix and staff involvement. At the level of individual professionals, professional role, underlying philosophy of care and competencies were important. Characteristics of the intervention that impacted on implementation included evidence of benefit, ease of use and adaptability to local circumstances. We postulate that the "fit" between the intervention and the context is critical in determining the success of implementation.

Conclusions: This comprehensive review of reviews summarises current knowledge on the barriers and facilitators to implementation of diverse complex interventions in primary care. To maximise the uptake of complex interventions in primary care, health care professionals and commissioning organisations should consider the range of contextual factors, remaining aware of the dynamic nature of context. Future studies should place an emphasis on describing context and articulating the relationships between the factors identified here.

Systematic review registration: PROSPERO CRD42014009410

Keywords: Barriers, Complex interventions, Evidence-based practice, Facilitators, Health services research, Implementation research, Primary care, Systematic review

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BMJ Open

Achieving change in primary care—effectiveness of strategies for improving implementation of complex interventions: systematic review of reviews

Rosa Lau,[1] Fiona Stevenson,[1] Bie Nio Ong,[2] Krysia Dziedzic,[2] Shaun Treweek,[3] Sandra Eldridge,[4] Hazel Everitt,[5] Anne Kennedy,[6] Nadeem Qureshi,[7] Anne Rogers,[6] Richard Peacock,[8] Elizabeth Murray[1]

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► Prepublication history and additional material is available. To view please visit the journal (http://dx.doi.org/10.1136/bmjopen-2015-009993).

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ABSTRACT

Objective: To identify, summarise and synthesise available literature on the effectiveness of implementation strategies for optimising implementation of complex interventions in primary care.

Design: Systematic review of reviews.

Data sources: MEDLINE, EMBASE, CINAHL, Cochrane Library and PsychINFO were searched, from first publication until December 2013; the bibliographies of relevant articles were screened for additional reports.

Eligibility criteria for selecting studies: Eligible reviews had to (1) examine effectiveness of single or multifaceted implementation strategies, (2) measure health professional practice or process outcomes and (3) include studies from predominantly primary care in developed countries. Two reviewers independently screened titles/abstracts and full-text articles of potentially eligible reviews for inclusion.

Data synthesis: Extracted data were synthesised using a narrative approach.

Results: 91 reviews were included. The most commonly evaluated strategies were those targeted at the level of individual professionals, rather than those targeting organisations or context. These strategies (eg, audit and feedback, educational meetings, educational outreach, reminders) on their own demonstrated a small to modest improvement (2–9%) in professional practice or behaviour with considerable variability in the observed effects. The effects of multifaceted strategies targeted at professionals were mixed and not necessarily more effective than single strategies alone. There was relatively little review evidence on implementation strategies at the levels of organisation and wider context. Evidence on cost-effectiveness was limited and data on costs of different strategies were scarce and/or of low quality.

Conclusions: There is a substantial literature on implementation strategies aimed at changing professional practices or behaviour. It remains unclear which implementation strategies are more likely to be effective than others and under what conditions. Future research should focus on identifying and assessing the effectiveness of strategies targeted at the wider context and organisational levels and examining the costs and cost-effectiveness of implementation strategies.

PROSPERO registration number: CRD42014009410.

Strengths and limitations of this study

- To the best of our knowledge, this is the most comprehensive systematic review of reviews to examine the evidence on the effectiveness of single or multifaceted strategies for improving implementation of any kinds of complex interventions in primary care. As a result, 91 relevant reviews were included.
- The review addressed a number of questions and was conducted using rigorous and transparent multistep reviewing methods.
- The review reveals most of the existing research focused on strategies that addressed individual-level barriers. Most of these professional-level strategies were associated with small to modest improvement in professional practice and process outcomes. There is a lack of research on organisational-level strategies and context-level strategies.
- It is possible that not all relevant primary research studies were captured by included reviews (especially those published recently), so some findings may be missed by concentrating on reviews.

INTRODUCTION

Internationally the pace of change in healthcare continues to be rapid with a drive to implement more clinically and cost-effective

Appendix 21: Systematic review 2 - Effectiveness of strategies for improving implementation of complex interventions in primary care: a systematic review of reviews

Lau R, Stevenson F, Ong BN et al. Achieving Change in Primary Care – effectiveness of strategies for improving implementation of complex interventions: systematic review of reviews. BMJ Open. 2015; 5(12):e009993. *http://bmjopen.bmj.com/content/5/12/e009993.long*

Introduction

Chapter 2 presented a systematic review of reviews which summarised and synthesised barriers and facilitators to implementation of complex interventions in primary care. In order to fully understand the evidence to practice gap, it is equally important to look at the effectiveness of different strategies in facilitating implementation.

Implementation strategies can be defined as techniques or methods aimed at improving or optimising the uptake and implementation of complex interventions into routine care (Proctor, Powell, & McMillen, 2013). In this paper, I use this definition of implementation strategies, and use the term “strategy” where I focus on implementation, to differentiate from the term “intervention” which I use for the clinical intervention being implemented. The Cochrane Effective Practice and Organisation of Care (EPOC) group has developed the EPOC taxonomy of interventions designed to improve the delivery, practice and organisation of health care services. This taxonomy divides implementation strategies into 1) professional interventions (strategies targeted at professionals), such as printed educational materials, audit and feedback, educational meetings, computerised and non-computerised reminders, educational outreach visits, local opinion leaders; 2)

organisational interventions (strategies targeted at the organisation), such as introducing a new role or way of working; 3) financial interventions (strategies targeted the wider context) such as incentives or changes in reimbursement structure/method and 4) regulatory interventions (strategies targeted at the wider context) such as introduction of or change in policy or legislation (Appendix 5) (EPOC, 2002). Strategies may be used alone or in combination and as described in the EPOC taxonomy, may target health professionals, organisations or wider contextual issues.

A systematic review of reviews was deemed to be the appropriate method to address this complex issue as the literature is substantial and heterogeneous, covering different clinical interventions, populations, clinical domains and outcomes. Existing reviews tend to focus either on a particular type of complex intervention (e.g. introduction of new technologies or promoting uptake and use of guidelines) or on a particular health condition (e.g. mental health or diabetes). No single review provides researchers, managers, clinicians or policy makers with coherent guidance to which strategies are effective at implementing change in primary care.

In this systematic review of reviews, I aimed to identify, summarise and synthesise the available review literature on the effectiveness of implementation strategies for improving uptake of complex interventions in primary care. This review addressed the following questions:

1) What is the effectiveness of single strategies alone in improving uptake of complex interventions in primary care compared with no strategy or alternative single strategy?
2) What is the effectiveness of (particular combinations of) multifaceted strategies in improving uptake of complex interventions in primary care, compared with no strategy, alternative single strategy or other combinations?

3) Are multifaceted strategies more effective than single strategies (or vice versa)?
4) What are the active components of strategies which appear to be associated with success?
5) What is the cost-effectiveness of available implementation strategies?

Methods

Search strategy

A comprehensive electronic search was performed in five databases: MEDLINE, EMBASE, Cumulative Index of Nursing and Allied Health (CINAHL), the Cochrane Library and PsycINFO. I executed the search with the support from a specialist librarian. The search strategy was developed using both medical subject headings, for example, “translational medical research”, “evidence-based practice”, “general practice”, “review”, “review literature as topic” and free-text words, for example, evidence to practice, evidence practice gap, family doctor, implementation, adoption. Articles reported in English and published up to December 2013 were eligible for inclusion in this review. Citation searches were carried out in ISI Web of Science and reference lists of all included articles were screened for additional literature. Details of the search strategy for MEDLINE are provided in Appendix 1.

Eligibility criteria

Eligibility criteria were defined to enable transparent and reproducible selection of papers for inclusion, using the PICO framework.

Population: reviews where at least 50% original studies came from primary care in developed countries.

The Royal College of General Practitioners (RCGP) has defined primary care as "the first level contact with people taking action to improve health in a community" (Royal College of General Practitioners, 2007). Primary care teams are defined as teams or groups of health professionals that include a primary care physician (i.e. general practitioners, family physicians, and other generalist physicians working in primary care settings). I excluded reviews exclusively on secondary care, dental practices, pharmacies or developing countries.

Intervention: use of single or multifaceted strategies to improve implementation of complex interventions that focus on changing clinical practice. Studies that aimed to evaluate the efficacy or effectiveness of new models of care (e.g. collaborative care model for depression care, case management or other integrated care services) were excluded. As this review focused on implementation with the aim of improving health care delivery and / or clinical practice, I excluded strategies aimed at directly changing patients' behaviour.

Comparator: usual care, no strategy, or a different implementation strategy (either single or multifaceted).

Outcome: degree of implementation measures, such as composite professional outcome (e.g. adherence to desired practice), measures of process of care (e.g. referral rates) and professionals' performance (e.g. prescribing, adherence to guidelines). Papers that reported outcomes related to patient health status or change in professionals' knowledge (without any reference to behaviour or performance in practice) only were excluded.

Study types: systematic reviews (structured search of bibliographic and other databases to identify relevant literature; use of transparent methodological criteria; presentation of rigorous conclusions about outcomes), meta-analyses and narrative reviews (purposive sampling of the literature use of theoretical or topical criteria to

include papers on the basis of type, relevance and perceived significance, with the aim of summarising, discussing and critiquing conclusions) (Mair et al., 2012). These reviews were carried out by including quantitative primary studies (e.g. randomised controlled trials, controlled before and after studies) and they are the appropriate study design to investigate the effectiveness of implementation strategies. Original research studies, meta-syntheses of qualitative research papers, secondary analysis of original data (e.g. individual patient data meta-analysis), conference abstracts, editorials and commentary articles were excluded.

Study selection

Duplicate references were deleted. The titles and abstracts of all the records obtained from the search were independently double-screened. I screened all identified citations (titles and abstracts) for potential inclusion; co-authors acted as the second reviewers. I obtained the full text of potentially eligible articles which were assessed for eligibility against the pre-specified inclusion and exclusion criteria by me and my supervisor. Any discordance or uncertainty was resolved through discussion initially and the involvement of a third reviewer as necessary.

Data management and extraction

For all eligible full text articles, I extracted data using standardised structured data abstraction forms. The content of the data abstraction forms were reviewed for validity by the co-authors, who have extensive experience in systematic review methodologies and implementation/ evaluation of complex interventions, to ensure all key important information from the included reviews were captured. Information about the reviews, including title, aims and objectives, setting, review methodology, number of included primary studies, details of analysis, critical appraisal of included primary studies such as the use of any quality assessment tool, and outcome measures were extracted.

Owing to the substantial literature relevant to this review, I developed and applied a systematic, transparent and rigorous method, to enable more effective and efficient data management and synthesis. In brief, this method involved the following steps: 1) sorting papers according to the EPOC taxonomy; 2) selection of a benchmark review paper for each category; 3) selection of important outcomes; 4) data extraction. Selection of a benchmark review was based on pre-determined criteria, namely: rigor of reviewing methodology (quality associated with methods and analysis undertaken), comprehensiveness (scope and breadth of topic) and year of publication (most recent review usually included the highest number of relevant studies). These criteria were developed by all co-authors through consensus, and then applied by me and checked by two other authors independently. For example, Forsetlund et al. (Forsetlund et al., 2009) was chosen as the benchmark review paper for continuing medical education because i) it included the largest number of primary studies covering a number of broad topics, i.e. general management of various health conditions such as prescribing behaviour, preventive care, screening, ii) quality appraisal was conducted using appropriate checklists, iii) adjusted median risk difference and relative percentage change were calculated and iv) the analysis included only primary studies that were of low/moderate risk of bias. I identified six subsequent reviews that were found to be relevant to continuing medical education, all of which conducted narrative synthesis and did not assess the quality of the included primary studies; one had a relatively limited scope of only focusing on older patients. As many benchmark reviews reported large numbers of outcomes of varying relevance, I made the decision to select at least one and no more than three outcomes based on their generalisability, validity and reliability. I operationalised generalisability as the degree to which a given outcome was likely to apply across different settings, validity as the extent to which the measure accurately reflected a desired outcome (e.g. a change in prescribing behaviour was prioritised over a change in knowledge), and reliability as the degree to which the measure was likely

to give similar results if repeated under similar circumstances. As many of these judgements were subjective, I aimed to achieve consensus amongst co-authors using the following process: I extracted all the outcomes from each benchmark review and circulated them to all co-authors, who applied the above criteria to rank the available outcomes. Where there was disagreement between co-authors, further discussion was held until consensus was reached.

Finally, data were fully extracted from each selected benchmark, including characteristics of the review (e.g. aim/objectives, databases searched, topic/ targeted behaviour, selection criteria, outcome measures) and selected outcomes. Data for both dichotomous and continuous outcome measures were extracted. For dichotomous outcomes, the adjusted risk difference (RD) was usually calculated and reported in the reviews. The RD is the difference in outcome between intervention and control group means post-intervention minus the difference between groups before the intervention. For continuous outcomes, the percentage change relative to the control mean post-intervention was usually calculated. This is the adjusted difference between the intervention and control group means divided by the post-intervention control group mean x 100%. Median risk difference or change relative to the control was preferred as the summary estimate is less likely to be driven by possible outlying results (such as large effects from small studies of poor methodological quality). The interquartile ranges (IQR), as a measure of the spread of the data, were also extracted. The results of the remaining relevant reviews in each EPOC category were summarised and entered into the synthesis table. Some papers conducted subgroup analyses and meta-regression on various pre-determined features, most commonly level of complexity (low vs. high), type of targeted behaviour, format and presence or absence of tailoring. This information was extracted if provided, in order to explore potential features associated with implementation success.

Data synthesis

I employed a narrative approach to synthesise the results of the included reviews using a synthesis table that was structured in accordance with our research questions. The synthesis table allowed comparison of results between benchmark paper and non-benchmark papers for each strategy. An example of this can be found in Appendix 6. Results of each non-benchmark paper were summarised (along with effect size if provided) and compared with the results of the benchmark paper. The results were arranged by topic or targeted behaviour (1. any targeted behaviour; 2. guideline implementation (e.g. guideline on asthma, cardiovascular disease); 3. disease management/ diagnosis (e.g. diabetes, hypertension, dementia); 4. prevention and screening (e.g. cervical cancer, breast cancer); 5. prescribing behaviour (e.g. antibiotic prescribing for respiratory conditions). Information such as the number or type of included studies and whether quality appraisal of studies was performed, were extracted to help explain potential differences (if applicable) in results between the benchmark and non-benchmark paper. Furthermore, a table (Appendix 11) was developed to record the active components of strategies which appear to be associated with success.

In addition to reporting the size of effect, to aid interpretation, I categorised the results using the definitions proposed by Grimshaw et al. for dichotomous outcomes (absolute difference) (Grimshaw et al., 2004):

- “Small” to describe effect sizes ≤5%
- “Modest” to describe effect sizes >5% and ≤10%
- “Moderate” to describe effect sizes >10% and ≤20%
- “Large” to describe effect sizes >20%

A flow diagram summarising the steps used to undertake this review of review can be found in Appendix 7.

Quality assessment

A subset of data extraction and synthesis (all benchmark review papers plus two randomly selected subsequent papers for each category) were checked by the co-investigators, using a quality assurance form which I developed. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) checklist was used to critically appraise the quality of reporting of the included benchmark review papers. PRISMA is a 27-item checklist consisting of preferred reporting items for systematic reviews and meta-analyses and it is primarily focused on randomised trials and quantitative data (Liberati et al., 2009).

The findings were reported in accordance with the PRISMA guidelines. The full version of the review protocol was published elsewhere (Lau et al., 2014). This systematic review was part of a NIHR SPCR funded project (SPCR FR4 project number: 122). The systematic review protocol was registered on the PROSPERO database (CRD42014009410).

Results

Identification of relevant reviews

Searches of the five electronic databases to December 2013 yielded a total of 6,164 potentially eligible papers. Following the screening of titles and abstracts and full text papers, 91 papers were included in the final systematic review of reviews, of which 9 were selected as benchmark reviews. **Error! Reference source not found.** presents the PRISMA flow diagram of study selection.

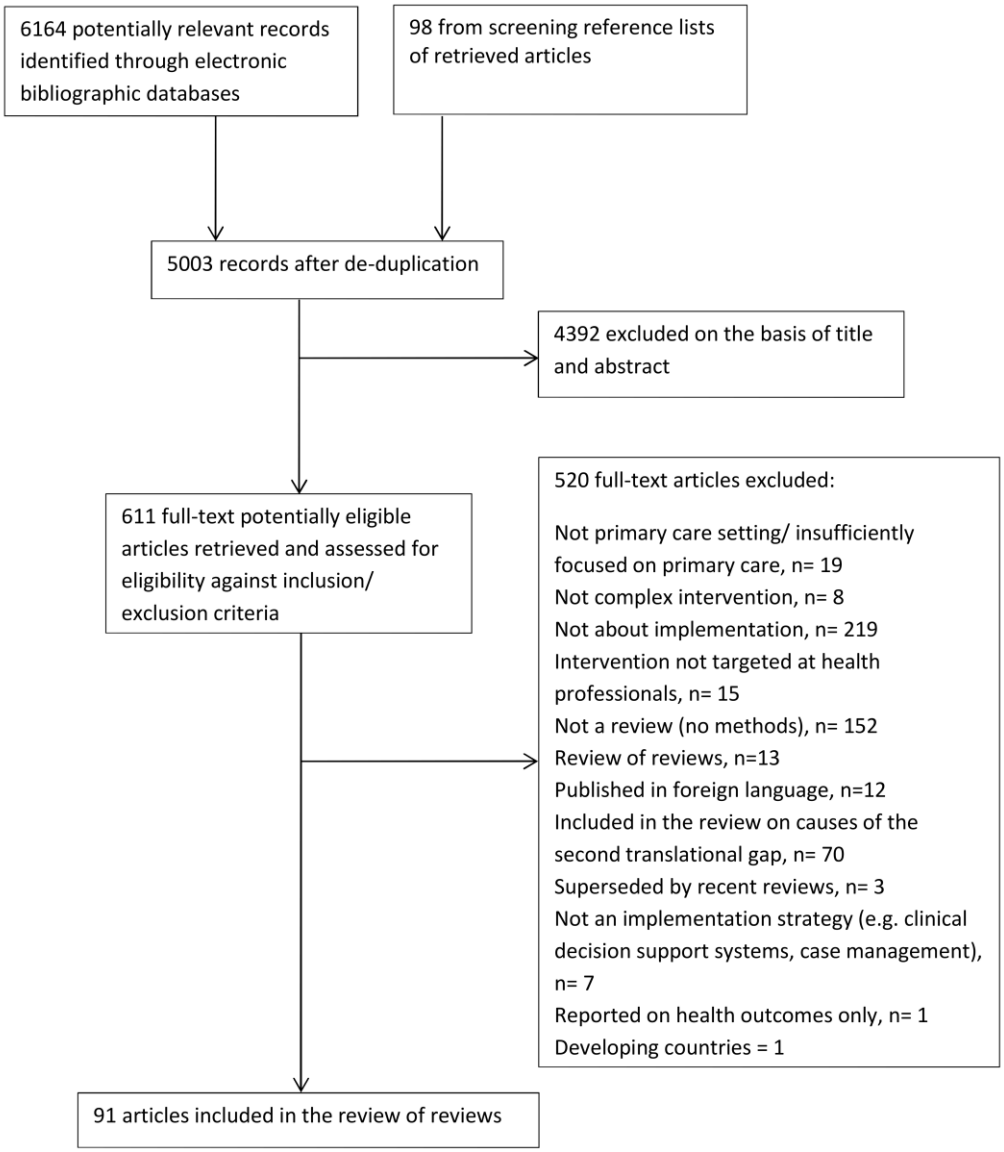

Figure 1: Study 2 PRISMA flow diagram of study selection

Characteristics of included reviews

Details of included reviews are presented in Appendix 8. The majority of the included reviews (n=64; 70%) reported data on strategies targeted at individual health care professionals (i.e. professional-level strategies); with 20 reviews (22%) reporting data on audit and feedback (Gardner et al., 2010; Dulko, 2007; Mugford et al., 1991; Unverzagt et al., 2014; Okelo et al., 2013; Schichtel et al., 2013; Medves et al., 2010; Akbari et al., 2008; Grimshaw et al., 2004; McKenna et al., 2004; Weingarten

et al., 2002; Gross & Pujat, 2001; Gill et al., 1999; Yano et al., 1995; Bywood et al., 2008; Xyrichis & Lowton, 2008; Zwar et al., 2006b; Davis & Taylor-Vaisey, 1997; Balas et al., 1996b; Ivers et al., 2012),18 (20%) on printed educational materials (Freudenstein & Howe, 1999; Schichtel et al., 2013; Medves et al., 2010; Akbari et al., 2008; Smolders et al., 2008; Grimshaw et al., 2004; McKenna et al., 2004; Gross & Pujat, 2001; Gill et al., 1999; Conroy & Shannon, 1995; Oxman et al., 1995; Grimshaw & Russell, 1993; Soumerai et al., 1989; Pippalla et al., 1995; Nilsen et al., 2006; Lomas, 1991; Davis & Taylor-Vaisey, 1997; Giguère et al., 2012), 16 (18%) on educational outreach visits (Grimshaw et al., 2004; Qureshi et al., 2002; Freudenstein & Howe, 1999; Schichtel et al., 2013; Koch & Iliffe, 2011; Lineker & Husted, 2010; Medves et al., 2010; Anderson & Jane-Llopis, 2004; Gross & Pujat, 2001; Gill et al., 1999; Beilby & Silagy, 1997; Conroy & Shannon, 1995; Yano et al., 1995; Soumerai et al., 1989; Davis & Taylor-Vaisey, 1997; O'Brien et al., 2007), 26 (29%) on educational meetings (Unverzagt et al., 2014; Schichtel et al., 2013; Thomas et al., 2006; Cauffman et al., 2002; Davies et al., 1999; Freudenstein & Howe, 1999; Waddell, 1991; Beaudry, 1989; Davis et al., 1992; Gual & Sabadini, 2011; Glynn et al., 2010; Lineker & Husted, 2010; Medves et al., 2010; Perry et al., 2011; Hulscher et al., 2006; Gilbody et al., 2003; Weingarten et al., 2002; Oxman et al., 1995; Flodgren et al., 2010; Pippalla et al., 1995; Nilsen et al., 2006; Gould et al., 2010; Goodwin et al., 2011; Zwar et al., 2006b; Davis & Taylor-Vaisey, 1997; Forsetlund et al., 2009), 7 (8%) on local opinion leaders (Schichtel et al., 2013; Medves et al., 2010; McKenna et al., 2004; Conroy & Shannon, 1995; Soumerai et al., 1989; Davis & Taylor-Vaisey, 1997; Flodgren et al., 2011) and 24 (26%) on physician-based reminders (Bywood et al., 2008; Dexheimer et al., 2008; Balas et al., 1996a; Austin et al., 1994; Unverzagt et al., 2014; Schichtel et al., 2013; Van et al., 2012; Nam et al., 2011; Glynn et al., 2010; Medves et al., 2010; Grimshaw et al., 2004; Hulscher et al., 2006; Bauer, 2002; Weingarten et al., 2002; Kupets & Covens, 2001; Beilby & Silagy, 1997; Conroy & Shannon, 1995; Mandelblatt &

Kanetsky, 1995; Yano et al., 1995; Soumerai et al., 1989; Harvey et al., 2002; Vernon et al., 2010; Shojania et al., 2009; Holden et al., 2010). Ten reviews (11%) reported data on organisational implementation strategies (including revising professional roles and facilitation) (Franx et al., 2013; Nagykaldi et al., 2005; Thomas et al., 2010; Langberg et al., 2009; Baskerville, Liddy, & Hogg, 2012; Arroyave et al., 2011; Van et al., 2012; Horrocks et al., 2002; Yano et al., 1995; Gilbody et al., 2003). Eleven reviews (12%) reported data on strategies targeted at the context level; all focused on financial strategies (e.g. performance based payment, fixed fee per patient achieving a specified outcome, single threshold target payment, capitation) (Van et al., 2010; Petersen et al., 2006; Town et al., 2005; Gosden et al., 2001; Chaix-Couturier et al., 2000; Giuffrida et al., 2000; Thomas et al., 2010; Akbari et al., 2008; Okelo et al., 2013; Franx et al., 2013; Scott et al., 2011) and I could not identify any reviews on the effectiveness of regulatory strategies. Limited evidence was found on the cost-effectiveness of implementation strategies (economic evaluations e.g. cost-effectiveness, costs benefit analyses were rare).

The focus of included reviews varied: some focused on a specific strategy (e.g. audit and feedback) across multiple topic areas and outcomes; others considered the effectiveness of *any* or multiple strategies to improve a *particular* targeted behaviour (e.g. cancer screening, guideline adherence); and yet others considered the effectiveness of a specific strategy to improve a particular targeted behaviour (single strategy, single topic area). Seventeen reviews focused on guideline implementation, 13 on quality of care or disease management, 1 on technology implementation, 18 on preventative care, 2 on collaborative working and 4 on prescribing behaviour.

Fifty reviews (71%) were based exclusively in primary care and the remaining in mixed health care settings. Twenty-four reviews (26%) were undertaken in the United States of America (USA), 12 (13%) in Canada, 17 (19%) in the UK, 6 (7%) in Australia, 14 (15%) in Europe, and 9 elsewhere (10%). The original studies included in the reviews were conducted worldwide, although 21 (23%) reported that the original studies were predominantly conducted in USA. The number of original studies included in the reviews ranged from 2 to 235.

Methodological quality of included reviews

Benchmark reviews: All nine benchmark reviews (Ivers et al., 2012; Shojania et al., 2009; O'Brien et al., 2007; Forsetlund et al., 2009; Flodgren et al., 2011; Giguère et al., 2012; Baskerville et al., 2012; Scott et al., 2011; Baker et al., 2010) applied *a priori* criteria for selecting eligible papers and critically appraised the quality of the included primary studies. Five included randomised controlled trials (RCT) only (Ivers et al., 2012; O'Brien et al., 2007; Forsetlund et al., 2009; Giguère et al., 2012; Baker et al., 2010), and four excluded studies that were graded as high risk of bias, or judged to be of poor quality (Ivers et al., 2012; O'Brien et al., 2007; Forsetlund et al., 2009; Baskerville et al., 2012). Some benchmark reviews used criteria to select the outcomes reported. Where the primary papers described a primary outcome, this was used; where there were multiple outcomes with no named primary outcome, the median value across multiple outcomes was calculated (Ivers et al., 2012; O'Brien et al., 2007; Forsetlund et al., 2009; Flodgren et al., 2011). All outcomes were expressed as compliance with desired practice (composite outcome) which may include outcomes such as adherence to guidelines, screening rates and appropriate referrals, or process improvements. Eight reviews conducted some form of quantitative analysis (e.g. meta-analysis, calculations of median risk difference,

meta-regression) (Ivers et al., 2012; Shojania et al., 2009; O'Brien et al., 2007; Forsetlund et al., 2009; Flodgren et al., 2011; Giguère et al., 2012; Baskerville et al., 2012; Baker et al., 2010) and one conducted narrative synthesis (Scott et al., 2011). Quality assessment of all benchmark papers can be found in Appendix 9.

Other (non-benchmark) reviews: Overall, 79 reviews (96%) reported the use of explicit inclusion/exclusion criteria. Sixteen reviews (20%) included only randomised trials, 59 (72%) included studies with both randomised and non-randomised designs (e.g. quasi-experimental, controlled before-after studies, interrupted time series). Eighteen (22%) conducted some form of quantitative analysis (e.g. meta-analysis, calculations of median risk difference, meta-regression) and the rest conducted narrative synthesis. Forty-seven reviews (57%) critically appraised their included primary studies using some form of checklist/ assessment or described quality issues in the results or discussion. Only one review synthesised data using a theoretical framework (Gardner et al., 2010).

Effects of single strategies

Strategies directed at individual professionals

Single strategy alone vs. no strategy or usual care

The most frequently reported comparison was between the effectiveness of a single implementation strategy (e.g. educational outreach or audit and feedback) and no strategy (Appendix 10). The majority of these reviews reported dichotomous outcomes (or median improvement, often calculated as median risk difference) observed small to modest effects, ranging from 2% to 9%. **Error! Reference source not found.** illustrates the median effects and interquartile ranges (IQRs) of single strategies targeted at professionals compared to no strategy or usual care, reported in the benchmark reviews. The lower IQR of educational outreach visits, audit and feedback, educational meetings and computerised reminders were all above zero (the line of no effect). Printed educational materials and local opinion leaders were the least effective single strategies. The IQRs of all strategies overlapped considerably, indicating that no single strategy appeared to be more effective than others.

Not all benchmark reviews provided results for continuous outcomes. The use of educational outreach visits was associated with the largest median change relative to no strategy (23%, IQR = 12-39%), followed by educational meetings and workshops (10%, IQR= 8-32%) and audit and feedback (1.3%, IQR= 1.3-11%). In general, findings from non-benchmark reviews agreed with those from the benchmark reviews (Appendix 10).

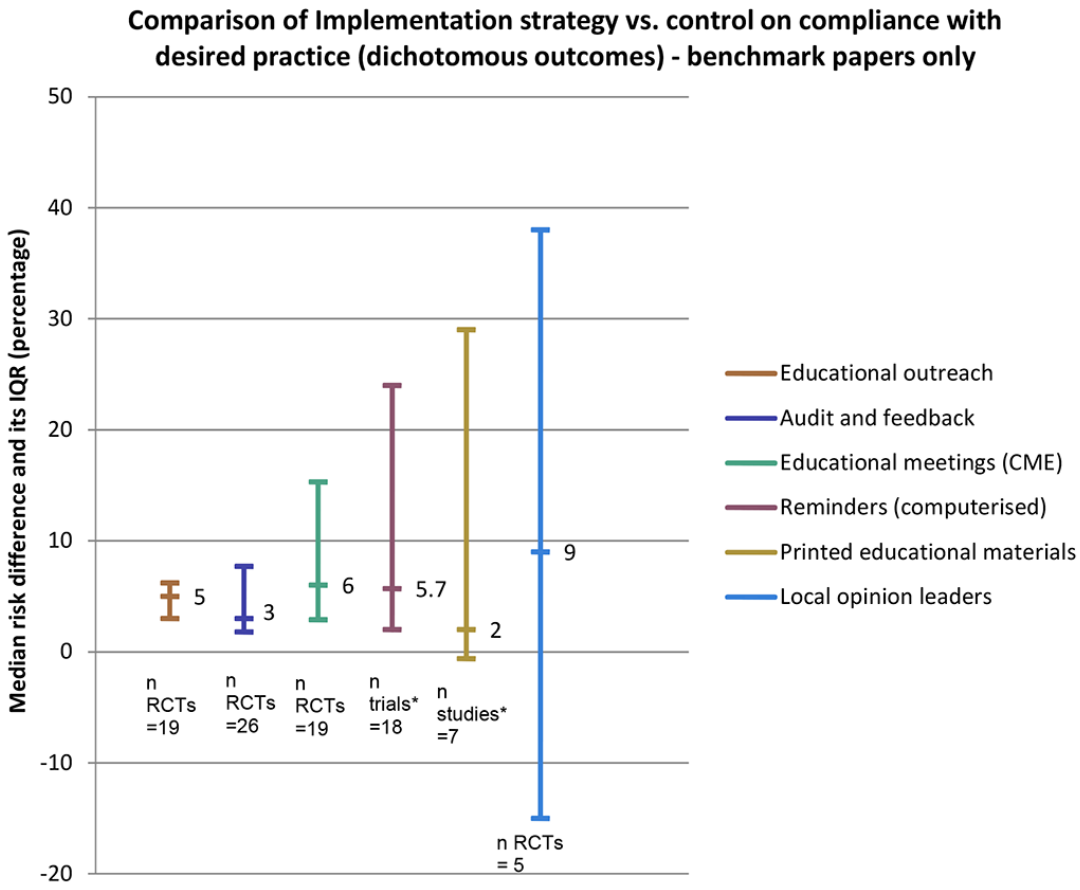

Figure 2: Graph illustrating median effects of single professional-level strategies alone vs. no strategy or usual care

Single strategy vs. alternative single strategy

Only benchmark reviews of audit and feedback, local opinion leaders, printed educational materials and educational meetings reported direct head-to-head comparisons of these single strategies with alternative single strategy; this comparison was not commonly reported in primary studies. For example, only two trials with a moderate risk of bias compared educational meetings to other strategies, namely an educational outreach visit and a facilitated implementation of an office system to improve services. In both trials, educational meetings were associated with a decrease in compliance (adjusted RD of -1.4% and -8.0%), relative to the comparison strategies. Similarly, two trials compared opinion leaders alone to

other strategies (standardised lectures and audit and feedback) and found a 14% absolute increase in adherence to desired practice for opinion leaders alone (Flodgren et al., 2011). No conclusions could be drawn from the limited evidence.

Strategies directed at the organisation

Revising professional roles

I could not identify a benchmark review in this category. Six reviews examined the effects of revising professional roles, for example, having a nurse with a redefined role to offer support, such as undertaking preventive and follow up tasks (Arroyave et al., 2011; Gilbody et al., 2003; Van et al., 2012; Franx et al., 2013; Horrocks et al., 2002; Yano et al., 1995). In general, these reviews demonstrated an improvement in process of care outcomes.

Practice facilitation

Five reviews (Baskerville et al., 2012; Nagykaldi et al., 2005; Thomas et al., 2010; Langberg et al., 2009; Franx et al., 2013) examined the effects of practice facilitation, defined as having experienced facilitators, who can be internal or external to an organisation, to work with individual practices in order to facilitate and support a range of processes and activities, such as education, interactive consensus building and goal setting, quality improvement and problem solving. The benchmark review (total n=23 studies; 20 RCTs and three controlled clinical trials) reported an overall effect size of 0.56 (95% CI, 0.43 to 0.68; $p<0.001$) which favoured practice facilitation (relative to controls) with non-significant heterogeneity and some indications of publication bias. It also found primary care practices are 2.76 (95% CI, 2.18 to 3.43) times more likely to adopt evidence-based guidelines through practice facilitation (Baskerville et al., 2012). Similar significant effects were observed in other reviews (Nagykaldi et al., 2005; Thomas et al., 2010; Langberg et al., 2009). Practice

facilitation improved adoption of guidelines in various clinical areas that focused on prevention, system-level improvements and outcomes associated with chronic disease management within practice settings (Nagykaldi et al., 2005).

Changing organisational culture

One review assessed strategies to change organisational culture to improve professional practice (Parmelli et al., 2011). However, the authors were unable to draw conclusions about effective strategies for changing culture as no relevant primary studies fulfilled the methodological criteria for inclusion. There was a lack of reviews that summarised the evidence on organisational-level implementation strategies and little is known about what they might comprise.

Strategies directed at the wider context (e.g. policy)

Financial strategies

Eleven reviews examined the effectiveness of financial strategies and the majority of these could not calculate an overall effect estimate due to heterogeneity, including the type of financial payment (e.g. performance based payment, capitation, fee-for-service), the size of payment, outcomes measured, targeted behaviour and the context/ setting in which they were implemented. The benchmark review included seven studies and showed that financial strategies had positive but modest and variable effects on a small number of performance and quality of care outcomes (Scott et al., 2011). Other relevant reviews also reported mixed effectiveness. The majority of primary studies included in these reviews were conducted in the USA, and therefore may have limited applicability to other health care systems.

Effects of multifaceted strategies

Some reviews hypothesised that multifaceted implementation strategies could be more effective as more barriers could be addressed (Hulscher et al., 2006). However, the data suggested the effects of multifaceted strategies were variable and either no more effective or only slightly more effective in changing practice than single strategies (Appendix 10).

All benchmark reviews assessed the effectiveness of their chosen strategy (or strategy of interest, e.g. audit and feedback) plus additional strategies (more than one, e.g. audit and feedback plus educational outreach visits), compared with no strategy; and the findings of this comparison group were largely similar to the findings of single strategies alone vs. no strategy. Evidence from the remaining reviews (in the same category) also presented mixed results. Single strategies could be as effective as multifaceted strategies in improving practice particularly when baseline adherence to desired practice was low.

Features of implementation strategies associated with success

Drawing on the literature included in this review of reviews, I identified features of implementation strategies that appeared to be associated with success. These are presented in Appendix 11 and include features such as interactivity, tailoring and status of the individual delivering the strategy. Features that appeared to be relatively ineffective included didactic teaching format, low intensity strategies and infrequent feedback.

Evidence on economic evaluations

Overall there was a lack of economic evaluation data on the use of implementation strategies. Benchmark reviews mentioned that few primary studies reported costs or cost-effectiveness of the strategy (O'Brien et al., 2007).

Discussion

The purpose of this systematic review of reviews was to evaluate the effectiveness of strategies to improve implementation of complex interventions in primary care. I found that there has been a rapid increase in the number of primary studies and reviews examining the effectiveness of implementation strategies. Most of the included reviews evaluated the effects of individual professional-level implementation strategies and they may achieve small to modest improvement (range 2-9%) compared to no strategy. Of these professional-level strategies, educational outreach visits, educational meetings, and audit and feedback had the best evidence base; included a relatively large number of RCTs with low risk of bias. Passive dissemination strategies such as the distribution of educational materials appeared largely ineffective and the effect of local opinion leaders appeared variable.

There was a lack of evidence directly comparing the effectiveness of different strategies. These findings are largely consistent with those reported in a previous review of reviews on the effectiveness of professional-level strategies to promote the implementation of research findings (Bero et al., 1998). Although the median effects of most strategies were found to be small to modest, they might have much greater impact when applied at the population level, as 90% of care is delivered in primary care. Their effects may also be greater when applied in certain circumstances or settings. In addition, the follow up period of the primary studies tended to be relatively short, therefore, long term effects could not be determined.

There was limited review evidence on the effectiveness of organisational-level implementation strategies in primary care. There are some on-going studies especially around promoting leadership and organisational culture, for instance, Curry et al have developed a theoretically informed intervention (multifaceted strategy approach) aimed at promoting organisational culture by encouraging organisational leadership which accelerates

learning and improvement and integrated evidence-based practices into routine work of the organisation in 10 hospitals (Curry et al., 2015). Similarly Aarons et al conducted a randomised mixed methods pilot study of a leadership and organisation development strategy for evidence-based mental health practice implementation (Aarons, Ehrhart, Farahnak, & Hurlburt, 2015). Further work is needed in this area, including identifying, describing and characterising potential organisational-level strategies and evaluating their effectiveness in any health care context. I identified even fewer reviews on strategies that addressed characteristics of the wider context level in primary care and most of these focused on financial arrangements and structures. None of the included reviews addressed regulatory strategies such as changes in medical liability laws, licensure standards and governance, or other wider context level strategies, such as creating new funding for the use of a particular complex intervention or changes in policy.

Previous literature had suggested that multifaceted strategies could be more effective than single strategies (Bero et al., 1998; Davis, Thomson, Oxman, & Haynes, 1995; Wensing et al., 1998), and their use was advocated in the 2008 MRC complex intervention guidance as potentially useful approaches to implementation (2000). However, I found that multifaceted implementation strategies were not necessarily more effective than single implementation strategies and that the effectiveness of multifaceted strategies did not increase incrementally with the number of components. Another recent systematic review of reviews examining whether multifaceted strategies are more effective than single strategies (Squires, Sullivan, Eccles, Worswick, & Grimshaw, 2014) reported similar findings. There could be a number of possible reasons for this: 1) *ceiling effect* – both groups received co-strategies and any additional strategy would be unlikely to show further benefits; 2) *relevance* – strategies are often rarely justified theoretically (Proctor et al., 2013; Michie, Fixsen, Grimshaw, & Eccles, 2009), i.e. some strategies included are not necessary or relevant to the context; 3) *Timing and delivery* – all the strategy components included in the primary studies might have been delivered at the same time, and possibly by spacing the components of multifaceted

strategies at different times, may be more effective; 4) *active features* that support effective implementation were not included and 5) strategies (in terms of combinations, timing/ frequency, duration) and settings were too heterogeneous across primary studies to make it appropriate to combine them. In addition, multifaceted implementation strategies are likely to cost more than single implementation strategies.

Since the completion of this review, Powell et al compiled and published the ERIC refined compilation of strategies for implementing change. This is a list of strategies for implementing clinical innovations in health and mental health based on sources such as published reviews and through expert consensus (Powell et al., 2015). I undertook a post-hoc exercise and mapped the included reviews to the ERIC refined compilation of implementation strategies (see Appendix 12). I found that the evidence base for the majority of strategies included in this list was limited. This list is a valuable resource of discrete implementation strategies and more primary evaluation studies on the efficacy and effectiveness of these implementation strategies are required. Finally, I found very limited evidence on the cost-effectiveness of implementation strategies. Hoomans et al. commented that despite the demand for undertaking economic evaluation in health services research, its use is not standard practice in assessing implementation strategies. They also found that studies on implementation strategies tend to assess only their effect on practice and health outcomes, and very few conducted economic evaluations (Hoomans & Severens, 2014).

Strengths and limitations

There are several strengths to this review of reviews. To the best of my knowledge, this is the most comprehensive review of the available literature on the effectiveness of single and multifaceted implementation strategies and is not restricted to any topic or health condition. It is therefore highly generalisable. The review was conducted using rigorous reviewing methods, including a comprehensive search strategy, double screening of all titles, abstracts and full text articles, the use of a robust approach to selecting benchmark reviews, with

findings elaborated with reference to other reviews. In addition, I was able to identify a tentative list of components of specific strategies that appeared to be associated with effective implementation.

There are also some limitations, including the possibility that not all relevant primary research studies were captured by included reviews so some findings may be missed by concentrating on reviews. Moreover, by only focusing on reviews, there is an inevitable time lag, with recent studies less likely to be reported in reviews. Data extraction was conducted by a single reviewer. However, data extraction and synthesis of all benchmark papers plus two other randomly selected papers for each category were checked independently for accuracy by a second reviewer. There are a number of challenges to conducting this narrative synthesis: 1. the heterogeneous nature of the included primary studies and reviews (in terms of topic area, health conditions, type of analysis); 2. each review contained an enormous amount of information and I made a good attempt to focus on the results that best addressed our review question(s) by applying rigorous criteria and using a structured approach to synthesise the results.

Implications for clinical practice

Most implementation strategies targeted at changing practice at the professional level can achieve small to modest improvement. To facilitate successful implementation of complex interventions, the choice of strategies needs to be based upon barriers relevant to the setting (context) in which the implementation occurs, in order to achieve maximum benefits. Furthermore, these barriers or implementation issues may change over time; they need to be reviewed periodically throughout the change process to ensure that the strategies used continue to be appropriate and relevant. In some circumstances, it may be more effective to use a single strategy and focus on one key problem of implementation instead of trying to tackle numerous problems using complex multifaceted strategies. When applying an

implementation strategy, it is important to incorporate features shown to improve the likelihood of successful implementation.

Implications for research

This systematic review of reviews suggests that there is an increasing amount of primary and secondary research on the effectiveness of implementation strategies; however, they tended to focus on a small number of strategies with known evidence. Despite the large body of published literature, the evidence base on implementation strategies remains inconclusive. The evidence could not distinguish differences in effectiveness between various professional-level implementation strategies. Better designed (i.e. development of strategies based on theoretical framework, tailored to relevant barriers) and described (i.e. reporting of strategy components in accordance with reporting guidelines) studies are needed. Passive strategies alone are unlikely to be effective and in the authors' opinion, no further studies of this kind are needed. Future research and systematic reviews should focus on why and how an implementation strategy (or combinations of strategies) works differently in different contexts and on more rigorous research testing a broad range of strategies that work at the organisational and wider contextual levels (What are they? How do they work? How effective and/or cost-effective are they?).

Conclusion

The effects of professional level implementation strategies were small to modest. Limited evidence was found in relation to the effectiveness of organisational- and wider-contextual-level implementation strategies. My findings suggest multifaceted strategies may not always be more effective than a single strategy. Development and evaluation of implementation strategies should be informed by theoretical frameworks. There is no "one size fits all"

implementation strategy; they are likely to work best if tailored to local circumstances and takes account of broader policy context.