

REVIEW PAPER

Key characteristics of knowledge transfer and exchange in healthcare: integrative literature review

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Abstract

Aim. This paper presents the results of a review of literature relating to knowledge transfer and exchange in healthcare.

Background. Treatment, planning and policy decisions in contemporary nursing and healthcare should be based on sound evidence wherever possible, but research knowledge remains generally underused. Knowledge transfer and exchange initiatives aim to facilitate the accessibility, application and production of evidence and may provide solutions to this challenge. This review was conducted to help inform the design and implementation of knowledge transfer and exchange activities for a large healthcare organization.

Data sources. Databases: ASSIA, Business Source Premier, CINAHL, PsychInfo, Medline and the Cochrane Database of Systematic Reviews.

Review methods. An integrative literature review was carried out including an extensive literature search. English language systematic reviews, literature reviews, primary quantitative and qualitative papers and grey literature of high relevance evaluating, describing or discussing knowledge transfer or exchange activities in healthcare were included for review (January 1990–September 2009).

Findings. Thirty-three papers were reviewed (four systematic reviews, nine literature reviews, one environmental scan, nine empirical studies and ten case studies).

Conclusion. Robust research into knowledge transfer and exchange in healthcare is limited. Analysis of a wide range of evidence indicates a number of commonly featured characteristics but further evaluation of these activities would benefit their application in facilitating evidence-based practice in nursing.

Keywords: evidence-based practice, knowledge exchange, knowledge transfer, literature review, nursing, research implementation

Introduction

The importance of basing decisions regarding the use of interventions, distribution of services and policy directions in contemporary health services on best available evidence is an established concept (Sackett & Rosenberg 1995).

However, extensive literature demonstrates that knowledge generated by research endeavours is generally underused in these areas, with investigation and commentary focused on identifying and explaining the barriers and facilitators to research use (Haynes & Haines 1998, Newman *et al.* 1998, Grol & Grimshaw 2003, McKenna *et al.* 2004, Green 2008, Lees 2008, Schoonover 2009).

Healthcare policy and funding in the UK, Europe, the United States, Canada and Australia increasingly reflects the growing importance of supporting research efforts that result in both worthwhile treatments and technologies whilst ensuring that the primary outcome of these developments is their judicious implementation with populations whose health benefits as a result (Woolf 2008).

Numerous models for enabling changes to evidence-based decision-making illustrate previous efforts to develop solutions. However, these lack sufficient depth and impose overly rigid and linear frameworks, which fail to recognize the impact of context, and in particular the effects that complexities in healthcare organizations may have on allowing such changes (Kitson *et al.* 1998, Kitson 2009).

Knowledge transfer (KT) and knowledge exchange (KE) strategies are emerging as potential solutions to commonly encountered barriers to using evidence that are more capable of accommodating the particular challenges of healthcare systems. There currently exists a multitude of definitions, concepts, processes, descriptions and models relating to KT and KE, which have greatly complicated working and research in this field (Graham *et al.* 2006). Existing research tends to investigate individual KT and KE methods and there is a need to conduct a broader examination and review of the literature relevant to healthcare with the aim of identifying their key characteristics and features.

The review

Aims

This review was conducted to help inform the design and implementation of sustainable knowledge transfer and exchange mechanisms in a large healthcare organization. The review examines literature concerning KT and KE methods and their use in healthcare settings. Specifically, literature relating to three processes was reviewed:

- How research knowledge is communicated to clinical practitioners
- How research of greater priority, relevance and applicability is generated
- Whether these processes facilitate changes in health professionals' practice and decision-making

Design

Diverse language and definitions in this field have resulted in a literature base comprising disparate studies and commentaries. An integrative review design was developed to be broad enough to include simultaneously primary sources utilizing different methodologies, existing review information and theoretical commentary whilst being structured enough to remain focused on the primary topics.

The design of this review was informed by recent guidance on integrative reviewing intended to maintain rigour whilst mitigating the risks of bias and inaccuracy that can be associated with interrogating literature of this nature (Whittemore & Knafelz 2005).

Search methods

Reviewing diverse literature was recognized as central to providing a comprehensive understanding of the phenomena that facilitate effective KT and KE in healthcare, but it was necessary to narrow the scope somewhat to develop practicable search parameters.

Exploratory engagement with existing literature enabled the reviewers to identify subjects to exclude, enabling focus to be retained on examining the most relevant literature. For instance, literature relating to the communication of research knowledge to the public was omitted. Specific parameters to guide the inclusion of papers were developed, full details of which are presented in Table 1.

Search strategies

Six computerized databases were searched for abstracts published between January 1990 and September 2009. Two social science and business databases were included alongside healthcare databases to ensure relevant literature from those fields was not omitted. Specific search strings were developed for each database using combinations of key words, subject headings, abstract and subject terms and a wide range of indexed and non-indexed synonyms.

This strategy ensured the comprehensive identification of papers, helping to mitigate potential limitations caused by inconsistencies in the indexing of the review topics

Table 1 Inclusion and exclusion criteria

For inclusion in the review research papers had to meet the following criteria:

- 1) Peer-reviewed journal articles
- 2) Reports commissioned by health service organizations
- 3) English language only
- 4) Published from January 1990 to September 2009

As this integrative literature review is designed to help identify the most effective methods of knowledge transfer and exchange in health services the following criteria were also used:

- 1) Included articles which displayed the following characteristics:
 - a. Evaluations or descriptions of collaborations between health service knowledge users and knowledge providers to promote the sharing of research information or evidence
 - b. Evaluations or descriptions of collaborations between health service knowledge users and knowledge providers to create action from knowledge
 - c. Evaluations or descriptions of collaborations between health service knowledge users and knowledge providers to undertake the production of new research information or evidence
 - d. Literature reviews (including unpublished/grey literature) relating to the overall process of, or individual elements of KT and KE
- 2) Articles were not included that
 - a. Dealt with the transfer of knowledge between the practitioners/researchers and the public
 - b. Dealt with the transfer and diffusion of programme or organizational innovations that do not include new research evidence
 - c. Focused solely on the further education of health staff in research techniques, methods for accessing knowledge or building capacities to use research in practice

(Whittemore & Knafl 2005). In addition, the reference lists of those papers identified for inclusion in the review formed the basis for a hand search to identify further potentially relevant literature and ensure better coverage (Conn *et al.* 2003).

Search outcome

The results of the computerized search process returned 1720 abstracts for review, which was increased to 1770 with the addition of 50 papers identified during the hand search. Initial management of retrieved abstracts included screening for relevance and assignment to appropriate categories including 'not for review', 'for review' and 'duplicates'. Inclusion and exclusion criteria were applied to the papers in the 'for review' category during secondary screening, and relevant papers were identified for full data extraction. A total of 1641 irrelevant papers were disqualified leaving 160 for detailed abstract review of which 33 were included for full review: four systematic reviews, nine literature reviews, one environmental scan, nine empirical studies and ten case studies.

Quality appraisal

Recognizing the challenges associated with gauging the quality of sources in any review is essential to informing the evaluative approach employed. Reviewing the methodological rigour of papers with homogenous designs is traditionally used to appraise quality in meta-analyses and systematic reviews (Cooper 1998). The lack of homogeneity in diverse sources presents challenges to quality appraisal (Whittemore & Knafl 2005). Rather than adopting a predefined checklist to identify papers for exclusion, an alternative method suggested by Kirkevold (1997) in which the authenticity, methodological quality, informational quality and representativeness of the papers are considered during data abstraction and synthesis was felt to be most appropriate.

Data abstraction and synthesis

To ensure trustworthiness and rigour during data abstraction and synthesis, a four-stage systematic analytic method making use of qualitative approaches was developed.

First, a standard format for summarizing descriptive and methodological information and outcomes of included studies was developed recording dimensions including: descriptive information (authors, date of publication, methodology); description of study objectives (focus, target audience); any definitions offered (definitions of knowledge transfer, knowledge exchange, knowledge translation etc.); and any findings and opinion related to activities intended to enable the use of knowledge in practice by health professionals.

The extracted information was compared and patterns recorded as they became apparent. The results of this process of comparative analysis were further scrutinized, from which it was possible to discern groupings of similar data and the identification of a number of key themes. Four key themes were identified at this stage including knowledge transfer, knowledge exchange, the importance of context and the role of brokers. Further examination of the data within these themes resulted in the identification of several sub-groups of information, which comprise the detailed findings in this review. Table 2 details the key findings of each review paper pertaining to methods for facilitating the use of knowledge in practice.

Results

Theme 1: Sharing knowledge – key characteristics of knowledge transfer

There are various definitions for KT, which despite discrepancies in language share a common theme relating to

Table 2 Summary of included studies

Author and study type	Aims	Findings related to knowledge transfer and exchange
Mitton <i>et al.</i> (2007) Systematic review of 81 papers	Examination and summary of the evidence base for KTE	Successful KTE can be achieved through activities at the individual, organizational and communications levels and factors related to time/timing. Key factors include: ongoing researcher-practitioner collaborations built on trust and clear roles and responsibilities fostered by ongoing face-to-face communications; healthcare organizations should build capacity to encourage readiness for change and foster collaborative research; research outcomes should be summarized with recommendations tailored and relevant to specific audiences and delivered whilst timely. The value of knowledge brokers to facilitate these is indicated
Grimshaw <i>et al.</i> (2001) Meta-synthesis of 41 systematic reviews	Appraisal and synthesis of systematic reviews of professional educational or quality assurance interventions designed to change healthcare provider behaviour	Passive approaches to research dissemination are generally ineffective and unlikely to result in behaviour change. Most other interventions are effective under some circumstances but none are effective under all circumstances. Interventions with evidence for general, if variable, effectiveness are educational outreach and reminders. Combining techniques to deliver multifaceted interventions targeting different barriers to change are more likely to be effective than single interventions
Bero <i>et al.</i> (1998) Overview of 18 systematic reviews	Identification of evidence for the effectiveness of research dissemination and implementation strategies	Interventions consistently effective at promoting behavioural change among health professionals include: educational outreach visits; reminders (manual or computerized); multifaceted approaches (a combination that includes two or more of the following: audit and feedback, reminders, local consensus processes, or marketing); interactive educational meetings
Fixsen <i>et al.</i> (2005) Meta-synthesis of 377 papers including 22 experimental studies	Synthesis of implementation science in the fields of mental health, social services, juvenile justice, education, early childhood education, employment services, and substance abuse	Interventions with variable effectiveness include: audit and feedback (or any summary of clinical performance); use of local opinion leaders; local consensus processes; patient-mediated interventions
Best <i>et al.</i> (2008) Mixed-method review	Review of evidence supporting knowledge integration methods in practice and policy for cancer control systems	Information dissemination methods alone (research literature, mailings and practice guidelines) are ineffective as is training as a stand-alone method
Harrington <i>et al.</i> (2008) Synopsis	Synthesis of the key approaches, strategies, learning, and resources aimed at increasing linkages between research and decision-making/practice processes in healthcare	Employing longer term multilevel approaches to implementation is more effective with evidence for the inclusion of: skill-based training; practice-based coaching; practitioner performance evaluation; programme evaluation; facilitative administrative practices; and methods for systems interventions
Glasgow and Emmons (2007) Literature review	Summary of the key factors that interfered with the translation of research to practice and how public health researchers can improve the process	Key translational research and knowledge integration factors include: improved communications; collaborative research; support systems; funding and incentives; and consideration of policy development and organizational change principles

Table 2 (Continued)

Author and study type	Aims	Findings related to knowledge transfer and exchange
National Centre for the Dissemination of Disability Research (2006) Literature review	Summary of knowledge transfer processes in healthcare as described by several international authors	Knowledge transfer activities should include various different levels of evidence: programmes or initiatives should be developed in a manner that is appropriate for a specific target audience (as such audience analysis is recommended); participatory and collaborative efforts may facilitate relationship building & trust in the KT process; collaborative KT strategies often produce the formation of networks and partnerships; capacity building is needed for sustained KT in organizations
Hemsley-Brown (2004) Literature review (150 papers)	Cross-sector literature review focused on understanding the barriers to research utilization; indentifying the recommendations made for addressing these; and the most effective strategies for facilitating the use of research	Key activities for improving the use of research evidence in decision-making include: the need for practitioners to gain support and encouragement from managers; collaborative approaches, partnerships or links, and involving users in research; networks which increase communication between researchers and users are an effective approach to facilitating research use; leadership also emerged as a key factor in facilitating research use by managers from three reviews of literature
Majumdar <i>et al.</i> (2004) Commentary and literature review	Description of the most common potential barriers to the application of evidence into clinical care; and an exploration of the strategies for translating evidence into clinical care	Strategies identified as effective for supporting the application of research in practice include: audit and feedback with comparison to local peers; real-time clinical reminders; face-to-face educational outreach; engagement of local opinion leaders; critical pathways and; multifaceted interventions
Pyra (2003) Literature review	Review and summary of formal and grey literature relating to the relationship between research and policy including the role and effectiveness of knowledge translation initiatives	Strategies identified as potentially valuable but requiring further study include: use of lay media to influence patients and physicians; patient decision aids and other forms of patient 'activation'; continuous quality improvement strategies; computerized decision support and other 'E-health' strategies; incentives to promote best practice; disincentives to restrict suboptimal practice; and expanded roles and responsibilities for non-physician providers
Harvey <i>et al.</i> (2002) Literature review and concept analysis (75 papers)	Presents the findings of a concept analysis of facilitation in relation to successful implementation of evidence into practice	Enablers of Knowledge Translation include: developing ongoing relationships between researchers & policy makers; knowledge brokering; active dissemination efforts by researchers; improving research & evidence acquisition skills among decision-makers; conceptualizing knowledge translation as an ongoing process; creation of state-funded health services research & applied policy analysis organizations to promote development of state-level core staff with specific research skills; and producing evidence-based summaries on relevant topics for distribution to local policy-makers
Corrigan <i>et al.</i> (2001) Literature review	Reviews the research on dissemination strategies that facilitate the transfer of research-based practices from academic setting to public-sector psychiatry	The presence of a facilitator who provides face-to-face communication and uses a range of enabling techniques has some impact on changing clinical and organizational practice despite variable effect sizes and differing costs. It is difficult to isolate which aspects of the facilitation process or the facilitator role are more or less effective in influencing change
Canadian Population Health Initiative (2001)	Identifies the strategies used by 17 health and social research focused organizations for transferring	Three strategies are identified as useful in fostering research dissemination including: packaging research so that specific interventions are more accessible and user-friendly to service providers including ensuring the high face validity of manuals with built-in fidelity systems; educating providers about relevant knowledge and skills through interactive, clinically representative learning activities; and addressing the organizational dynamics of the team to facilitate the implementation of innovations including improving team leadership skills to include either transformation styles of transactional styles

Table 2 (Continued)

Author and study type	Aims	Findings related to knowledge transfer and exchange
Environmental scan	research knowledge	dissemination; broader public should be included as partners for effecting indirect research transfer to decision makers Stakeholder and decision makers should be engaged early on, and throughout the research process; environmental scanning is effective at for informing research agendas; impact/outcomes should be evaluate Working groups rather than conferences to encourage dialogue; research evidence should be available in various formats including those designed to be clear and concise; every research programme should have KT strategy built into its design; research transfer specialists should be employed
Conklin and Stolee (2008) Qualitative Study	Study designed to test a pilot model for evaluating knowledge exchange in a network context	Large KT networks may enable the better communication and use of knowledge. The organizational context afforded by Communities of Practice can support the flow of knowledge among participants and enables research evidence and expert opinion to be delivered; variable evidence for cited methods having a direct effect on the behaviours of caregivers
McWilliam <i>et al.</i> (2008) Mixed-method evaluation	Pilot study into the effectiveness of a knowledge translation intervention promoting evidence-based home care through social interaction	Facilitators at the organizational level include: geographic proximity; remuneration of efforts; recognition for outcomes achieved; team working is generally seen as highly facilitative of KT; time to build trust important facilitator of KT and more attainable in smaller groups; individual practitioners respond to adequate remuneration for time/effort
Garland <i>et al.</i> (2006) Qualitative case study	Describes the development of one research-practice endeavour in mental health and qualitatively investigates the participants' perceptions of the process	Practitioners were initially sceptical of collaborative research-practice activities; group dynamics, especially the effects of dominant voices play a large role in collaborations. Differences in the language used by researchers/practitioners can cause challenges. Communication is key to developing and maintaining trust – reciprocal trust is central to making the collaborative process work; Clarity about leadership roles is essential
Bowen and Martens (2005) Multi-method qualitative study	Explores the characteristics of effective knowledge translation initiatives from the perspective of community partners	Knowledge Translation approaches should include efforts to: create an environment of interest and openness to research (providing a setting for KT to occur in, including building trust and confidence between partners); provide opportunities for collaborative research; develop and use a shared vocabulary and conceptual base; facilitate an understanding of research findings; foster an understanding of implications for practice (findings need to be interpreted and applied in relation to specific settings); quality is an important factor in interactions; organizational barriers are an ongoing impediment to KT and capacity building should focus at this as well as the individual level
Dobbins <i>et al.</i> (2004) Qualitative study	Investigates public health decision makers' preferences for receiving research knowledge	KT strategies should be customized to meet individual needs at particular points in time. Building flexibility into the KT strategy is required to provide decision makers with sufficient choice and control over the content, format and delivery of research evidence; audience-specific messages from systematic reviews that are in line with the contexts to which they apply should be developed. Research evidence should appear user friendly and be concise, where possible screening out irrelevant information; automatically updating users with recently published reviews only in areas of interest is preferred and; capacity building in research use is essential for ongoing KT
Jacobson <i>et al.</i> (2005) Qualitative case studies	Explores the conditions that facilitate interactive knowledge transfer with a particular focus on academic consulting as a strategy	Pressing needs see knowledge used more quickly, whilst less urgency means knowledge is less likely to be used; consultants [knowledge brokers] need to be perceived as accessible, organized, expert & credible (clients begin this assessment from pre-entry on); clients' needs to be communicative

Table 2 (Continued)

Author and study type	Aims	Findings related to knowledge transfer and exchange
Molfenter <i>et al.</i> (2009) Qualitative case study	Describes a knowledge-to-action framework and intervention used with speech and language pathologists, identifying key elements of the process and evaluating the outcomes of the process through qualitative investigation	and committed; facilitating strategies should be aimed at promoting clients' participation and collaboration, using where possible steering committees to integrate local expert views into design, conduct and interpretation of research Hands-on training identified as more effective than lectures at enabling knowledge to action; ongoing support from researchers was particularly valued by clinicians; successful KTA requires collaboration at both the knowledge creation and knowledge action stages; the process allowed clinicians to feel more comfortable engaging in novel treatments in the future
Kothari <i>et al.</i> (2005) Qualitative case studies	Investigates if interaction between users and producers of research is associated with a greater level of adoption of research findings in the design and delivery of healthcare programmes	The information processing of research report findings increased with interaction between researchers and research users; as the interaction strategy employed involved the articulation of research questions for programme planning, reading of draft versions of the report, and conversing about the report, interacting teams were predictably more informed about report contents; results also indicated that interacting teams were better educated about methodological and analytical issues associated with the research
Russell <i>et al.</i> (2004) Qualitative mixed-method	Explores the process of knowledge exchange in an informal email network for evidence-based healthcare, to illuminate the value of the service and its critical success factors, and to identify areas for improvement	Several aspects were important in informal KE networks. Skilled staff are needed to establish, develop and maintain the networking process; simple communication methods (e-mail) enables members to draw upon 'the strength of weak ties' (best source of new idea is a stranger or not directly related rather than one from the same social groupings); informal networks enables the spontaneous emergence of communities of practice; The network allowed for 'lurking' – benefiting from the network even without directly contributing – allows spontaneous learning about research use
Rosser (2008) Case study	Describes two strategies to transfer research evidence into clinical practice	Physicians responded well to the critical appraisal of literature with key references credible and helpful; They also appreciated the automated literature search update function; presenting patients with evidence and involving them in decision-making improved the patient-physician relationship; 60–80,000 hits per week on website after public launch suggestive of a suitable delivery mechanism
Forrester <i>et al.</i> (2008) Case study	Describes a partnership between a nursing school, the Joanna Briggs Institute Centre for Evidence-Based Practice, and hospital in which a faculty member, the resources of the JBI and the laboratories of the nursing school were shared to enable clinically led research	Direct outcomes of the initiative were identified as: an increase in the use of new EBP resources; the initiation of new practice-problem focussed research activities. These successful improvements in EBP may have been due to: leadership provided by a supportive administration; a shared governance structure that drives full participation of nurses; the partnering of three institutions with a shared focus and commitment to scientific research and excellence in EBP
Baumbusch <i>et al.</i> (2007) Case study	Presents examples of the authors' experience of developing a model of KT that emerged from a programme of research focussed on understanding the experiences of patients being discharged from hospital to home	Key elements of knowledge translation initiatives were identified as: the development of shared accountability, reciprocity and respect for each other; collaboration between researchers and practitioners in designing strategies and action plans to change practice in response to research findings; allowing the research to be informed by practitioners so as to ensure the study remained relevant to practice and context; ensuring continuing dialogue allowed for a shift from the discussion of findings to the development and implementation of specific KT initiatives; dynamic KT processes lead to transformations in practice and the identification/solving of further practice needs and; allowing researchers to become more credible messengers by communicating the emerging research findings directly to practitioners

Table 2 (Continued)

Author and study type	Aims	Findings related to knowledge transfer and exchange
Farkas and Anthony (2007) Case study	Reviews five basic principles for overcoming the most common barriers to effective dissemination and utilization of research knowledge as experienced by a research and training centre	Five key elements of knowledge transfer identified as: development of evidence-based messages based on bodies of research rather than single data sets; building credibility with decision makers as legitimate developers of these messages; building KT expertise and infrastructure within the research organization; conveying messages using an organized approach to achieve targeted outcomes and; routinely evaluating knowledge transfer efforts
Eke et al. (2006) Case study	Reports on the Replicating Effective Programmes (REP) technology transfer process, recommending specific methods that can be used to prepare for possible knowledge transfer during research trials	Preparing for successful transfer during the research process may include: documenting details of interventions beyond what is normally published in journals, specifically including detailed information about the nature of the intervention, the preparatory processes involved, and information about the interventions delivery; and involving all relevant stakeholders throughout the research and technology transfer processes is essential for encouraging the collaborative exchange of ideas and increases the probable relevance, acceptability and potential implementation of the intervention
McConnell et al. (2007) Case study	Reports on the feasibility and value of an academic practice partnership to implement evidence-based approaches to solving resident care problems in a long term care setting	Key elements of the process were identified as: involving the supporters of innovation at local and supervisory level who can influence and persuade others to adopt innovation; exploiting opportunities among local networks and internal and external organization contexts to build interest, foster commitment to innovation and develop communications around upcoming change; allowing staff to frame innovation implementation facilitators and barriers; establishing linkage functions to engage internal and external people with knowledge of the innovation in guiding identification, interpretation and application; collaboration throughout is essential; interpersonal approaches are more effective at fostering the adoption of evidence; methods of sharing evidence that are time efficient, easy-to-use and not burdensome are more likely to succeed; building on existing communication channels is a useful way of targeting and disseminating research knowledge
Philip et al. (2003) Case study	Examines a 'user fellowship' and evaluates the effectiveness of the approach on research dissemination	The evaluation of the initiative concludes that the user fellow was a key element in success of dissemination. Tapping into communication networks among practitioners was seen as beneficial (achieved through data-basing and selecting key people); newsletters were useful at stimulating contacts between knowledge users; and practitioners need and appreciate tailor-made forms of dissemination
Vingilis et al. (2003) Case study	Describes the integration of Knowledge Diffusion and Utilization (KDU) theory with practice via a case study in mental health	Early, ongoing and active engagement with, mentoring of, and provision of research assistants to non-research active knowledge users was key to knowledge generation, diffusion and use; adequate time was required to build mutual respect & shared knowledge and create increased potential for successful KDU through greater homophily; use of 'connectors' between researchers and knowledge users is central to effective KDU; a willingness to fund KDU is important but traditional patterns of funding single studies as a whole entity is at odds with KDU which is non-linear participatory and evolving
Titler et al. (1999) Case study	Describes the essential components of implementing evidence-based practice at an American higher education organization through two examples	Evidence-based practice can be fostered by: tailoring protocols to the clinical setting; assisting the acquisition of organizational support for increased training and motivation to use research findings; ensuring leaders expect and support practices that are congruent with research; producing data demonstrating the application of findings improves quality of care/practice; making guidelines accessible; ensuring early, regular and ongoing collaboration with multiple care providers when implementing practice changes; providing written and verbal feedback to

Table 2 (Continued)

Author and study type	Aims	Findings related to knowledge transfer and exchange
Crosswaite and Curtice (1994) Case study	Reports on the activities of a research dissemination project aimed at defining dissemination and identifying barriers to effective dissemination; describes the audiences for health promotion research and defining their needs; and identify appropriate strategies to implement dissemination and promote research utilization	staff who provide leadership and progress research based practice and; using change champions during the process Effective transmitters of research information have a significant impact upon a research audience; effective communication for the duration of a research project increases the likelihood that findings will be taken up; problems of resourcing and planning effective dissemination, cultivating new contacts and audiences can be addressed in part by a specialist individual whose remit is to liaise between researchers, managers and other user groups in order to implement a dissemination strategy; taking advantage of opinion leaders can potentially expand the audience for research findings; adequate resources are fundamental; and establishing linkages between managers, researchers and research users is central to the sustainable dissemination and use of research findings

communicating forms of knowledge to relevant stakeholders through a variety of methods. The majority of papers in this review offer some commentary on communicating knowledge to health professionals with this theme well represented in systematic and literature reviews, and case studies. Information relating to the efficacy of methods for sharing or transferring research knowledge to healthcare personnel has three sub-groups identified as contributing to the value of KT initiatives: relevance, accessibility and format or method.

Relevance

Ensuring the relevance of research information or findings when sharing them with knowledge users is indicated by several studies to influence directly whether research evidence will be used in making decisions (Pyra 2003, Mitton *et al.* 2007, Harrington *et al.* 2008). Several papers discuss the importance of ensuring relevance by commenting on the value of actively and accurately targeting individuals or user groups when sharing knowledge, indicating that exploiting or building upon pre-existing communication channels can facilitate this [Titler *et al.* 1999, Canadian Population Health Initiative (CPHI) 2001; Philip *et al.* 2003, McConnell *et al.* 2007].

Accessibility

Making research evidence accessible to potential users was also noted to be an important feature of KT strategies in qualitative studies, case studies, a literature and a systematic review. Where research evidence was to be used in clinical decision-making, on-demand evidence-based information tools and computerized decision support methods were both noted to be potentially effective strategies for improving accessibility and therefore implementation (Majumdar *et al.* 2004, Best *et al.* 2008). Several case studies note the benefits of allowing knowledge users swift and easy access to relevant research evidence (Titler *et al.* 1999, CPHI 2001; Rosser 2008).

Similarly, timeliness, as an aspect of accessibility and relevance, also receives attention. Mitton *et al.* (2007) note the importance of ensuring research evidence is provided when needed and still of direct relevance to the decisions at hand. Similarly, a qualitative study into public health decision makers' preference for knowledge sharing methods notes the importance of ensuring relevance to context and need through the timely delivery of knowledge (Dobbins *et al.* 2004).

The review conducted by Mitton *et al.* (2007) focussed on sharing research findings with policy makers in the healthcare field and identified the provision of clearly

summarized research findings which include actionable messages or policy recommendations as the most effective method. In addition, tailoring the findings of research for specific audiences and ensuring its relevance are noted as key characteristics of successful knowledge sharing (Mitton *et al.* 2007).

Format and method

The format in which knowledge is presented and the methods used to share it with health professionals can have direct impact on its perceived value and subsequently the likelihood of it being used in practice. In addition to the importance of making knowledge physically accessible, ensuring its clear and concise presentation has been identified as a vital characteristic in improving its probability of use (Pyra 2003, Mitton *et al.* 2007, Harrington *et al.* 2008). Dobbins *et al.* (2004) further illustrate the importance of this characteristic by arguing that knowledge sharing methods should be flexible enough to provide users with access to research evidence in various formats and levels of detail to meet individual preferences and needs.

In addition, an overview of systematic reviews identifies evidence for the effectiveness of a number of different knowledge sharing strategies (Bero *et al.* 1998). Face-to-face methods including educational outreach visits, reminders of research findings and multifaceted interventions including combinations of audit and feedback, marketing and local consensus processes are indicated to be consistently effective methods of promoting the implementation of research findings by healthcare practitioners. This overview noted that limiting knowledge sharing methods to the provision of educational materials or didactic educational methods has minimal effects. This finding is corroborated by a meta-synthesis of systematic reviews into interventions to change health practitioners' behaviours in response to new knowledge, which also notes the effectiveness of multifaceted and active educational approaches such as outreach and reminders (Grimshaw *et al.* 2001).

Several other studies report on the benefits of using active and interpersonal KT techniques and the benefits of tailoring these to specific audiences (Pyra 2003, Majumdar *et al.* 2004, Fixsen *et al.* 2005, NCDDR 2006; McConnell *et al.* 2007, Best *et al.* 2008, Forrester *et al.* 2008, Harrington *et al.* 2008). Although less well addressed in the empirical studies, basing KT activities on strategies that include tailoring the format and delivery method to the circumstances and needs of specific audiences was a key conclusion of the study by Conklin and Stolee (2008). Another qualitative study reported similar results, concluding that customizing KT methods to meet individuals' needs at particular points in

time and developing audience specific messages increases the value attached to a knowledge resource (Dobbins *et al.* 2004).

The influence of networks on successful KT is noted in two papers. Informal electronic networks offering targeted e-mails highlighting new research information or evidence was perceived to be a highly valuable and legitimate knowledge sharing strategy (Russell *et al.* 2004). This study also noted that knowledge sharing networks allow for peers to act as rich sources of research evidence often inaccessible through formal literature searching methods. A study exploring a community of practice also indicated that networks make communication infrastructures more readily available, allowing for both research evidence and expertise about its clinical application to be effectively shared (Conklin & Stolee 2008).

Theme 2: Generating knowledge – key characteristics of knowledge exchange

The literature also offers a variety of definitions, terminology and models relating to knowledge exchange. In general, explanations of KE propose an interactive and ongoing process of collaboration, which provides research users with information they perceive as relevant in easily usable formats whilst research producers receive information about the needs of users. The information about KE identified in this review focussed largely on collaboration and communication during the formulation, conduct and dissemination of new research knowledge.

Collaborative research formulation

Collaborations between researchers and health professionals during the design of research studies were identified throughout the literature as an important element of producing relevant and practicable new knowledge. Systematic reviews (Bero *et al.* 1998, Fixsen *et al.* 2005, Mitton *et al.* 2007), several literature reviews (Hemsley-Brown 2004, NCDDR 2006; Glasgow & Emmons 2007, Harrington *et al.* 2008) and case studies (Titler *et al.* 1999, Baumbusch *et al.* 2007) note that collaboration during research formulation is an effective way of identifying the knowledge needs of health professionals. These papers also suggest that research studies based on a sound understanding of health professionals' needs tend to be perceived as more relevant and are therefore more likely to be applied in practice.

Collaborative research production

There is a strong theme represented in systematic reviews and many of the literature reviews indicating the value of collaboration between those using research evidence and its

producers in influencing clinical, planning and policy decisions (CPHI 2001; Pyra 2003, Hemsley-Brown 2004, Fixsen *et al.* 2005, NCDDR 2006; Glasgow & Emmons 2007, Mitton *et al.* 2007, Best *et al.* 2008, Harrington *et al.* 2008). Most of the literature reviews and several empirical and case studies include information about establishing and maintaining collaborations between the producers and users of research knowledge. The value of this lies largely in the opportunity for knowledge users to ensure that the direction of a research programme remains focussed on relevant issues, causing the resulting knowledge to be of increased relevance, utility and acceptability to the user (Crosswaite & Curtice 1994, Bero *et al.* 1998, Hemsley-Brown 2004, Fixsen *et al.* 2005, Jacobson *et al.* 2005; Eke *et al.* 2006, NCDDR 2006; Baumbusch *et al.* 2007, Glasgow & Emmons 2007, McConnell *et al.* 2007, Harrington *et al.* 2008).

In addition, allowing research to be informed by stakeholders may help a study's outcomes to be more practicable, as specific constraints and opportunities present in the practice context can be considered during its design (Eke *et al.* 2006, Farkas & Anthony 2007).

Many of the reviewed studies discuss the need to establish and maintain quality relationships during collaborative research in KE initiatives. Quality interactions during collaborative research are key to building effective and reciprocal partnerships, maintaining the application of knowledge in practice and fostering an understanding of the specific interests, priorities and expertise that may shape the project and the use of any findings (Pyra 2003, Bowen & Martens 2005, Garland *et al.* 2006, Harrington *et al.* 2008).

Collaborative dissemination

Other qualitative and case studies note the benefits of collaboration suggesting that it improves researchers' understanding and appreciation of clinical environments, leading to the speedier identification of more relevant training needs and methods, as well as a greater appreciation among knowledge users of the quality, merit and potential application of research evidence (Crosswaite & Curtice 1994, Vingilis *et al.* 2003, Kothari *et al.* 2005, Forrester *et al.* 2008). Similarly, it is suggested that collaboration during research makes action from knowledge more probable as it allows stakeholders the opportunity to inform implementation strategies by bringing local and context-specific knowledge to the process (Eke *et al.* 2006, Baumbusch *et al.* 2007, Farkas & Anthony 2007).

The method by which research evidence is shared with clinicians or other knowledge users may have a significant impact on whether or not it is used. Educational outreach is effective at facilitating action from knowledge, as noted in

systematic reviews (Bero *et al.* 1998, Grimshaw *et al.* 2001, Fixsen *et al.* 2005), and several of the literature reviews (Majumdar *et al.* 2004, Best *et al.* 2008). Multifaceted educational techniques focussed on using active or interactive methods are similarly noted to be effective (Bero *et al.* 1998, Grimshaw *et al.* 2001, Fixsen *et al.* 2005, Best *et al.* 2008, Harrington *et al.* 2008). Fixsen *et al.*'s (2005) extensive synopsis of research implementation literature notes that there is empirical evidence to support the assertion that on-site, face-to-face methods of facilitating action from knowledge are effective. Corrigan *et al.*'s (2001) literature review cites various educational methods including modelling, role-play, feedback and in-service education sessions, concluding that knowledge users involved in such activities learn more skills and are more likely to apply and maintain them in practice. Likewise, Molfenter *et al.*'s (2009) investigation into facilitating evidence-based practice with speech and language pathologists identified interactive and practical training as more effective than lecturing, attributing the difference to the opportunity to tailor the educational intervention to the individual knowledge user's preferences.

In addition, Glasgow and Emmons (2007) and Eke *et al.* (2006) suggest that knowledge producers should make efforts to share information that has the potential to inform the application of research evidence. They suggest including specified training methods and levels, reports about their experiences during the research process of implementing a treatment or intervention, and any understanding about how to address commonly encountered challenges to implementation and maintenance. Glasgow and Emmons (2007) also suggest that it would be useful for knowledge producers to create comparison conditions that are more reflective of real life situations, thereby increasing the generalizability of research findings.

Theme 3: Applying knowledge – creating optimal conditions for action

The influence of contextual factors on the ability of knowledge users to make evidence-based decisions is identified throughout the reviewed literature. Identifying and managing potential barriers, or identifying and exploiting potential facilitators already present in the knowledge users' context increases the likelihood that KT and KE activities will successfully support the application of research evidence in practice (Grimshaw *et al.* 2001, Glasgow & Emmons 2007, McConnell *et al.* 2007, Forrester *et al.* 2008, Molfenter *et al.* 2009).

Details about how best to manage barriers and exploit facilitators are not fully identified but several studies note the

potential benefits of engaging local opinion leaders in guiding the changes necessary to apply knowledge in practice. Systematic and literature review evidence concludes that opinion leaders are variably effective at achieving this end (Bero *et al.* 1998, Pyra 2003, Mitton *et al.* 2007). Likewise, case studies by McConnell *et al.* (2007) and Crosswaite and Curtice (1994) reported favourably on opinion leaders' ability to facilitate the process, indicating their value in gauging and managing areas of tension, stimulating interest from stakeholders and helping to maintain commitment to making evidence-based changes to practice.

Likewise, engaging managerial and organizational stakeholders is reported as a useful method for creating the conditions most amenable to the use of knowledge. Titler *et al.* (1999) suggest that securing organizational support for change is essential for success, but often difficult to achieve. Corrigan *et al.* (2001) argue that equipping key stakeholders with transformational and transactional leadership skills can help to progress evidence-based changes by encouraging modifications in staff approaches to using knowledge. Furthermore, developing knowledge users' capacity to understand and critique research evidence is a potentially effective method for increasing the likelihood of action (Corrigan *et al.* 2001, Pyra 2003, Mitton *et al.* 2007, Harrington *et al.* 2008).

A number of specific organizational capacities are suggested as necessary prerequisites for creating action from knowledge. The need to ensure sufficient time, financial, technological and human resources is often cited (Fixsen *et al.* 2005; NCDDR 2006, Mitton *et al.* 2007, Best *et al.* 2008, Harrington *et al.* 2008, McWilliam *et al.* 2008).

Best *et al.* (2008) explain how organizational capacities can have effects on efforts to access, produce and use new knowledge, noting that the processes involved are influenced by an organization's 'unique rhythms and dynamics, world-views, priorities and processes, language, time scales, means of communication, and expectations' (Best *et al.* 2008, p. 322). Realigning these factors to create an organizational environment supportive of KT and KE appears a potentially important aspect of successfully facilitating evidence-based practice in healthcare.

Similarly, the research paper by Bowen and Martens (2005) reports that further organizational capacity is needed to overcome the barriers that cannot be surmounted through the development of individuals' skills. Forrester *et al.*'s (2008) description of a clinical-academic partnership attributes the scheme's success to the leadership associated with a supportive administration and a shared governance structure that actively promoted the involvement and participation of nurses in collaborative research activities. Farkas and

Anthony (2007) conclude that organizations that are enabled to both generate and disseminate research have more successful outcomes as they can deliver the most favourable conditions in which KT and KE may occur. Amongst these is supporting ongoing dialogue between researchers and stakeholders, continually developing new evidence-based messages and actively attempting to overcome shifting barriers to implementation.

Theme 4: Knowledge brokering – facilitating knowledge sharing, creation and application

Knowledge brokers, whose role is to facilitate links between researchers, research users and policy or decision makers, were identified as having a beneficial impact on KT and KE activities, increasing their effectiveness at progressing the acquisition, generation and use of research knowledge by health professionals. Harrington *et al.* (2008) note that although their effectiveness is being still being examined, accounts of knowledge brokers suggest they can be an integral resource for assisting researchers to develop the skills, experience and confidence to interact with varied audiences as well as enabling knowledge users to understand the research process. Harvey *et al.*'s (2002) literature review concludes that studies with variable effect sizes indicate that an individual who provides face-to-face communication using multifaceted strategies can have some impact on changing clinical and organizational practice. Several papers note the potential benefits of including a knowledge broker, including the promotion of collaborative relationships, knowledge sharing activities and network building within and between research producers, users and managers and organizations (Crosswaite & Curtice 1994, Philip *et al.* 2003, Vingilis *et al.* 2003, Best *et al.* 2008).

Farkas and Anthony (2007) demonstrate that the perceived value of research evidence is directly affected by the credibility of the person who shares it with knowledge users. They suggest that knowledge brokers are integral to earning credibility as they assist in creating action from knowledge, build reciprocal and regular interactive relationships and can identify key stakeholders. It is worth noting that healthcare policy makers were shown to be more likely to use research evidence if they found it credible and that future research produced by an organization would be more readily used once credibility had been established (Dobbins *et al.* 2004).

Discussion

The review focused on identifying the key characteristics of KT and KE initiatives in healthcare to identify which methods

can support health professionals to progress their evidence-based practice. Various methods or features, which can enhance the value of these activities have been identified, but comprehensive approaches inclusive of the three key themes of knowledge sharing, generation and application are less obvious.

Robust, high-level evidence for KT and KE is lacking, despite the identification and inclusion of systematic reviews, synopses, primary research studies and case studies in this review. At present, these focus largely on individual methods or limited aspects of the KT or KE process, such as interventions to help create action from knowledge or enable the efficient sharing of knowledge. This shortage of empirical evaluative research into knowledge transfer and exchange initiatives, and their suitability for application in different healthcare contexts and with different disciplines, has been noted in the wider literature (Armstrong *et al.* 2006), as well as by authors in this review (Corrigan *et al.* 2001, Mitton *et al.* 2007).

Variations in terminology, definitions and conceptualizations of how to achieve sustained evidence-based practice have led to the development of multiple models and frameworks describing KT and KE processes. This has provided particular challenges for the development research in this area. Greenhalgh *et al.* (2004) have made several recommendations for developing this field, asserting that research should be driven by theory, concentrate on process and use common definitions and measures. The absence of these factors may partially explain the absence of coherent and developed evidence bases for KT and KE.

Further to this, the findings of this review suggest that there should be a focus on designing, implementing and evaluating practical solutions, which enable health professionals to engage in these three core processes. This would progress the field of study in a worthwhile direction by expanding existing models, which conceptualize how the process may occur and identify the importance of many of the characteristics noted in this review.

One model used in nursing research is the Promoting Action on Research Implementation in Health Services (PARiHS) framework (Kitson *et al.* 1998), which aims to represent the complexity of processes involved in using research in practice, identifying the interdependence of several key elements. These include the potent affect contextual factors have on the implementation of evidence into practice; the value of facilitators who, similar to the emerging knowledge brokering concept, can support the development of many key factors and; the importance of combining different evidence types for use by clinicians. Similarly, the Canadian Institutes of Health Research's Knowledge-to-

Action (KTA) model (Graham *et al.* 2006) also describes the key elements of this process, many of which have been highlighted by the literature included in this review. Graham *et al.* (2006) outline an action cycle in which knowledge is adapted to the local context and assessing barriers to its application feature prominently.

Whilst PARiHS notes the successful use of knowledge in healthcare as a function of how types of knowledge, context and facilitation interact, there is an opportunity to expand the value of this framework by identifying the specific methods, which allow these three things to interact effectively in complex healthcare settings. Likewise, understanding the practical processes, which would enable the cycles of Graham *et al.*'s (2006) KTA model to be successfully completed would be of considerable value in helping nurses and other healthcare professionals achieve routine evidence-based practice.

Despite the existence of models like these that reflect the core characteristics of successful KT and KE, they remain in need of conceptual clarity and agreement. These processes tend to be complex, intricate, participatory and evolving, which may prevent support from funding bodies, which traditionally favour single project-based research endeavours (Lomas 2000, Vingilis & Lindsay 2001). A lack of funding and the potentially highly problematical nature of any study may have delayed the development of investigation into their efficacy and applicability. Established views about the quality of research methods mean that experimental formats and especially the randomized controlled trial are still viewed as the most valuable form of evidence (Gray 1997, Evans 2003). Applying randomization to research into processes focused on enabling teams of healthcare professionals or indeed whole services to share, use and create knowledge more effectively is likely to be challenging (Corrigan *et al.* 2001). Furthermore, despite several proposed frameworks and models (Champion & Leach 1989, Funk *et al.* 1991, Lavis 2006), no valid method for measuring the effects of KT or KE has been established. Rather, the most commonly used approach is to develop local, individual and non-standardized measures (Estabrooks *et al.* 2006).

The findings of this review recommend several areas for development in this field. First, the value of comprehensive and connected approaches attentive to the different processes key to evidence-based practice should not be underestimated. Whilst there is value in conceptualizing the processes, which may illustrate how to effectively acquire and apply research knowledge, more concerted efforts to design and implement practical strategies reflective of the characteristics identified in this review are needed.

A particular area for attention includes finding ways to support actively the creation of facilitating conditions. The

What is already known about this topic

- Established methods for facilitating evidence-based decision-making in healthcare are generally ineffective due to a variety of commonly encountered barriers.
- Knowledge transfer and exchange initiatives can facilitate the generation and communication of research of greater relevance and practicality to potential users.

What this paper adds

- A clearer perspective on the key elements that should be included in knowledge transfer and exchange initiatives.
- Evidence for the critical role of organizational capacity and support during knowledge transfer and knowledge exchange initiatives.
- Impetus to use specialist knowledge brokers to progress initiatives aimed at improving evidence-based practice.

Implications for practice and/or policy

- The importance of collaboration in sharing, applying and generating knowledge may require a change in researchers' and health professionals' roles to allow greater involvement in the processes and activities of knowledge transfer and exchange.
- Active support, funding and incentivizing from policy makers and healthcare managers will be needed to ensure the creation of suitable conditions for knowledge transfer and exchange.
- Further primary research into the effectiveness and transferability of the specific methods and techniques used in knowledge transfer and exchange initiatives is needed.

literature in this review suggests that capacity building is needed to allow successful knowledge transfer and exchange activities to take place. Further work is needed to identify, adopt and develop methodologies, which will allow such capacity building to happen in a manner compatible with the complex and fluctuating nature of modern healthcare. Little information about designing organizationally led efforts to create environments supportive of knowledge transfer and exchange presently exists, despite many papers that identify the importance of providing sufficient resources. At the other end of the spectrum, the interpersonal nature of many of the valuable knowledge transfer and exchange processes necessitates a concurrent focus on learning how to enable individuals to participate in sharing, generating and applying knowledge in practice.

The challenge for researchers and members of healthcare organizations aiming to improve levels of evidence-based practice is to discover how to create these levels of support. Further research into designing, implementing and evaluating KT and KE solutions should be based on concerted efforts to support key activities from both an organizational standpoint, and where necessary, through the active partnering of practitioners, researchers and decision makers.

Conclusion

In the absence of a coherent high-level evidence base, it is worth noting that there is much agreement about the key characteristics of KT and KE across a range of sources. The findings in this review are drawn from a complex evidence base and include studies pertaining to individual methods and strategies for achieving KT and KE in the context of health services, and the wider process itself.

It is important that nurses take the opportunities to engage with researchers wherever possible to generate knowledge that is more relevant to both their specific clinical needs, and the realities of contemporary nursing contexts. This appears to be a key step in developing more practicable and applicable knowledge. In addition to making the most of opportunities as they arise, the nursing profession should actively identify their research needs and lobby for the inclusion of nurses into research programmes as participants, designers and researchers.

The findings that illustrate the importance of creating the optimal conditions for KE, KT and evidence-based practice to occur in, usually through the development of specific organizational and individual capacities, suggest that healthcare managers and service leads should be more receptive to allowing innovative KT and KE activities to take place. Allowing nurses the resources and space to become involved in research collaborations and interactive KT activities may appreciably increase their ability to make evidence-based decisions.

Several areas for ongoing research can be identified, including investigating the efficacy of KT and KE activities both in general and with specific professions in specific contexts; the role and value of using knowledge brokers in realizing these activities; and more focussed explorations into the organizational supports and contextual circumstances that would allow nurses to engage in KT and KE. However, a key message for researcher producers is that they should actively engage and collaborate with, and remain responsive to, their target audiences throughout the entirety of the research process from design to dissemination.

Conflict of interest

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KF, MW, RM, LI and SS were responsible for the study conception and design. DP performed the data collection. DP and DM performed the data analysis. DP was responsible for the drafting of the manuscript. DP, DM, KF and RM made critical revisions to the paper for important intellectual content. KF, MW and LI obtained funding. DM provided administrative, technical or material support. DM, KF, MW and SS supervised the study.

Supporting Information Online

There is no Supporting Information associated with this article.

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Appendix A: Computerized search strategies

Applied Social Sciences Index and Abstracts (ASSIA)

Limited to: journal articles, 1990–2010, English language only

1. DE = Knowledge management
2. DE = Research transfer
3. DE = Knowledge based development
4. DE = Research and development
5. DE = Research management
6. DE = Research partnerships
7. DE = Innovation+
8. (1 or 2 or ... or 7) – 1403
9. DE = Medicine+
10. DE = Health services+
11. (9 or 10) – 12426
12. (8 and 11) – 102
13. DE = Medical research
14. DE = Medical effectiveness research
15. DE = Evidence-based medicine
16. DE = Evidence-based psychiatry
17. DE = Evidence-based psychosomatic medicine
18. (13 or 14 ... or 17) – 2376
19. AB = knowledge *within 2* transfer
20. AB = knowledge *within 2* exchange
21. AB = knowledge *within 2* broker
22. AB = knowledge *within 2* development
23. AB = knowledge *within 2* dissemination
24. AB = knowledge *within 2* management
25. AB = knowledge *within 2* sharing
26. AB = knowledge *within 2* diffusion
27. AB = knowledge *within 2* distribution
28. AB = knowledge *within 2* utilization
29. AB = knowledge *within 2* mobilization
30. AB = knowledge *within 2* generation
31. AB = research *within 2* transfer
32. AB = research *within 2* exchange
33. AB = research *within 2* broker
34. AB = research *within 2* dissemination
35. AB = research *within 2* management
36. AB = research *within 2* sharing
37. AB = research *within 2* diffusion
38. AB = research *within 2* distribution
39. AB = research *within 2* utilization
40. AB = research *within 2* mobilization
41. AB = research *within 2* generation
42. AB = research *within 2* translation
43. AB = Innovation *within 2* broker
44. AB = Innovation *within 2* development

45. AB = Innovation *within 2* distribution
46. AB = Innovation *within 2* diffusion
47. AB = Innovation *within 2* exchange
48. AB = Innovation *within 2* management
49. AB = Innovation *within 2* partnership
50. AB = Innovation *within 2* sharing
51. AB = Innovation *within 2* transfer
52. AB = Innovation *within 2* translation
53. AB = Innovation *within 2* utilization
54. (19 or 20 or 21... or 53) – 1398
55. (18 and 54) – 34
56. (12 or 54) – 132

Business source premier

Limited to: Peer reviewed journal articles; Jan 1990 – present; English language only.

1. SU = Knowledge management
2. SU = Knowledge process outsourcing
3. SU = Knowledge workers
4. SU = Research institutes
5. SU = Research and development
6. SU = Diffusion of innovations
7. SU = Innovation management
8. SU = Innovation adoption
9. SU = Organizational learning
10. (1 or 2 or 3 ... or 9) – 14682
11. SU = Health* - 22250
12. (10 and 11) – 132

Cumulative Index to Nursing and Allied Health Literature (CINAHL)

1. MH = Knowledge management
2. MH = Information management
3. MH = Clinical research+
4. MH = Diffusion of innovation
5. (1 or 2 or 3 or 4) – 3671
6. MH = Health services+ - 118685
7. (5 and 6) – 554

PsychInfo

1. SU = Knowledge management
2. SU = Knowledge transfer
3. SU = Evidence-based practice
4. SU = Information dissemination
5. SU = Innovation
6. SU = Research and development
7. (1 or 2 or 3... or 6) – 7802

8. SU = Healthcare services+ - 9189
9. (7 and 8) – 266

Medline

1. MH = Research+
2. MH = Diffusion of innovation+
3. MH = Evidence-based practice+
4. (1 or 2 or 3) – 87355
5. MH = Health services+ - 559461
6. AB = knowledge n2 broker
7. AB = knowledge n2 development
8. AB = knowledge n2 diffusion
9. AB = knowledge n2 dissemination
10. AB = knowledge n2 distribution
11. AB = knowledge n2 exchange
12. AB = knowledge n2 management
13. AB = knowledge n2 mobilization
14. AB = knowledge n2 network
15. AB = knowledge n2 partnership
16. AB = knowledge n2 sharing
17. AB = knowledge n2 transfer
18. AB = knowledge n2 translation
19. AB = knowledge n2 utilization
20. AB = research n2 broker
21. AB = research n2 diffusion
22. AB = research n2 dissemination
23. AB = research n2 distribution
24. AB = research n2 exchange
25. AB = research n2 management
26. AB = research n2 mobilization

27. AB = research n2 network
28. AB = research n2 partnership
29. AB = research n2 sharing
30. AB = research n2 transfer
31. AB = research n2 translation
32. AB = research n2 utilization
33. AB = innovation n2 diffusion
34. AB = innovation n2 development
35. AB = innovation n2 dissemination
36. AB = innovation n2 distribution
37. AB = innovation n2 exchange
38. AB = innovation n2 management
39. AB = innovation n2 mobilization
40. AB = innovation n2 network
41. AB = innovation n2 partnership
42. AB = innovation n2 sharing
43. AB = innovation n2 transfer
44. AB = innovation n2 translation
45. AB = innovation n2 utilization
46. (6 or 7 or 8... or 45) – 7127
47. (4 and 5 and 46) – 562

Cochrane database of systematic reviews

1. MeSH = Knowledge+
2. MeSH = Information dissemination+
3. MeSH = Research+
4. MeSH = Evidence-based practice+
5. MeSH = Diffusion of innovation+
6. (1 or 2 or 3 or 4 or 5) - 20

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