Title: Knowledge translation studies in paediatric emergency medicine: a systematic review of the literature

Type of manuscript: Systematic literature review

Authors:

Catherine L Wilson^a, David Johnson^b, Ed Oakley^{a,c,d}

Institutions:

^a Emergency Research, Murdoch Childrens Research Institute, Royal Children's Hospital, Flemington Road, Melbourne, Victoria, Australia

^b Departments of Pediatrics and Physiology and Pharmacology, Cummings School of Medicine, University of Calgary, Calgary, Alberta, Canada

^c Department of Emergency Medicine, Royal Children's Hospital, Flemington Road, Melbourne, Victoria, Australia

^d Department of Paediatrics, The University of Melbourne, Victoria, Australia

Corresponding Author:

Ed Oakley, Department of Emergency Medicine, Royal Children's Hospital, 50 Flemington Road, Parkville 3052, Australia

Email: ed.oakley@rch.org.au

Phone: +613 9345 6592

Fax: +613 9345 5938

Version: 2, 19/08/2015

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: [10.1111/jpc.13074](https://doi.org/10.1111/jpc.13074)

Word Count: 3109

Author Manuscript

Abstract

Objective: Systematic review of knowledge translation studies focused on paediatric emergency care to describe and assess the interventions used in emergency department settings.

Method: Electronic databases were searched for knowledge translation studies conducted in the emergency department that included the care of children. Two researchers independently reviewed the studies.

Results: From 1305 publications identified, 15 studies of varied design were included. Four were cluster controlled trials, two patient-level randomized controlled trials; two interrupted time series, one descriptive study and six before and after intervention studies. Knowledge translation interventions were predominantly aimed at the treating clinician, with some targeting the organisation. Studies assessed effectiveness of interventions over 6 to 12 months in before and after studies, and 3 to 28 months in cluster or patient level controlled trials. Changes in clinical practice were variable, with studies on single disease and single treatments in a single site showing greater improvement.

Conclusion: Evidence for effective methods to translate knowledge into practice in paediatric emergency medicine is fairly limited. More optimal study designs with more explicit descriptions of interventions are needed to facilitate other groups to effectively apply these procedures in their own setting.

Key words: Emergency; knowledge translation; dissemination; evidence based medicine; paediatrics

Key Points

- Knowledge translation interventions in the emergency department setting, are predominantly aimed at the health professional, using before and after or cluster controlled trial designs.
- Thorough identification of potential barriers to implementation is critically important and needs to be undertaken early on so they can be addressed.
- Description of knowledge translation interventions needs to be made more explicit so that other groups can implement in their local setting.

Author Manuscript

Introduction

The capacity for generating new knowledge to address evidence gaps in paediatric emergency care is steadily improving. A critical mass of paediatric emergency medicine (PEM) specialists is now established and collaborative research is being conducted through several highly successful national and international research networks focusing on generating better evidence for how to manage children who are critically ill or injured. .

Whilst this is important, the capacity to generate new evidence is only the first step in improving emergency care outcomes for children. The second and arguably harder step is to translate new knowledge into practice. There are often significant gaps in time – upwards of fifteen years - between when evidence is first generated and when it is routinely used to treat patients. How to most effectively shorten the time period between discovery of new knowledge and its routine wide spread use in the emergency department (ED), is a critically important goal.

When clinicians who care for acutely ill and injured children do not utilise best evidence, outcomes are suboptimal with potential exposure to unnecessary interventions which increase health care costs and may also lead to unnecessary adverse events (1). Acute bronchiolitis, asthma, gastroenteritis, pneumonia and upper respiratory infections in children are all common conditions for which evidence on diagnosis and management exists (2-5). Despite this there is substantial variation in how these conditions are managed all around the world, as evidenced-based care is inconsistently provided.

There is general agreement that the ED setting presents many challenges to the effective translation of knowledge into practice (6). Large patient volumes, time pressures to meet demand, frequent staff rotations and substantial child and parent anxiety, all contribute to a dynamic and demanding environment. The challenges are made even greater for paediatric emergency medicine as most children are cared for in mixed EDs that are focussed primarily on adult care, and may not have specific paediatric emergency medicine expertise.

Consequently, ED knowledge translation (KT) initiatives need to be tailored to address these and other potential barriers to delivering optimal care and to harness the inherent strengths of a flexible and capable workforce.

This paper aims to provide a systematic review of published clinical knowledge translation studies carried out in the ED setting and focused on paediatric care. Different approaches to knowledge translation, types of interventions and their overall impact on practitioners, work processes and clinical care outcomes will be reviewed.

Materials and Methods

Details of the data sources, search strategy and the study selection process for this review are summarised in Table 1.

Search strategy

Our systematic search followed PRISMA guidelines (7). A literature search was conducted in OvidSP Medline, OvidSP Embase, PubMed and the Cochrane Database. The search included thesaurus terms and key words relating to KT studies in EDs and research

involving paediatric populations. The search strategy was broad to include studies of varied research design that used both quantitative and qualitative methods.

Study selection

Only papers published in the past ten years and in English were included. Because paediatric emergency medicine is our topic of interest, the search aimed to select translational studies carried out in an emergency department setting with paediatric populations. However, we also included studies carried out with other departments and or mixed paediatric and adult populations.

Screening and quality assessment

All results from electronic databases and reference lists (n=1305) were reviewed, based on the inclusion and exclusion criteria in Table 1. After exclusion of duplicates and screening of the title and abstract, a further 1281 were excluded (see Figure 1). Full texts of 26 studies were obtained and each study was evaluated independently by two reviewers/authors (Wilson and Oakley). Fifteen of the 26 studies met both our inclusion and exclusion criteria and are presented in this review. The remaining 11 studies were excluded for the following reasons: two studies (8, 9) did not include any patients under 18 years of age in the sample; three papers (10-12) were protocols only; two studies did not include sufficient description of their knowledge translation interventions to add value to this review (13, 14); three studies focused heavily on patient mediated interventions (requiring change in patient behaviour) which were not of interest in this review (15-17) and one study by a different author (18) duplicated another already in this review (19). The included studies have been reported using the domains outlined by the Cochrane Effective Practice and Organisation of Care Review group (EPOC) (20).

Results

Selected studies and their characteristics are presented in Table 2.

Study Design:

A wide range of study designs have been used in ED paediatric knowledge translation research. The studies included in this review are: four cluster controlled trials (21-24), two patient-level randomized controlled trials (3, 25); two interrupted time series (2, 26), one descriptive study (19) and six before and after intervention studies (of which four were single site (5, 27-29), one multisite uncontrolled (30) and one multisite controlled (31)).

KT Interventions:

The KT Interventions were predominantly aimed at healthcare professionals. They included involving the clinicians in formulating the tools and methods to be implemented, and educating them in both the need for the tools and interventions, and how to use them (3, 5, 19, 21-25, 27-31). In all of these studies, staff engagement was perceived to be very important for success. Organisational interventions were also common and included: formation of new multidisciplinary teams to coordinate the writing and implementation of guidelines (3, 21, 27-29), development of clinical governance guidelines and checklists (30), implementing new clinical roles and redefining clinical boundaries (19), implementing clinical decision support software (3, 25), and prospective identification of practice and process gaps and barriers (22, 24).

Interventional studies were focussed on modification of existing management (5, 21, 22, 25, 27) with some aiming for a reduction of established management (23, 24, 28, 31) such as reduction in anti-biotic prescribing, and some aiming to establish new models of care (19).

Study intervention times varied across studies and intervention types. The mean study time in the before and after intervention studies was 7 months (range 4 to 12 months), and in the cluster controlled or patient level randomised trials was 14 months (range 7 to 28 months).

Ambroggio (27) was the only investigator to incorporate ongoing intermittent interventions over the period of the trial to improve antibiotic prescribing for community acquired pneumonia. These interventions included Grand Rounds presentation, distribution of a guideline summary, prescribing reminder lanyard cards, small group meetings with targeted clinicians and weekly audit. Each of the interventions was associated with an improvement in antibiotic prescribing and after the last intervention, compliance was 100% for the final 3 months of the trial.

When implementing the “Low Risk Ankle Rule”, Boutis (31) incorporated a three staged approach to intervention that had a control period of no intervention followed by a period of intensive education plus use of the tool, followed by a period of use of the tool alone to simulate ‘real’ ongoing conditions. This strategy showed a progressive improvement in performance with absolute reduction in unnecessary ankle imaging of 21.9% between phase 1 to 2 and reduction of 23.9% between phases 1 – 3.

Outcomes:

Outcomes are shown in Table 2 with primary outcomes presented as absolute change from baseline.

Three trials reported clinicians or families experience with the study intervention.(19, 25, 30) Roukema (25) implemented a computer assisted clinical decision support system to support ordering of diagnostic blood tests in febrile children, and reported only 49% compliance with the advice supplied. The reason reported by staff for non-compliance was the difficulty in agreeing to order blood tests on children who appeared perfectly well. Pannifex (30) reported on the introduction and compliance with governance processes in relation to procedural sedation in children with 20-30 random charts audited at each site before and after the intervention. The compliance with best practice process, was markedly improved in the 6 month follow up period and staff satisfaction with impact of interventions and the outcomes was very high. Bernstein (19) collected interview data from staff in the ED where the model of care had been changed to deliver screening and health promotion information to patients at risk of drug and alcohol dependency. The staff described their initial resistance to the new process then gradual acceptance with unexpected improvements in patient flow through the ED and greater understanding of resources they could offer the patient group.

The trials by Stiell (23, 24) which focussed on implementing clinical imaging guidelines for cervical spine and head injuries using computerised tomography (CT), used identical implementation methods yet had very different degrees of success. Stiell reviewed why the implementation of the Head CT rule was not so successful and discovered a number of barriers to implementation that were not identified prior to the implementation of the knowledge translation interventions but were raised later on.(24) These barriers related to underlying physician beliefs that opposed application of the rule because of concerns it might miss something clinically important and that CT scanning was a local standard of care that would likely lead to more timely discharge.

Johnson's (2) study investigating the effect of the publication of the 2006 American Academy of Pediatrics guideline for managing bronchiolitis on subsequent bronchiolitis hospital care, showed no difference in the utilisation of interventions known to be of no benefit over a 4 year post publication period. Knapp (26) retrospectively reviewed management documented in the US National Hospital Ambulatory Medical Care Survey and found that publishing a guideline (for croup) and disseminating a guideline with a planned implementation approach (for asthma) had no differential effect on the degree of practice change.

Discussion

Knowledge translation in paediatric emergency medicine is a relatively new field with its necessity only really being recognised in the last decade.(32-34) This has come after a realisation that producing high quality evidence does not in itself change practice; and knowledge that one third of patients do not receive care they could benefit from; and one quarter receive care that has been shown to be of no benefit (35-37).

There are varied approaches to knowledge translation that have arisen from different disciplinary or stakeholder groups and different contexts (1). The barriers and difficulties begin with the fact that effective treatment paradigms in one population or region may not translate to other populations or contexts due to cultural difference which affects attitudes and beliefs, and the way things are done. Add to this a lack of evidence on effective methods to translate new knowledge into clinical practice in the emergency department, and the problem of a growing evidence-practice gap becomes understandable. (1, 34, 38)

In the ED the individual clinician often has power of decision making, especially in test ordering and treatment choice. This should be but is not always supported by systems and

evidence. This is exemplified by over 80% of KT interventions targeting individual clinician behaviour in some way, despite there being little evidence on how this should be done, or the impact this may have on effectively translating knowledge (38, 39).

The studies identified in this systematic review undertook a range of processes for KT intervention with some similarities and with some different points of emphasis. They attempted to engage the clinician users, encouraged and undertook discussion, gained agreement and support, developed or modified tools before implementation and a few provided ongoing education, audit or feedback. These types of intervention process are supported by literature in relation to KT in other fields (40, 41). Our findings are broadly similar to those found by EPOC Cochrane overviews of systematic reviews of the implementation literature (42, 43). See Table 3 for a summary of key steps to consider when undertaking a KT project (44) and a listing of potential implementation strategies (1, 39-41, 43, 45-47).

Unfortunately, description of these KT interventions in the studies reviewed is of variable quality and often insufficient to allow the process to be undertaken at other sites or in other studies. This is a significant impediment because effective translation of knowledge into practice requires a thorough understanding and assessment of the implementation processes used and barriers encountered, in order to allow them to be critically appraised and adapted locally. The paediatric emergency KT literature to date, tends to report on outcomes of the 'clinical' interventions, with success determined by the 'clinical outcomes' that the interventions desired to change, with inadequate reporting on and evaluation of the process or KT intervention that was used to bring about the change. A recent review of ICU-based knowledge translation studies highlighted similar issues with limited evidence

available to demonstrate any benefit of knowledge translation interventions or clinical outcomes in the studies undertaken (48). Additionally the EPOC overviews have levelled a similar critique of the broader KT literature (39, 43).

Distinguishing between evaluation of KT interventions and clinical outcomes is an important distinction to make, and is highlighted by having successful implementation in only six studies. (5, 22, 23, 27, 29) In the unsuccessful studies, it is not clear whether this is because the practice was already reasonable in the participating institutions and hence they did not measure improvement, whether the KT intervention was not appropriate to bring about change, or whether the intervention was not implemented adequately to effect change. Thorough evaluation of KT interventions success or failure can be a very powerful way to better understand the complexities involved in a change initiative and how it relates to a particular setting. A study carried out by Kinsman (8) to implement a clinical pathway for management of acute myocardial infarction in rural areas, illustrates this very well. No change in clinical outcomes was measured in this study but significantly more insight was gained into what is potentially achievable in this context and what needs to be the area of focus for intervention in the future.

The two studies by Steill (23, 24) further highlight the importance of these distinctions. In these trials identical methods were used in similar institutions with different results. The C-Spine study was successful in bringing about a reduction in unnecessary ordering of cervical spine x-rays through implementation of the Canadian C-spine rule, but the equivalent study to implement the Canadian CT Head rule did not bring about the desired reduction in the ordering of unnecessary head CT scans. Further exploration of why this occurred revealed that in the unsuccessful CT Head trial there existed a number of barriers to clinicians using

the intervention had not been identified or addressed at commencement of the study. Study designs that describe the provider specific factors that may be barriers to successful implementation of new knowledge, and methods used to address these, are needed to help future groups to learn more from existing KT evidence. (38) There are a number of theoretical frameworks that can be used to explore and identify a range of factors that will potentially influence implementation such as the Theoretical Domains Framework (49, 50) or the Theory of Planned Behaviour (51).

As in many other fields, Johnson (2) showed that production of high quality evidence based guidelines is insufficient to change practice at a population level (41). To date the evidence of what is effective in implementing change in paediatric emergency medicine is also sparse. It is unclear if there is a series of KT interventions that will be effective (or able to be adapted) across regions or will translate between different professional, patient or disease populations.

There was a reasonable consistency in the timeframes of the assessment of the KT interventions in the identified trials, with approximately 6 to 12 months follow up and pre study data being the norm. However, there are potential issues with these short timeframes. The sustainability of the KT interventions in an environment where physician training requirements produce a regular turnover of clinical staff has not been adequately assessed. Furthermore, a slow and persistent practice change that has been underway since the evidence emerged may be overlooked. The change identified over a short study period that is attributed to the KT intervention, may be diminished if this longer term trend for improvement is uncovered. To be sure this scenario has not occurred, a period of 2-3 years data collection pre and post intervention is warranted.

The most popular trial design in the reviewed studies was a before and after KT intervention measure. Most of these studies were at single institutions and their generalisability to other settings is unclear.(5, 21, 27-29) Furthermore, it is well established that this study design can lead to overly optimistic estimates of the effectiveness of KT interventions due to extrinsic factors underlying trends. (52, 53). Four studies used cluster-controlled trial design which is widely considered to be the most rigorous method for determining the effectiveness of a KT intervention (52, 53). However one of these trials (21), inappropriately used a ‘time-period (one week)’ as the cluster so that the same ED staff who were the target of the intervention, were included in both the intervention and control arms – making the intervention effect less distinguishable. Another of the cluster controlled trials (22), included only four matched pair EDs which is an inadequate number. As well, they did not account for clustering in their analysis. This most certainly resulted in an overestimate of the effect of their study intervention. The cluster trials by Stiell were the only two which used optimal study designs, appropriate statistical analysis and included sufficient number of EDs to provide adequate power and enhance generalisability(23, 24).

Conclusion

Evidence for effective methods to translate knowledge into practice in paediatric emergency medicine is fairly limited. Studies which use optimal study designs such a cluster controlled trials and appropriate statistical analysis accounting for intracluster correlation coefficients are needed. Studies should carefully assess potential barriers to success such as attitudes and beliefs relevant to different professional groups, diseases and patient populations. Use of a theoretical model to underpin identification of barriers and mixed methods study design (qualitative and quantitative research) should also be considered. More explicit descriptions

of interventions undertaken in KT studies and measurement of process, is essential to facilitate other group's implementation in their own setting. Measurement of change over longer periods is also desirable to further understand sustainability. Well designed, conducted and reported KT trials in paediatric emergency medicine are urgently needed to enhance our understanding of how best to translate knowledge into practice. Otherwise the promise of better child health outcomes from paediatric emergency research networks generating best evidence will be unfulfilled for many years to come.

Acknowledgements

This review is supported by a National Health and Medical Research Council, Centre for Research Excellence Grant, APP1058560. The authors also wish to acknowledge the support of Ms Poh Chua, Royal Children's Hospital Library, with the literature search.

Table 1 Search and selection strategy

Data Sources	Medline (OvidSP); EMBASE (OvidSP); PubMed; The Cochrane Database
Thesaurus terms	Broad searches were performed using the relevant thesaurus terms: (emergency care OR emergency medicine OR emergency service, hospital OR emergency ward), AND (information dissemination OR knowledge OR translational medical research OR “diffusion of innovation” OR professional knowledge OR translational research OR evidence based medicine OR evidence based emergency medicine OR randomized controlled trial OR randomised controlled trial (topic)) AND pediatrics
Keywords	Emergency AND (knowledge translation OR dissemination OR innovation) AND (child* OR infant* OR adolesc* OR neonat* OR pediatric* OR paediatric*)
Search dates	1 January 2004 to 19 January 2015
Other information sources checked	Reference lists of included studies were searched to identify additional relevant papers (i.e. snowballing references)
Inclusion criteria	<ul style="list-style-type: none"> • Studies published in English language in peer reviewed journals • Studies undertaken in an emergency department setting (but not limited to the ED ie other departments could be involved) • Studies which described knowledge translation interventions adequately • The knowledge translation interventions were mostly professional interventions targeted to staff rather than patients • Studies included paediatrics but were not limited to paediatric populations
Exclusion criteria	<ul style="list-style-type: none"> • Studies which did not describe knowledge translation interventions sufficiently • Studies carried out in settings that did not included the emergency department

Figure 1. PRISMA information flow diagram for the systematic review

*PubMed search only completed for 2014-2015 to obtain Epubs.

Table 2. Studies selected for review

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
Ambroggio 2013(27)	<p>Aim: improve compliance with the community acquired pneumonia in children national antibiotic prescribing guideline</p> <p>Tool: Local guideline based on National antibiotic prescribing guideline for community acquired pneumonia</p>	Cincinnati, USA: single tertiary children's hospital; ED and hospital medical (HM) department.	<p>Single site before and after study; 6 months before data (n=67) compared with 9 months post data (n=150). Quality Improvement, plan-do-study-act methodology, with ongoing interventions. Sample: (n=217) patients aged 3 months to 19 years.</p>	<p>Organisational: - Multidisciplinary team designed the interventions using a process map;</p> <p>Professional: Interactive seminar about guidelines; Summary of guidelines emailed; reminder prescribing card; default link to guideline in electronic medical record; weekly audit of eligible patients for success or failure.</p>	Proportion of eligible patients receiving appropriate first line antibiotic therapy; and Length of stay (LOS)	<p>ED had an 82% absolute improvement in correct prescribing (0 vs 82%); HM department had a 60% absolute improvement (30 vs 90%). Ongoing interventions improved rates to 100% after 3 months in both locations. Pre intervention median LOS <1 day, IQR: 0-1 day, post intervention median LOS: 1 day; IQR: 0-2days <.001.</p>
Bernstein 2009(19)	<p>Aim to implement a high risk drug and alcohol screening intervention in emergency departments across the state i.e. "SBIRT", Screening, brief intervention and referral to treatment.</p> <p>Tools to assess the intervention in the ED were based on the RE-AIM theory (Reach, effectiveness, adoption, implementation and maintenance).</p>	Massachusetts, USA: 7 hospital EDs in urban, suburban and rural community settings.	<p>Descriptive study; 18 months data collection prospectively over implementation period with 15,383 patients screened across 7 sites. Qualitative semi-structured interviews of staff (n=24) to determine reach and success. Data from this state based study was compared with Federal data; sample age was not stated, assumed to include adolescents.</p>	<p>Organisational: 12 health promotion advocates (HPA) were employed in 7 EDs to do screening of at risk patients; ED and HPA staff identified at risk groups to be screened.</p> <p>Professional: Peer educators at each site delivered education and training to HPAs which included quarterly workshops and monthly monitoring of performance for accuracy.</p>	RE-AIM (Reach, effectiveness, adoption, implementation and maintenance). Quantitative: total patients screened; % positive; % negative; % referred to other resources. Qualitative: identification of barriers, challenges and successes to the intervention.	<p>SBIRT required a team focused model of delivery customised to each ED. Overcoming staff attitudes to SBIRT was best addressed by local staff champions who intervened when problems arose. The intervention relies on continued funding of the staff to implement SBIRT at each site.</p>
	Aim to reduced use of	Ontario, Canada:	Multisite controlled	Professional:	Proportion of eligible	In comparison with

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
Boutis 2013(31)	<p>radiography in management of ankle injuries in children.</p> <p>Tool:– Clinical decision support rule - “The Low Risk Ankle Rule” and computerised decision support system (CDSS) to support the rule.</p>	2 urban children’s hospitals, 2 urban general hospitals, 2 community based suburban hospitals; all in ED.	before and after study; 18 month study period with 3 consecutive 26 week phases at the intervention sites (one 18 month period for controls); prospective data collection. Sample: (n=2151); patients aged 3 – 16 years.	<p>Intervention sites only: phase 1 – internal control phase i.e. clinical data collection re ankle injury management and assessment of physician satisfaction.</p> <p>phase 2 – physician teaching sessions; pocket cards and posters of the rule; flagging of charts for ankle injuries; physician champions; use of CDSS; training of physicians in management of low risk ankle injury;</p> <p>phase 3 – use of CDSS only.</p>	children who received ankle radiography; proportion of children with missed significant fractures; proportion of children who did not have radiology in ED but did so subsequently; length of stay. Patient satisfaction and ED physician satisfaction were assessed. All were compared with the control group.	control group, there was an absolute reduction of 21.9% in radiography between phase 1 to 2 and 23.9% between phase 2 – 3. No increase in clinically important fractures missed. Use of the rule did not affect patient or physician satisfaction or length of stay.
Cunningham 2008(21)	<p>Aim: assess effectiveness of implementing an Integrated care tool on the management of asthma</p> <p>Tool Local Integrated Care tool based on the United Kingdom asthma management guidelines.</p>	Edinburgh, Scotland: single, tertiary paediatric hospital; ED and hospital respiratory department.	Cluster randomised controlled trial; 26 week trial of 7 day trial periods randomly assigned to either standard care or care delivered using the ICP in blocks of 8 weeks. Sample: (n=298); patients aged 2 - 16 years.	<p>Organisational: Multidisciplinary team developed an Integrated care pathway (ICP) for acute asthma/wheeze which involved development of a single document for use by whole team incorporating guidelines and reducing variation.</p> <p>Professional: Tutorials were given in the use of these tools and underpinning knowledge.</p>	Difference in length of hospital stay; rate of asthma improvement in physiological variables, and bronchodilator requirements; bronchodilator and prednisolone use. Discharge process: time to complete discharge criteria; provision of education to family; parent questionnaire to determine receipt and understanding of discharge information. Proportion of prescribing errors	Physiological recovery or length of stay did not improve. There was an absolute reduction of 30% in prescribing errors and an absolute increase of 39% (72% versus 33%) in prednisolone prescribing. Patient education and discharge planning improved by 48% (89% versus 41%).

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
Dexheimer(3) 2014	<p>Aim: Implement evidence based guidelines for the management of asthma:</p> <p>Tool: Integrated computerised asthma detection and management system in the ED.</p>	Cincinnati, USA: single tertiary paediatric hospital; ED.	<p>Randomised controlled trial to intervention or standard care (paper based) over a 5 month period.</p> <p>Sample: (n=788); patients aged 2 – 18 years.</p>	<p>Organisational:</p> <p>Multidisciplinary team refined evidence based practice guideline, care flow sheet and severity based order sheets which informed the computerised and paper based systems 2 years prior.</p> <p>Use of the computerised asthma management system was used to detect patients with asthma exacerbation and used computer driven work flow, tracking asthma scores at triage and onwards and delivering re-scoring reminders and relevant order sets.</p> <p>Professional:</p> <p>Physician, nurse and respiratory therapist education sessions at meetings, in two months prior; divisional email re study.</p>	<p>Time from ED triage to disposition decision; adherence to guidelines including asthma education ordered; asthma scoring performed; ED length of stay; hospital admissions.</p> <p>Survey to evaluate staff awareness of study.</p>	<p>The absolute difference between the two groups median time to disposition decision was 5 minutes, which was not significant, $p=0.362$. ED median length of stay was 15 minutes longer in the intervention group but this was not significant. Admission rates were also very similar. There was no difference between the two groups in any of the guideline adherence measures.</p>

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
Diaz 2004(5)	<p>Aim: 1. Implement evidence based guideline for diagnosis and management of pharyngitis. 2. Reduce antibiotic prescription.</p> <p>Tool: Locally created clinical practice guideline for pharyngitis</p>	Akron, USA: single tertiary paediatric hospital; ED.	Single site before and after study; retrospective medical record review of pre-intervention and post-intervention randomly selected cohorts, over a 4 month period, using standardized data collection. Sample: (n=443); patients aged 1.5 - 19 years.	<p>Professional: Development of a pharyngitis pathway by ED physicians in form of a document which contains reminders re guidelines.</p> <p>Organisational: Triage nurse adds the pathway document to appropriate patients notes.</p>	Compliance with guideline as indicated by appropriate diagnosis and antibiotic prescribing.	An absolute improvement in diagnosis procedure and appropriate antibiotic treatment of 47% (44% to 91%).
Doherty 2006(22)	<p>Aim: to assess if an evidence based approach to implementation of an asthma guideline improved compliance with evidence based care</p> <p>Tool: Evidence based approach to implementing an established asthma guideline</p>	New South Wales, Australia: eight rural district hospitals; EDs.	Cluster randomised controlled study; four matched pairs of rural hospitals. Retrospective medical record review of pre-intervention (n=52) and post-intervention (n=47) cohorts, over 7 month periods, using standardized data collection. Sample: (n=187); patients aged 14 + years.	<p>At intervention sites only</p> <p>Organisational: Identification of practice gaps; identification of barriers to change in ED at each hospital prior to implementing the EBI tool.</p> <p>Professional: Guideline reformatting to useable format - incorporated in medical record; reminders with site visits twice during study period; education sessions for medical and nursing staff; audit and feedback twice per 7 months; study co-ordinator/ knowledge broker lead change.</p>	Changes in 6 targeted areas: asthma severity; use of spirometry; use of ipratropium; use of corticosteroids; use of antibiotic; documentation of short term asthma management plan.	An absolute improvement of 26% (36% vs 62%) in the adherence to the aggregate of all six indicators.
Fong 2008(28)	Aim: improve appropriate use of Computerised Tomography (CT) scans in	Melbourne, Australia: single tertiary hospital; mixed ED.	Single site before and after study; comparison of pre-intervention	Professional: Development of a local guideline with a focus	CT head ordering rates in head injury; appropriateness of	An absolute increase of 27% (32% vs 59%) in the ordering of Head CT.

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
	the management of head injury. Tool: A locally developed head injury guideline developed based on the Canadian CT Head Rule (CCTHR)		period (n=311) over 5 months, and post-intervention period (n=326) over 7 months, using standardized data collection from medical records. Retrospective pre intervention data collection; prospective data collected post intervention. Patient follow up questionnaire used. Sample: (n=637); patients aged > 16 years.	group; training of medical staff in prospective application of the local head injury rule.	ordering CT scan. Comparison of the detection of clinically significant head injury abnormalities on CT (local rule versus CCTHR.).	No abnormalities were missed versus four that would have been missed using CCTHR alone.
Johnson 2013(2)	Aim: to assess change in bronchiolitis management after publication of American Academy of Pediatrics Guideline on management of bronchiolitis Tools: non-intervention study	U.S.A: nationally representative group of EDs across the country.	Interrupted time series; retrospective review of a subset of survey data from the U.S. National Hospital ambulatory Medical Care Survey during 2001 – 2009, pre (5 years) and post (4 years) comparison of data in relation to introduction of a guideline in November 2006. Sample: (n=678); patients aged 0 - 2 years.	National: Publication of national guideline in November 2006.	Use of bronchodilators, steroids, antibiotics, and chest x-ray for bronchiolitis.	No change in use of non-recommended therapies (bronchodilators, steroids, antibiotics). Absolute reduction of 19.7% (65.3% vs 48.6%). for CXR.
Knapp(26) 2014	Aim: to compare knowledge transfer in the Emergency Department management of paediatric asthma and croup by measuring trends in	U.S.A: nationally representative group of EDs across the country.	Interrupted time series; retrospective cross sectional study of a subset of survey data from the U.S. National Hospital ambulatory Medical Care Survey	National: Publication and dissemination of asthma guidelines in 1991 with expert panel review and update in 1997, 2001 and 2006.	Use of corticosteroids in for asthma or croup, administered in the ED.	From 1995 to 2009: absolute increase of 23% in use of corticosteroids for management of asthma. Absolute increase of 24% in use of

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
	corticosteroid use. Tools: national paediatric asthma guidelines versus only passive diffusion for croup.		during 1995 – 2009. Comparison of trends in corticosteroid usage between the two groups over 15 year period. Asthma Sample: (n=1829); patients aged 2 – 18 years. Croup Sample: (n=1075); patients aged 6 months - 6 years.			corticosteroids for management of croup. There was no difference in the trend between the two groups, OR interaction term was 0.99.
Pannifex 2013(30)	Aim: to develop and implement standardised approach to procedural sedation for children in the emergency department to improve safety. Tools: development of a training and documentation tool; and Clinical governance self-assessment checklist.	Victoria, Australia: 10 urban hospitals and 4 regional/rural hospitals; EDs..	Multi-site uncontrolled before and after study; comparison of baseline data with 6 months post intervention qualitative data review per ED department. Convenience sample: (n=215); patients (age was not stated but conducted within paediatric patients)	Organisational: Development of a clinical governance checklist; review and update of training materials; development of information sheets, risk assessment and documentation forms; materials about family centred approach; development of audit tool. Professional: Workshop and training of staff.	Comparison of clinical governance; number of staff trained during intervention period; compliance with and documentation of risk assessment procedures; qualitative feedback from staff on their satisfaction with the intervention and perception of impacts.	An average 33% (54 vs 87%) absolute improvement with compliance with all governance measures. Staff feedback very positive, increase teamwork reported.
Roukema 2008(25)	Aim: assess compliance with clinical decision support system recommendations; time spent in ED and test ordering. Tool: clinical decision support system (CDSS)	Rotterdam, The Netherlands: single tertiary paediatric ED.	Randomised controlled trial; enrolments were over a 28 month period. Sample: (n=164); patients aged 1 - 36 months.	Organisational: Implement CDSS - based upon prediction rules to identify high risk patients - then randomised the high risk patients to immediate diagnostic tests or clinician review and	Compliance with the CDSS in registration of febrile children and recommendation for testing. Time at the ED; diagnostic tests in high risk group in comparison with control group.	Compliance with using CDSS 49%. Compliance with CDSS randomisation 82%. There was an absolute increase of 38% (82% vs 44%) of using CDSS to order blood tests in high risk patients.

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
	developed locally for risk assessment of febrile young children.			ordering of tests (control group); Professional: Training for nursing staff in use of CDSS.		There was an absolute increase of 15 minutes (138 vs 123 min) in time in the ED.
Stiell 2009(23)	Aim: to evaluate the effectiveness of an active strategy of implementing the Canadian C-Spine Rule for appropriate ordering of cervical spine imaging; test the impact of the rule on use of imaging. Tools: the Canadian C-spine rule and active implementation strategies at intervention sites.	Canada: 12 hospitals, (6 teaching and 6 community sites); EDs.	Cluster randomised controlled study; matched pairs of 12 hospital sites. Data captured during 12 months pre intervention and 12 months post intervention. Sample: (n=11824); patients aged 16 - 100 years.	Professional: Discussion of rule with physician team and agreement on use of rule; education including pocket cards, posters; 1 hour teaching sessions; reminders of the rule when imaging requested.	Proportion of eligible patients referred for imaging of C-spine; number of clinically important injuries not identified on initial ED visit; adverse outcomes. Performance of the C spine rule at the intervention sites; accuracy of interpretation of and compliance with the rule.	An absolute reduction of 8.4% (61.7% vs 53.3%) of patients referred for imaging in the intervention group, compared with an absolute increase of 7.1% (52.8% vs 58.9%) at control sites. No fractures were missed.
Stiell 2010(24)	Aim: to evaluate the effectiveness and safety of an active implementation strategy for the Canadian CT Head Rule. (Aim to reduce use of CT Imaging) Tools: The Canadian CT Head Rule. An active implementation strategy.	Ontario, Alberta and British Columbia, Canada: 12 hospitals (6 teaching sites & 6 community sites); EDs.	Cluster randomised controlled study; matched pairs of 12 hospital sites. Data captured during 12 months pre intervention (n=1049) and 12 months post intervention (n=1531). Qualitative interviews of staff; Sample: (n=2580); patients aged 16 - 99 years.	Organisational: Assessed barriers prior to intervention and tailored interventions accordingly at sites; adherence to the rule was checked via the radiology department review of requests. Professional: Education sessions were held for physicians and information distributed; Use of pocket reminder cards and posters; real time reminder when requisitioning CT scans.	Proportion of eligible patients referred for CT head scan; number of clinically important brain injuries not identified; staff perception of using rule (and barriers and facilitators to using the rule); sensitivity and specificity of the rule (secondary outcome).	At intervention sites an absolute increase of 13.3% (62.8% vs 76.2%) in rates of CT imaging. At control sites an absolute increase of 6.7% (67.5% vs 74.1%). Sensitivity of the Canadian head CT rule was 100%. Unforeseen barriers to effective implementation were identified in post study feedback.
To 2010(29)	Aim: to examine whether use of a Paediatric Acute	Toronto, Canada: single tertiary paediatric	Single centre before and after study; retrospective	Professional: Development of acute	Administration of systemic corticosteroids	An absolute increase of 23.7% in the use of

Author and Year	Knowledge translation aims and tools	Location and setting	Design, study period and sample	Knowledge translation Interventions	Outcome measures	Findings
	<p>Asthma Management Guideline Reminder Card improves asthma management.</p> <p>Tools: A local guideline based on Canadian asthma consensus guideline. A reminder card with guideline information.</p>	hospital; ED.	chart review of ED visits over 12 months prior to the intervention were compared with 154 prospective ED visits over 12 months following the intervention. Sample: (n=432) ; patients aged < 7 years.	asthma management guideline by local team at hospital; formatted in pocket sized reminder card; disseminated to multidisciplinary team by presentations and email, plus provision of reminder card;	and bronchodilators during ED stay; delivery of asthma education to patient in ED; conduct of discharge planning.	corticosteroids (60.1% to 83.8%). An absolute increase of 20.7% (50.7% to 71.4%) in oxygen saturation reassessment. For discharge planning there was an absolute increase of 8.6% (72.3% vs 63.7%) in a combined measure of discharge planning.

Table 3. Summary of the key steps when undertaking KT projects and a list of potential implementation strategies**KEY STEPS**

- Confirmation that research evidence is clear and adequately strong to justify its use in everyday practice.
- Identification of practice gaps locally prior to initiating change.
- Engagement of key stakeholders in development of the change initiative, ideally including the multidisciplinary team in key elements of development and implementation of the change initiative.
- Identification of potential barriers and enablers to change at the level of organisations/departments/different professional groups and individuals. Theoretical frameworks can be used in this process. Aim to address modifiable barriers and enhance enablers in the change initiative.
- Based on assessment of potential barriers and enablers, and the theoretical framework chosen to guide your approach to change, select and modify one or more implementation strategies (see below).
- Plan and undertake a rigorous evaluation project that optimally assesses patient outcomes as well as change in clinician behaviour (e.g. patient treatments) and clinician knowledge of rationale for change
- Continue to monitor practice patterns and patient outcomes overtime to ensure change in practice has been sustained and has achieved anticipated improvement in patient outcomes

IMPLEMENTATION STRATEGIES

- Identification of staff to lead or “champion” the change initiative. These staff will have a strong knowledge of the change initiative and will be prepared to problem solve issues as they arise.
- Making new information readily accessible in a range of formats to suit different target audiences such as:
 - seminars and lecture presentations
 - small group education sessions
 - individual emails with links to new information

- reformatting of information into a readily accessible formats such as a pocket cards, posters or incorporation into relevant medical record forms.

- Reminders and prompts incorporated into standard processes such as completion of medical records, test requisition forms or computerised decision support systems.
- Capacity for regular audit and feedback on the implementation and outcome of the change initiative. This is ideally undertaken internally and feedback given by a supervisors.

1. Grimshaw J, Eccles Martin P, Lavis JN, Hill S, Squires J. Knowledge Translation of research findings. *Implement Sci.* 2012;**7**(50).
2. Johnson LW, Robles J, Hudgins A, Osburn S, Martin D, Thompson A. Management of bronchiolitis in the emergency department: impact of evidence-based guidelines? *Pediatrics.* 2013;**131 Suppl 1**:S103-9.
3. Dexheimer JW, Abramo TJ, Arnold DH, Johnson K, Shyr Y, Ye F, et al. Implementation and evaluation of an integrated computerized asthma management system in a pediatric emergency department: A randomized clinical trial. *International Journal of Medical Informatics.* 2014;**83**(11):805-13.
4. Webb A, Starr M. Acute gastroenteritis in children. *Australian family physician.* 2005;**34**(4):227-31.
5. Diaz MCG, Symons N, Ramundo ML, Christopher NC. Effect of a standardized pharyngitis treatment protocol on use of antibiotics in a pediatric emergency department. *Archives of Pediatrics and Adolescent Medicine.* 2004;**158**(10):977-81.
6. Plint AC, Newton A, Stang A, Bhatt M, Barrowman N, Calder L. How safe are our paediatric emergency departments? Protocol for a national prospective cohort study. *BMJ open.* 2014;**4**(12):e007064.
7. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ (Clinical research ed).* 2009;**339**:b2535.
8. Kinsman LD, Rotter T, Willis J, Snow PC, Buykx P, Humphreys JS. Do clinical pathways enhance access to evidence-based acute myocardial infarction treatment in rural emergency departments? *The Australian journal of rural health.* 2012;**20**(2):59-66.
9. Jones AE, Shapiro NI, Roshon M. Implementing early goal-directed therapy in the emergency setting: the challenges and experiences of translating research innovations into clinical reality in academic and community settings. *Acad Emerg Med.* 2007;**14**(11):1072-8.
10. Johnson DW, Craig W, Brant R, Mitton C, Svenson L, Klassen TP. A cluster randomized controlled trial comparing three methods of disseminating practice guidelines for children with croup [ISRCTN73394937]. *Implement Sci.* 2006;**1**:10.
11. Dainty KN, Scales DC, Brooks SC, Needham DM, Dorian P, Ferguson N, et al. A knowledge translation collaborative to improve the use of therapeutic hypothermia in post-cardiac arrest patients: protocol for a stepped wedge randomized trial. *Implement Sci* [Internet]. 2011; 6:[4 p.]. Available from: <http://onlinelibrary.wiley.com/o/cochrane/clcentral/articles/076/CN-00865076/frame.html>

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3031244/pdf/1748-5908-6-4.pdf>.

12. Curran Janet A, Osmond Martin H, Fitzpatrick E, Newton A, Sinclair D, Zee R, et al. Interventions to improve management and health outcomes for children and adults with asthma who present to the emergency department. Cochrane Database of Systematic Reviews [Internet]. 2010; (1). Available from: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008245/abstract>

<http://onlinelibrary.wiley.com/store/10.1002/14651858.CD008245/asset/CD008245.pdf?v=1&t=i25mx1pq&s=47f308a71036b72e739c250f195a3c30762bd559>.

13. Li P, To T, Parkin PC, Anderson GM, Guttman A. Association between evidence-based standardized protocols in Emergency Departments with childhood asthma outcomes: A Canadian population-based study. *Archives of Pediatrics and Adolescent Medicine*. 2012;**166**(9):834-40.

14. Armon K, MacFaul R, Hemingway P, Werneke U, Stephenson T. The impact of presenting problem based guidelines for children with medical problems in an accident and emergency department. *Archives of Disease in Childhood*. 2004;**89**(2):159-64.

15. Goldberg EM, Laskowski-Kos U, Wu D, Gutierrez J, Bilderback A, Okelo SO, et al. The Pediatric Asthma Control and Communication Instrument for the Emergency Department (PACCI-ED) improves physician assessment of asthma morbidity in pediatric emergency department patients. *Journal of Asthma*. 2014;**51**(2):200-8.

16. Merchant RC, Baird JR, Liu T, Taylor LE, Montague BT, Nirenberg TD. Brief intervention to increase emergency department uptake of combined rapid human immunodeficiency virus and hepatitis C screening among a drug misusing population. *Acad Emerg Med*. 2014;**21**(7):752-67.

17. Sheno R, Saz EU, Jones JL, Ma L, Yusuf S. An emergency department intervention to improve knowledge of child passenger safety. *Pediatr Emerg Care*. 2010;**26**(12):881-7.

18. Mello MJ, Bromberg J, Baird J, Nirenberg T, Chun T, Lee C, et al. Translation of alcohol screening and brief intervention guidelines to pediatric trauma centers. *The journal of trauma and acute care surgery*. 2013;**75**(4 Suppl 3):S301-7.

19. Bernstein E, Topp D, Shaw E, Girard C, Pressman K, Woolcock E, et al. A preliminary report of knowledge translation: Lessons from taking screening and brief intervention techniques from the research setting into regional systems of care. *Acad Emerg Med*. 2009;**16**(11):1225-33.

20. Group CEPaOoCR. Data Collection Checklist2002 17/03/2015.

21. Cunningham S, Logan C, Lockerbie L, Dunn MJG, McMurray A, Prescott RJ. Effect of an Integrated Care Pathway on Acute Asthma/Wheeze in Children Attending Hospital: Cluster Randomized Trial. *Journal of Pediatrics*. 2008;**152**(3):315-20.e2.

22. Doherty SR, Jones PD. Use of an 'evidence-based implementation' strategy to implement evidence-based care of asthma into rural district hospital emergency departments. *Rural and remote health*. 2006;**6**(1):529.

23. Stiell IG, Clement CM, Grimshaw J, Brison RJ, Rowe BH, Schull MJ, et al. Implementation of the Canadian C-Spine Rule: prospective 12 centre cluster randomised trial. *BMJ (Clinical research ed)*. 2009;**339**:b4146.
24. Stiell IG, Clement CM, Grimshaw JM, Brison RJ, Rowe BH, Lee JS, et al. A prospective cluster-randomized trial to implement the Canadian CT Head Rule in emergency departments. *CMAJ : Canadian Medical Association journal [Internet]*. 2010; 182(14):[1527-32 pp.]. Available from: <http://onlinelibrary.wiley.com/o/cochrane/clcentral/articles/768/CN-00762768/frame.html>
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2950184/pdf/1821527.pdf>.
25. Roukema J, Steyerberg EW, van der Lei J, Moll HA. Randomized Trial of a Clinical Decision Support System: Impact on the Management of Children with Fever without Apparent Source. *Journal of the American Medical Informatics Association*. 2008;**15**(1):107-13.
26. Knapp JF, Simon SD, Sharma V. Does Active Dissemination of Evidence Result in Faster Knowledge Transfer Than Passive Diffusion?: An Analysis of Trends of the Management of Pediatric Asthma and Croup in US Emergency Departments From 1995 to 2009. *Pediatr Emerg Care*. 2014.
27. Ambroggio L, Thomson J, Kurowski EM, Courter J, Statile A, Graham C, et al. Quality improvement methods increase appropriate antibiotic prescribing for childhood pneumonia. *Pediatrics*. 2013;**131**(5):e1623-e31.
28. Fong C, Chong W, Villaneuva E, Segal AY. Implementation of a guideline for computed tomography head imaging in head injury: A prospective study. *EMA - Emergency Medicine Australasia*. 2008;**20**(5):410-9.
29. To T, Wang C, Dell SD, Fleming-Carroll B, Parkin P, Scolnik D, et al. Can an evidence-based guideline reminder card improve asthma management in the emergency department? *Respiratory Medicine*. 2010;**104**(9):1263-70.
30. Pannifex J, Cetiner E, Wilkie T, Kelly AM. Design and roll out of standardised approach to paediatric procedural sedation in Victorian emergency departments. *Emerg Med Australas*. 2013;**25**(6):597-602.
31. Boutis K, Grootendorst P, Willan A, Plint AC, Babyn P, Brison RJ, et al. Effect of the Low Risk Ankle Rule on the frequency of radiography in children with ankle injuries. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne*. 2013;**185**(15):E731-8.
32. Scott S, Hartling L, Grimshaw J, Johnson D, Osmond M, Plint A, et al. Improving outcomes for ill and injured children in emergency departments: protocol for a program in pediatric emergency medicine and knowledge translation science. *Implement Sci*. 2009;**4**:60.
33. Hartling L, Scott-Findlay S, Johnson D, Osmond M, Plint A, Grimshaw J, et al. Bridging the gap between clinical research and knowledge translation in pediatric emergency medicine. *Acad Emerg Med*. 2007;**14**(11):968-77.
34. Runyon MS, Sawe HR, Levine AC, Pousson A, House DR, Agrawal P, et al. Clinical and translational research in global health and emergency care: a research agenda. *Acad Emerg Med*. 2013;**20**(12):1272-7.
35. Grol R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Med Care*. 2001;**39**(8 Suppl 2):li46-54.

36. McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, et al. The quality of health care delivered to adults in the United States. *The New England journal of medicine*. 2003;**348**(26):2635-45.
37. Schuster MA, McGlynn EA, Brook RH. How good is the quality of health care in the United States? 1998. *The Milbank quarterly*. 2005;**83**(4):843-95.
38. Brehaut JC, Hamm R, Majumdar S, Papa F, Lott A, Lang E. Cognitive and social issues in emergency medicine knowledge translation: a research agenda. *Acad Emerg Med*. 2007;**14**(11):984-90.
39. Bero LA, Grilli R, Grimshaw JM, Harvey E, Oxman AD, Thomson MA. Closing the gap between research and practice: an overview of systematic reviews of interventions to promote the implementation of research findings. The Cochrane Effective Practice and Organization of Care Review Group. *BMJ (Clinical research ed)*. 1998;**317**(7156):465-8.
40. Ivers N, Jamtvedt G, Flottorp S, Young Jane M, Odgaard-Jensen J, French Simon D, et al. Audit and feedback: effects on professional practice and healthcare outcomes. Cochrane Database of Systematic Reviews [Internet]. 2012; (6). Available from:
<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000259.pub3/abstract>
<http://onlinelibrary.wiley.com/store/10.1002/14651858.CD000259.pub3/asset/CD000259.pdf?v=1&t=i25msd5h&s=628a6208037b24cc0bf8043f9d9e43929badc07f>.
41. Baker R, Camosso-Stefinovic J, Gillies C, Shaw EJ, Cheater F, Flottorp S, et al. Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. *The Cochrane database of systematic reviews*. 2010(3):Cd005470.
42. <Doherty_2005.pdf>.
43. Grimshaw JM, Shirran L, Thomas R, Mowatt G, Fraser C, Bero L, et al. Changing provider behavior: an overview of systematic reviews of interventions. *Med Care*. 2001;**39**(8 Suppl 2):li2-45.
44. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, et al. Lost in knowledge translation: time for a map? *The Journal of continuing education in the health professions*. 2006;**26**(1):13-24.
45. Flodgren G, Conterno Lucieni O, Mayhew A, Omar O, Pereira Cresio R, Shepperd S. Interventions to improve professional adherence to guidelines for prevention of device-related infections. Cochrane Database of Systematic Reviews [Internet]. 2013; (3). Available from:
<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006559.pub2/abstract>
<http://onlinelibrary.wiley.com/store/10.1002/14651858.CD006559.pub2/asset/CD006559.pdf?v=1&t=i25mwd37&s=dc1391bc5634d3cf011f5b37ed88621f06b0e6d9>.

46. Flodgren G, Parmelli E, Doumit G, Gattellari M, O'Brien Mary A, Grimshaw J, et al. Local opinion leaders: effects on professional practice and health care outcomes. Cochrane Database of Systematic Reviews [Internet]. 2011; (8). Available from: <http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000125.pub4/abstract>
<http://onlinelibrary.wiley.com/store/10.1002/14651858.CD000125.pub4/asset/CD000125.pdf?v=1&t=i25mvor2&s=0dbd1974e4f00df7e619fb29e02b4c49a4e3f603>.
47. Arditi C, Rege-Walther M, Wyatt J, Durieux I, B B. Computer-generated reminders delivered on paper to healthcare professionals; effects on professional practice and health care ourcomes (Review). The Cochrane Library [Internet]. 2012; (12).
48. Sinuff T, Muscedere J, Adhikari NK, Stelfox HT, Dodek P, Heyland DK, et al. Knowledge translation interventions for critically ill patients: a systematic review*. *Critical care medicine*. 2013;**41**(11):2627-40.
49. Michie S, Johnston M, Abraham C, Lawton R, Parker D, Walker A. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Quality & safety in health care*. 2005;**14**(1):26-33.
50. Tavender EJ, Bosch M, Gruen RL, Green SE, Knott J, Francis JJ, et al. Understanding practice: the factors that influence management of mild traumatic brain injury in the emergency department--a qualitative study using the Theoretical Domains Framework. *Implement Sci*. 2014;**9**:8.
51. Ajzen I. The theory of planned behaviour. *Organisational behaviour and human decision processes*. 1991;**50**(2):179-211.
52. Grimshaw J, Campbell M, Eccles M, Steen N. Experimental and quasi-experimental designs for evaluating guideline implementation strategies. *Family practice*. 2000;**17 Suppl 1**:S11-6.
53. Shadish W, Cook D, Campbell D. Experimental and quasi-experimental designs for generalized causal inference. Boston: Houghton Mifflin; 2002.

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:

Wilson, CL;Johnson, D;Oakley, E

Title:

Knowledge translation studies in paediatric emergency medicine: A systematic review of the literature

Date:

2016-02-01

Citation:

Wilson, C. L., Johnson, D. & Oakley, E. (2016). Knowledge translation studies in paediatric emergency medicine: A systematic review of the literature. JOURNAL OF PAEDIATRICS AND CHILD HEALTH, 52 (2), pp.112-125. <https://doi.org/10.1111/jpc.13074>.

Persistent Link:

<http://hdl.handle.net/11343/290874>