

Chapter 33 Integrated patient information systems

Emergency and acute medical care in over 16s: service delivery and organisation

NICE guideline 94

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Chapter 33 Integrated patient information systems

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33 Integrated patient information systems

33.1 Introduction

It is generally accepted that appropriate information sharing within departments in an organisation and between different organisations is of importance in supporting co-ordinated care for patients, improving patient experience and achieving greater efficiency and value from health delivery systems.

An integrated patient information system would allow authorised health and social care professionals to have access to the patient's clinical information (for example, laboratory results, medications, allergies and clinical notes) from multiple providers. It could also allow the patient to view the record and where appropriate add any self-monitoring information. Many benefits and efficiencies can flow from information being recorded, at contact with health and care services, and shared securely between those providing care.

33.2 Review question: Do integrated patient information systems throughout the AME pathway (primary and secondary care) improve patient outcomes?

For full details see review protocol in Appendix A.

Table 1: PICO characteristics of review question

Population	Adults and young people (16 years and over) with a suspected or confirmed AME.
Intervention(s)	<ul style="list-style-type: none"> • Integrated patient information systems throughout AME pathway (including primary care, secondary care and social care) including: • Patient information database (for example, Summary Care Records) accessible to all HCPs directly involved in the care of their patients. • Shared IT systems between primary and secondary care. • Community/Pre-hospital/ambulance care.
Comparison(s)	<p>No integrated patient information systems throughout AME pathway (including primary care, secondary care and social care).</p> <ul style="list-style-type: none"> • Lack of accessibility to patient information databases to all HCPs involved in care of patients.
Outcomes	<p>Patient outcomes;</p> <ul style="list-style-type: none"> • Mortality (CRITICAL) • Avoidable adverse events (including missed or delayed treatments and missed or delayed investigations, prescribing errors (errors of omission or commission, medicines reconciliation) (CRITICAL) • Quality of life (CRITICAL) • Patient satisfaction (CRITICAL) • Length of stay (IMPORTANT) • ED admissions (IMPORTANT) • Unnecessary duplication of tests (IMPORTANT) • Staff satisfaction (IMPORTANT)
Study design	Systematic reviews (SRs) of RCTs, RCTs, observational studies only to be included if no relevant SRs or RCTs are identified.

33.3 Clinical evidence

One study was included in the review;⁷ these are summarised in Table 2 below. The study reported only important outcomes and did not report any critical outcomes stated in the protocol.

Evidence from these studies is summarised in the clinical evidence summary below (Table 3). See also the study selection flow chart in Appendix B, forest plots in Appendix C, study evidence tables in Appendix D, GRADE tables in Appendix E and excluded studies list in Appendix F.

Table 2: Summary of studies included in the review

Study	Intervention and comparison	Population	Outcomes	Comments
Lang 2006 ⁷ Cross-over cluster randomised trial Canada	<p><u>Intervention:</u></p> <p>When family physicians were in the intervention phase, they received detailed clinical information of their patients visit to the emergency department through a secure Web based standardised communication system (SCS). The SCS programme automatically issued advisory emails (at 0700) once per day to all family physicians whose patients or patients had presented to the emergency department within the previous 24 hours.</p> <p><u>Control:</u></p> <p>When family physicians were in the control phase, they received a carbon copy of the first page of the emergency physicians' notes by regular mail within 1-2 weeks of the visit to the emergency department; the standard practice at the emergency department.</p>	<p>n=2022</p> <p>Patients whose family physician was participating in the study were approached for recruitment upon presentation to the emergency department.</p> <p>For their visit to be eligible, patients had to be 18 years of age or older, have been seen by the participating family physician at least once within the previous 2 years. Participants agreed to have their clinical information extracted from their emergency department medical chart and sent to their family physician.</p>	<p>Repeat visits to the emergency department; duplication of requests for diagnostic tests.</p>	<p>Setting: emergency department of a Jewish General Hospital in Montreal; an adult university teaching hospital with 637 beds.</p>

Table 3: Clinical evidence summary: Integrated patient information systems versus no integrated patient information systems

Outcomes	No of Participants (studies) Follow up	Quality of the evidence (GRADE)	Relative effect (95% CI)	Anticipated absolute effects	
				Risk with No Integrated patient info system	Risk difference with Integrated patient info system (95% CI)
Repeat visits to the ED within 14 days	1616 (1 study)	⊕⊕⊖⊖ LOW ^{a,b} due to risk of bias, imprecision	RR 1.09 (0.83 to 1.42)	Moderate	
				110 per 1000	10 more per 1000 (from 19 fewer to 46 more)
Repeat visit to the ED within 28 days	1616 (1 study)	⊕⊕⊕⊖ MODERATE ^a due to risk of bias	RR 1.01 (0.81 to 1.25)	Moderate	
				168 per 1000	2 more per 1000 (from 32 fewer to 42 more)
Duplication of diagnostic tests (between ED and the family physician office)	1616 (1 study)	⊕⊖⊖⊖ VERY LOW ^{a,b} due to risk of bias, imprecision	RR 1.07 (0.61 to 1.9)	Moderate	
				27 per 1000	2 more per 1000 (from 11 fewer to 24 more)
Duplication of diagnostic tests (in speciality consultations)	1616 (1 study)	⊕⊕⊖⊖ LOW ^{a,b} due to risk of bias, imprecision	RR 2.46 (1.09 to 5.56)	Moderate	
				10 per 1000	15 more per 1000 (from 1 more to 46 more)

(a) Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.

(b) Downgraded by 1 increment if the confidence interval crossed 1 MID point, and downgraded by 2 increments if the confidence interval crossed 2 MID points.

33.4 Economic evidence

Published literature

No relevant health economic studies were identified.

The economic article selection protocol and flow chart for the whole guideline can be found in the guideline's Appendix 41A and Appendix 41B.

In the absence of health economic evidence, unit costs were presented to the guideline committee – see Chapter 41 Appendix I.

33.5 Evidence statements

Clinical

One study comprising 1616 participants evaluated integrated patient information system for improving outcomes in secondary care in adults and young people at risk of an AME, or with a suspected or confirmed AME. The evidence for integrated patient information systems suggested there was no difference for repeat visits to the ED within 28 days (moderate quality) or duplication of diagnostic tests between ED and the family physician (very low). However, the evidence for integrated patient information systems suggested there was a possible increase of repeat visits to the ED within 14 days (low quality) and duplication of diagnostic tests in speciality consultations (low quality) compared to no integrated patient information systems.

Economic

No relevant economic evaluations were identified.

33.6 Recommendations and link to evidence

Recommendation	-
Research recommendations	RR14. What is the clinical and cost effectiveness of different methods for integrating patient information throughout the emergency medical care pathway?
Relative values of different outcomes	<p>Mortality, avoidable adverse events (including missed or delayed treatments and missed or delayed investigations, prescribing errors – errors of omission or commission and medicines reconciliation), quality of life and patient and/or carer satisfaction were considered by the committee to be critical outcomes.</p> <p>Length of stay, ED admissions, unnecessary duplication of tests and staff satisfaction were considered to be important outcomes.</p>
Trade-off between benefits and harms	<p>There was evidence from 1 cross-over cluster randomised trial comparing integrated patient information systems with no integrated patient information systems.</p> <p>The evidence for integrated patient information systems suggested there was no difference for repeat visits to the ED within 28 days or duplication of diagnostic tests between ED and the family physician. However, the evidence for integrated patient information systems suggested there was a possible increase of repeat visits to the ED within 14 days and duplication of diagnostic tests in speciality consultations compared to no integrated patient information systems.</p> <p>No evidence was available for the outcomes mortality, avoidable adverse events (including missed or delayed treatments and missed or delayed investigations), prescribing errors (errors of omission or commission, medicines reconciliation), quality of life, patient and/or carer satisfaction, length of stay and staff satisfaction.</p> <p>The committee also noted that there was a lack of evidence identified on patient safety outcomes in this review.</p> <p>The committee were of the view that, given properly designed IT systems, information sharing between primary/secondary care and social care would be effective and should be beneficial for patients, particularly regarding prescription of medications and documenting allergies. However, the trials available did not demonstrate these effects. Personal experience of shared information systems by the committee indicated that they could be helpful in caring for patients, particularly those with multimorbidity. However, in view of the lack of evidence the committee considered that a research recommendation would be most appropriate in this area. It would be particularly helpful to understand what the optimum way to configure the system would be to deliver best use of limited resources.</p>
Trade-off between net effects and costs	<p>The committee discussed qualitatively the potential costs involved for an integrated information system. The committee considered there would be a significant upfront cost of these systems during development and during implementation as they would probably be used alongside the existing system. Additional long-term maintenance costs might be equivalent to existing systems, but data security and linkage across different platforms would probably increase costs. There would also be additional resource implications for performance upgrades, and ensuring that they remain fit for purpose.</p> <p>Given that the integration of systems could potentially provide benefits to a large number of patients over time, the upfront costs involved in the implementation would become relatively small when measured per person. The committee also considered the benefits to patients of the different providers having access to information about drug prescriptions and allergies; improvements in patient safety could well justify the implementation costs. The unit costs of tests and ED presentations were presented to the committee for them to consider the potential cost savings (Chapter 41 Appendix I).</p>

Recommendation	-
Research recommendations	RR14. What is the clinical and cost effectiveness of different methods for integrating patient information throughout the emergency medical care pathway?
Quality of evidence	The quality of the evidence for the study comparing integrated patient information systems with no integrated patient information systems was graded from moderate to very low; this was mainly due to risk of bias, indirectness and imprecision.
Other considerations	<p>The integration of information systems is essential to support shared care and to provide consistent patient centred care to individuals who may be mobile and have their care delivered in multiple facilities. Clinical care increasingly requires healthcare professionals to access patient record information that may be distributed across multiple sites, held in a variety of formats. In hospitals, information technologies tend to combine different modules or subsystems, resulting in a best-of-breed approach. To integrate clinical information systems in a way that will improve communication and data use for healthcare delivery, research and management, many different issues must be addressed. To consistently combine data from heterogeneous sources takes a great deal of time and effort because the individual feeder systems usually differ in several aspects, such as functionality, presentation and data representation. It will be challenging to make electronic health records operable between sites with the preservation of clinical meaning.</p> <p>The committee noted that the effective sharing of information has been recognised to be fundamental in the care of patients and is in line with the additional Caldicott Principle⁵ published in April 2013 which states “the duty to share information can be as important as the duty to protect patient confidentiality”. Healthcare professionals should have training into using the systems developed which also includes regular updates. The training should also outline the Caldicott Principles and demonstrate best practice in this aspect but also best practice in the efficient use of such systems. Patient consent for information sharing between sectors of health and social care would be required. Sometimes consent is implied, for example, when a patient is admitted to hospital, all relevant healthcare professionals who are caring for the patient should have access to that information; however, those who are not should not. When considering sharing large and important amounts of information about a patient, more formal consent will be required.</p> <p>Timely access to shared patient information would be particularly important when caring for patients with cognitive impairment or in meeting a patient’s preferences in terms of end of life care.</p> <p>Systems are likely to change in the future as technology advances, offering greater functionalities and rapid access to the results of investigations, combined with clinical decision support. Current examples of integrated patient information systems are NHS Spine and Enhanced Summary Care Records. The committee was aware that, in several locations around the country, web-based integrated patient information systems between primary and secondary care are currently being set up. This research recommendation is intended to encourage parallel evaluation of local innovation.</p>

References

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- 9 Overhage JM, Dexter PR, Perkins SM, Cordell WH, McGoff J, McGrath R et al. A randomized, controlled trial of clinical information shared from another institution. *Annals of Emergency Medicine*. 2002; 39(1):14-23
- 10 Sicotte C, Lapointe J, Clavel S, Fortin M-A. Benefits of improving processes in cancer care with a care pathway-based electronic medical record. *Practical Radiation Oncology*. 2016; 6(1):26-33
- 11 Van Eaton EG, Horvath KD, Lober WB, Rossini AJ, Pellegrini CA. A randomized, controlled trial evaluating the impact of a computerized rounding and sign-out system on continuity of care and resident work hours. *Journal of the American College of Surgeons*. 2005; 200(4):538-545

Appendices

Appendix A: Review protocol

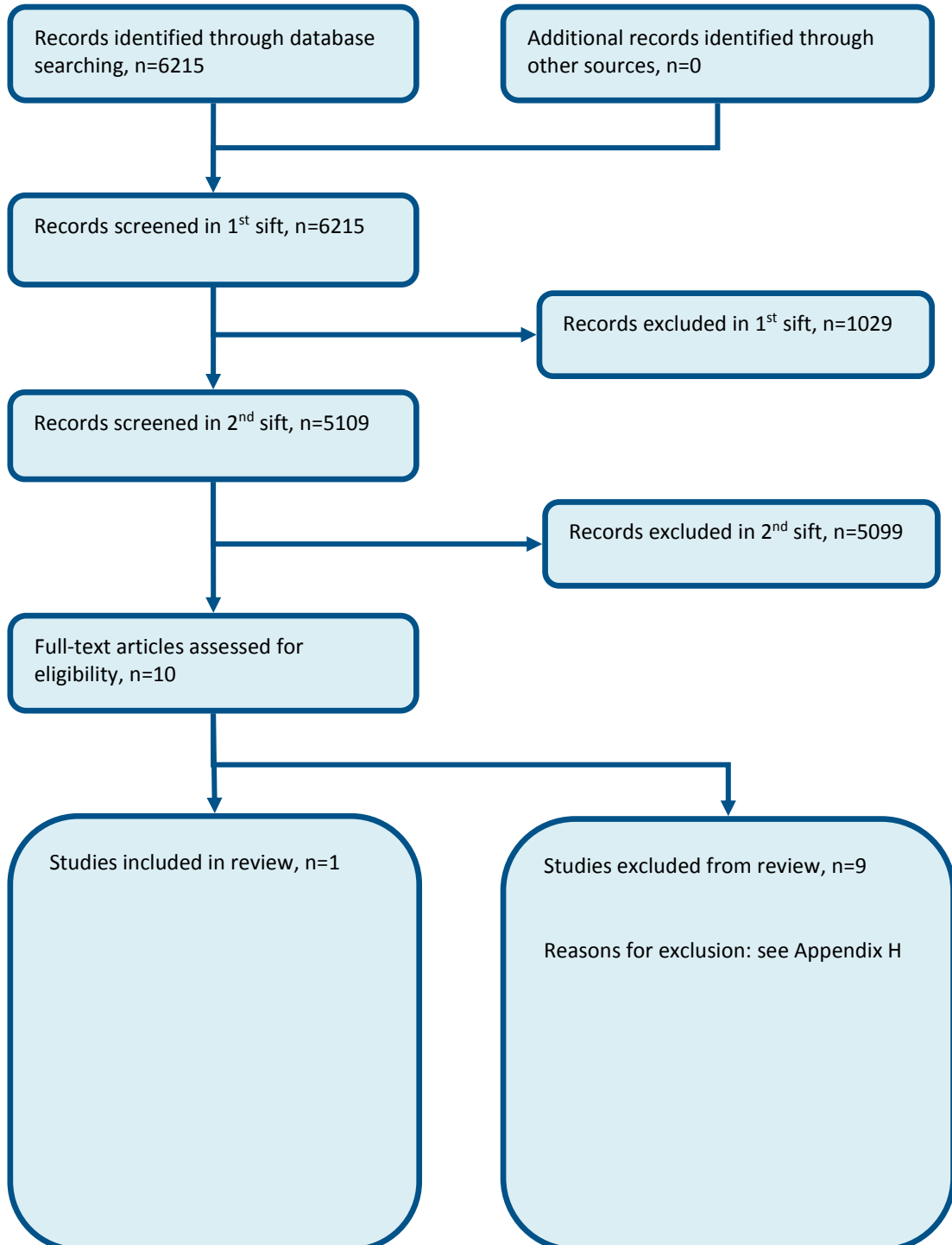
Table 4: Review protocol: Integrated Patient Information Systems

Review question	Do integrated patient information systems throughout the AME pathway (primary and secondary care) improve patient outcomes?
Guideline condition and its definition	AME.
Objectives	<p>Patient records are not easily accessible by all health care professionals (HCP) involved in the care of a patient, particularly if they are working in separate organisations. Information about patients' management, care provided and requirements is often lost during transfers of care. This can impair communication between HCPs and can lead to errors and unnecessary duplication all of which can lead to avoidable adverse events, delays and increase in HCP demand.</p> <p>A working definition of 'integration' is the management and delivery of health services so that clients receive a continuum of preventative and curative services, according to their need over time and across different health systems. IT or informatics integration involves sharing communication, data collection, storage, analysis and dissemination strategies. An integrated IT system throughout the AME pathway should improve patient care and thus outcomes.</p>
Review population	Adults and young people (16 years and over) admitted to hospital with a suspected or confirmed AME.
	Adults and young people (16 years and over).
	Line of therapy not an inclusion criterion.
Interventions and comparators: generic/class; specific/drug (All interventions will be compared with each other, unless otherwise stated)	<p>Integrated patient information systems throughout AME pathway (including primary care, secondary care and social care); patient information database (for example, summary care records) accessible to all HCPs directly involved in the care of their patients.</p> <p>Integrated patient information systems throughout AME pathway (including primary care, secondary care and social care); shared IT systems between primary and secondary care.</p> <p>Integrated patient information systems throughout AME pathway (including primary care, secondary care and social care); community/pre-hospital/ambulance care.</p> <p>No integrated patient information systems throughout AME pathway (including primary care, secondary care and social care); lack of accessibility to patient information databases to all HCPs involved in care of patients.</p>
Outcomes	<ul style="list-style-type: none"> - Quality of life at End of follow-up (Continuous) CRITICAL - Mortality at End of follow-up (Dichotomous) CRITICAL - Avoidable adverse events (including missed or delayed treatments and missed or delayed investigations, prescribing errors (errors of omission or commission, medicines reconciliation) at End of follow-up (Dichotomous) CRITICAL

	<ul style="list-style-type: none"> - Patient and/or carer satisfaction at End of follow-up (Dichotomous) CRITICAL - Length of hospital stay at end of follow-up (Continuous) IMPORTANT - Unnecessary duplication of tests at End of follow-up (Dichotomous) CRITICAL - ED admissions at End of follow-up (Dichotomous) IMPORTANT - Staff satisfaction at End of follow-up (Dichotomous) IMPORTANT
Study design	<p>Systematic Review RCT Quasi-RCT Non-randomised comparative study Prospective cohort study Retrospective cohort study Case control study Controlled before and after study Before and after study Non randomised study</p>
Unit of randomisation	Patient.
Crossover study	Permitted.
Minimum duration of study	Not defined.
Other inclusions	Adults and young people (16 years and over).
Other exclusions	<p>Studies from non-OECD countries. Non-English language studies.</p>
Subgroup analyses if there is heterogeneity	<ul style="list-style-type: none"> - Frail elderly (frail elderly; not frail elderly); different population. - People undergoing active cancer treatment (people undergoing active cancer treatment; people not undergoing active cancer treatment); variation in intervention. <p>In addition, if studies have pre-specified in their protocols that results for any of these subgroup populations will be analysed separately, then they will be included.</p>
Search criteria	<p>Databases: Medline, Embase, the Cochrane Library. Date limits for search: None. Language: English.</p>

Appendix B: Clinical article selection

Figure 1: Flow chart of clinical article selection for the review of Integrated Patient Information Systems



Appendix C: Forest plots

C.1 Integrated patient information systems versus No Integrated patient information systems

Figure 2: Repeat visits to the ED within 14 days

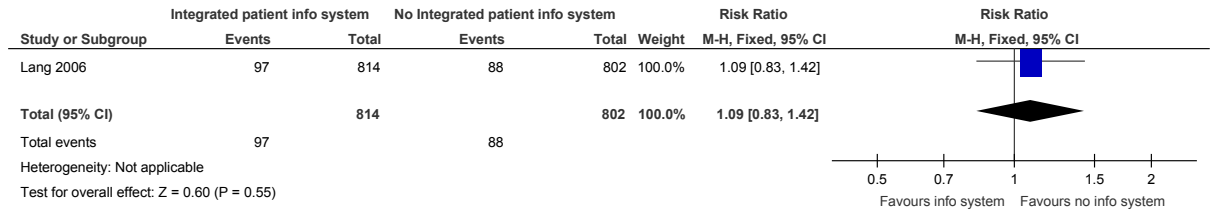


Figure 3: Repeat visits to the ED within 28 days

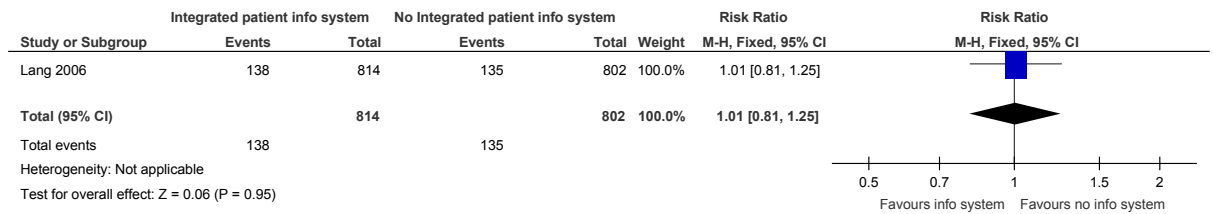


Figure 4: Duplication of diagnostic tests (between ED and the family physician office)

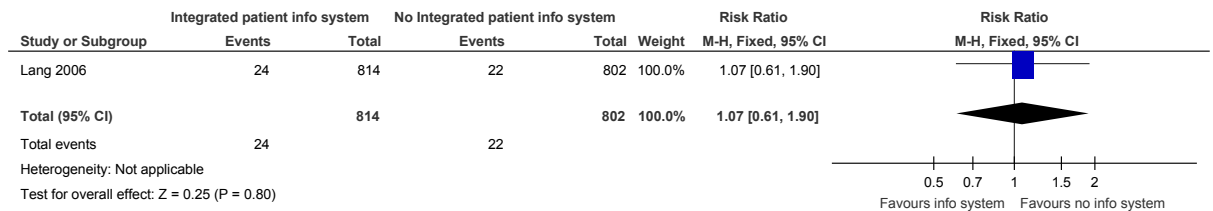
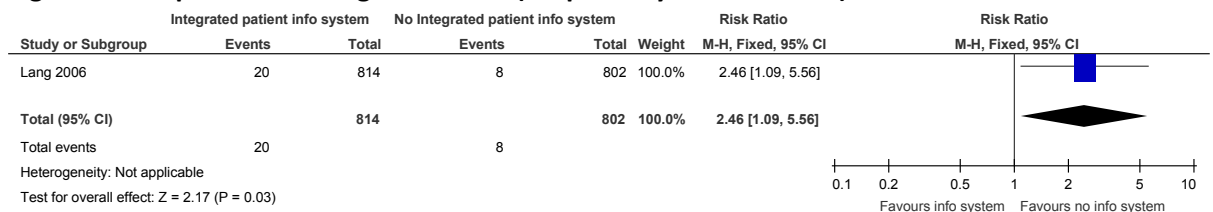


Figure 5: Duplication of diagnostic tests (in speciality consultations)



Appendix D: Clinical evidence tables

Study	Lang 2006 ⁷
Study type	RCT (Patient randomised; crossover: 4 crossover periods 10 weeks long).
Number of studies (number of participants)	1 (n=2022).
Countries and setting	Conducted in Canada; Setting: Emergency department of the Sir Mortimer B. Davis - Jewish General Hospital in Montreal, an adult university teaching hospital with 637 beds.
Line of therapy	1st line.
Duration of study	Intervention + follow up: 2 separate 10 week intervention phases. Follow-up 28 days.
Method of assessment of guideline condition	Adequate method of assessment/diagnosis.
Stratum	Overall.
Subgroup analysis within study	Not applicable.
Inclusion criteria	Patients whose family physician was participating in the study were approached for recruitment upon presentation to the emergency department between 18 June 2001 and 2 April 2002. For their visit to be eligible, patients had to be 18 years of age or older, have been seen by the participating family physician at least once within the previous 2 years. Recruitment occurred on weekdays between 0800 and 2200 except on statutory holidays. Participants agreed to have their clinical information extracted from their emergency department medical chart and sent to their family physician.
Exclusion criteria	Not stated.
Recruitment/selection of patients	Family physicians were selected for recruitment on the basis of the frequency with which their patients consulted the hospital's emergency department; a minimum of 100 annual visits per physician clientele was required. Physicians were recruited by phone, letters or invitation and information sessions. Consenting physicians, rather than patients or visits were then randomised to the initial intervention or control group phases.
Age, gender and ethnicity	Age - Mean (SD): Intervention: 62.1 (20.3); 62.1 (20.4). Gender (M: F): Intervention: 437/611; control: 427/551. Ethnicity: Not stated.
Further population details	1. Frail elderly: Not applicable/Not stated/Unclear.
Extra comments	Each of the 4 cross over periods was 10 weeks long. During each period, the results of the patients visit were communicated to the participating family physician by way of either the intervention strategy or the control strategy depending on the physicians' allocation at the time of the visit.
Indirectness of population	No indirectness.

Interventions	<p>(n=1048) Intervention 1: Integrated patient information systems throughout AME pathway (including primary care, secondary care and social care) - Patient information database (for example, summary care records) accessible to all HCPs directly involved in the care of their patients. When family physicians were in the intervention phase, they received detailed clinical information of their patients visit to the emergency department through a secure web-based standardised communication system (SCS). The SCS programme automatically issued advisory emails (at 0700) once per day to all family physicians whose patients or patients had presented to the emergency department within the previous 24 hours. The email also provided a link to a secure web page where the family physician could view and print a medical report with details of the emergency department visit, including the patients name, presenting symptoms, emergency department diagnosis, disposition, special consultation reports, laboratory test and electrocardiography results, imaging reports, discharge planning information and suggested follow-up, as well as any new medications or modifications to existing medication regimens. Emergency physicians were aware of which patients were having SCS reports issued because the names of the family physicians receiving SCS reports were posted in the emergency department. Duration: 10 weeks. Concurrent medication/care: background medications not stated. Chief symptom (most frequent): Chest pain- Intervention (11.2%) Abdominal pain-Intervention (9.5%) Dyspnoea-Intervention (7.3%) Further details: 1. People undergoing active cancer treatment: Not applicable/Not stated/Unclear.</p> <p>(n=974) Intervention 2: No integrated patient information systems throughout AME pathway (including primary care, secondary care and social care) - lack of accessibility to patent information databases to all HCPs involved in care of patients. When family physicians were in the control phase, they received a carbon copy of the first page of the emergency physicians' notes by regular mail within 1-2 weeks of the visit to the emergency department; the standard practice at the emergency department. Duration: 10 weeks. Concurrent medication/care: background medications not stated. Chief symptom (most frequent): Chest pain- control: 14.1%Abdominal pain-control (9.9%) Dyspnoea-control (8.1%). Further details: 1. People undergoing active cancer treatment: Not applicable/Not stated/Unclear.</p>
Funding	Academic or government funding.
<p>RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PATIENT INFORMATION DATABASE (FOR EXAMPLE, SUMMARY CARE RECORDS) ACCESSIBLE TO ALL HCPS DIRECTLY INVOLVED IN THE CARE OF THEIR PATIENTS versus LACK OF ACCESSIBILITY TO PATENT INFORMATION DATABASES TO ALL HCPS INVOLVED IN CARE OF PATIENTS.</p> <p>Protocol outcome 1: Unnecessary duplication of tests at End of follow-up. - Actual outcome: Duplication of diagnostic tests (between ED and the family physician office) at End of follow-up; Group 1: 24/814, Group 2: 22/802; Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Other 2 - Low, Other 3 - Low; Indirectness of outcome: No indirectness - Actual outcome: Duplication of diagnostic tests (in speciality consultations) at End of follow-up; Group 1: 20/814, Group 2: 8/802; Risk of bias: All domain - High,</p>	

Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Other 2 - Low, Other 3 - Low; Indirectness of outcome: No indirectness

Protocol outcome 2: ED admissions at end of follow-up.

- Actual outcome: Return visits to the ED within 14 days at 14 days; Group 1: 97/814, Group 2: 88/802; Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Other 2 - Low, Other 3 - Low; Indirectness of outcome: No indirectness

- Actual outcome: Return visits to the ED within 28 days at 28 days; Risk of bias: Risk of bias: All domain - High, Selection - Low, Blinding - High, Incomplete outcome data - Low, Outcome reporting - Low, Measurement - Low, Crossover - Low, Subgroups - Low, Other 1 - Low, Other 2 - Low, Other 3 - Low; Indirectness of outcome: No indirectness

Protocol outcomes not reported by the study

Quality of life at End of follow-up; Avoidable adverse events (including missed or delayed treatments and missed or delayed investigations, prescribing errors (errors of omission or commission, medicines reconciliation) at End of follow-up; Patient satisfaction at End of follow-up; Length of hospital stay at end of follow-up; Staff satisfaction at End of follow-up; Mortality at End of follow-up.

Appendix E: GRADE tables

Table 5: Clinical evidence profile: Integrated Patient Information Systems versus no Integrated Patient Information Systems

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Integrated patient info system	No Integrated patient info system	Relative (95% CI)	Absolute		
Repeat visits to the ED within 14 days												
1	randomised trials	serious ¹	no serious inconsistency	no serious indirectness	serious ²	none	97/814 (11.9%)	11%	RR 1.09 (0.83 to 1.42)	10 more per 1000 (from 19 fewer to 46 more)	⊕⊕○○ LOW	IMPORTANT
Repeat visit to the ED within 28 days												
1	randomised trials	serious ¹	no serious inconsistency	no serious indirectness	no serious imprecision	none	138/814 (17%)	16.8%	RR 1.01 (0.81 to 1.25)	2 more per 1000 (from 32 fewer to 42 more)	⊕⊕⊕○ MODERATE	IMPORTANT
Duplication of diagnostic tests (between ED and the family physician office)												
1	randomised trials	serious ¹	no serious inconsistency	no serious indirectness	very serious ²	none	24/814 (2.9%)	2.7%	RR 1.07 (0.61 to 1.9)	2 more per 1000 (from 11 fewer to 24 more)	⊕○○○ VERY LOW	IMPORTANT
Duplication of diagnostic tests (in speciality consultations)												
1	randomised trials	serious ¹	no serious inconsistency	no serious indirectness	serious ²	none	20/814 (2.5%)	1%	RR 2.46 (1.09 to 5.56)	15 more per 1000 (from 1 more to 46 more)	⊕⊕○○ LOW	IMPORTANT

¹ Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.

² Downgraded by 1 increment if the confidence interval crossed 1 MID point, and downgraded by 2 increments if the confidence interval crossed 2 MID points.

Appendix F: Excluded clinical studies

Table 6: Studies excluded from the clinical review

Study	Exclusion reason
Akbarov 2015 ¹	Incorrect interventions. A 2-stage dynamic fixed-effect modelling to demonstrate the use of electronic records and repeated measures of risk factors, to enable deeper understanding of the relationship between the full longitudinal trajectory of risk factors and outcomes.
Aubin 2012 ²	Incorrect interventions. Prospective longitudinal survey of primary care physicians, lung cancer patients and cancer specialists. The objective was to compare lung cancer patient, PCP and specialist expectations regarding PCP involvement in co-ordination of care, emotional support, information transmission and symptom relief at the different phases of cancer.
Cifuentes 2015 ³	Inappropriate intervention -the article describes the electronic health record related experiences of practices. No extractable outcomes Inappropriate study design- observation study
Cox 2016 ⁴	Inappropriate study design. Review article
Flemming 2013 ⁶	Systematic review- references checked
Moore 2011 ⁸	Incorrect comparison. EHR (electronic health records) used as a secondary information source versus EHR used as an initial information source.
Overhage 2002 ⁹	Study data not reported for the intervention and control groups separately.
Sicotte 2016 ¹⁰	Not AME- study evaluated the impact of application of electronic medical record (EMR) in an ambulatory care centre in medical and radiation oncology.
Van eaton 2005 ¹¹	Incorrect interventions. Computerised rounding and sign-out system. Study has been included in the 'ward rounds' review.