Communities of Practice in the Health Sector

A systematic review of the peer-reviewed literature

Centre for Clinical Governance Research

Australian Institute of Health Innovation

First published in 2010 by the Centre for Clinical Governance Research, Australian Institute of Health Innovation, Faculty of Medicine, University of New South Wales, Sydney, NSW 2052.

National Library of Australia

Cataloguing-in-Publication data:

ISBN: 978-0-7334-2946-0

1. Communities of Practice in the Health Sector: A systematic review of the literature

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ACKNOWLEDGEMENTS

This research was supported under the Australian Research Council Discovery Project (DP0986493) awarded to Professors J Braithwaite and JI Westbrook.

ABBREVIATIONS

CoP	Community of practice
CME	Continuing medical education
CR-BSI	Catheter related-blood stream infections
FQHC	Federally qualified health centre
GP	General Practitioner
NHS	National Health Service
WATI	Web assisted tobacco interventions

EXECUTIVE SUMMARY

Originally based on the theory of situated learning where professional learning occurred through participation in practice and interaction with colleagues, the term Communities of Practice (CoPs) has evolved over time to refer to groups of people who share a concern or a problem and who come together to interact, learn and create a sense of identity, and in the process, build and share knowledge and solve problems. CoPs have gained recognition in the business sector for fostering professional development of individuals and improving business outcomes for organisations. Based on these claimed benefits of CoPs in the business sector, the creation of CoPs is being promoted in the health sector to drive knowledge management and to improve organisational performance.

A previous systematic review of the literature on CoPs in the health sector published up to 2006 identified a dearth of empirical and evaluative studies providing evidence for the effectiveness of CoPs in the health sector. This review is no longer current and is limited by its focus on examining whether CoPs in the health sector have demonstrated achieving outcomes. It does not review in detail the aspects of a CoP (such as structure, function and contexts) that determine success in CoPs achieving a particular outcome. The objective of the current review is to systematically search and review the literature on CoPs in the health sector focusing particularly on the structure and function of CoPs and the research designs used to study CoPs in the health sector. The information obtained from this review will help develop a research framework to systematically assess the value of CoPs in the health sector.

MEDLINE, CINAHL, EMBASE, Web of Science and EconLit databases were searched in October 2009 for papers published in English between 01 January 1990 and 30 September 2009. Only peer-reviewed empirical and case-studies on CoPs or situated learning in the health sector were included. Of the 6 605 abstracts extracted, 90 were considered eligible based on reviewing the abstract. Extracting and reviewing the full paper reduced the number of papers for detailed review to 32.

United Kingdom was the most frequent country of origin with 13 papers reporting on research undertaken in the UK. Six of the papers reported on research from Canada; five from the United States of America; four from Australia; one from Denmark; and one that included participants from USA; Canada and Australasia. Two systematic reviews on CoPs were published – both were conducted by researchers in Canada. Eighteen of the 32 papers were published in or after the year 2007.

Excluding the two systematic reviews, 16 of the 30 individual papers reviewed presented information on CoPs that were multi-sectoral – that is, they were multi-organisational and/or multi-professional. These CoPs were established for purposes of learning, knowledge transfer, information exchange, and/or for sharing and promoting evidence-based practice. The 14 CoPs where membership consisted of a single professional group or was hospital based (and did not cross organisational boundaries) were established to change practice, support practitioners, and/or to promote learning and innovation in clinical practice, to facilitate knowledge transfer and information exchange and to facilitate teaching and learning research.

Twenty-one of the papers reporting on CoPs had been artificially created for a specific purpose. Based on information contained in the research papers, these CoPs, even though artificially created, were free

of the organisational hierarchy. The presence of a facilitator was often referred to, and reference to organisational management was in terms of endorsement of the CoP rather than hierarchical management.

Eleven of the 32 individual studies reviewed reported CoPS which used a combination of methods for members to communicate with each other. This consisted of opportunities for face-to-face interaction at meetings and seminars and a variety of electronic means of communication using emails, websites, and electronic newsletters. Face-to-face interaction within usual workplace environment was the next most common with 10 papers reporting this as the only means of communication between members. Six papers reported on CoPs that used only virtual methods for members to interact. The variation in methods used suggests that the means of communication and interaction depend on the geographical distribution of the members and also on the objective of the CoP.

All research on CoPs examined in the previous review published in 2009 was qualitative and descriptive. These papers report on the establishment of CoPs in the health sector and use interviews and/or ethnographic observations to ascertain perceived value of the CoP. The first mixed methods study that incorporated a quantitative component was published in 2006, but qualitative methods continued to be the popular choice. The few quantitative studies that were identified by this current search provide limited evidence to demonstrate convincingly, the direct beneficial effects of CoPs in terms of changing practice and making healthcare more effective. This limitation is largely due to the multifaceted nature of the interventions where the effects of the CoPs cannot be differentiated from those of the other components of the intervention. None of the studies identified by this search have demonstrated sustainability of the changes that have been attributed to membership with the CoP.

Our review suggests that there is insufficient information in the peer-reviewed health literature about CoPs to systematically assess the effectiveness of CoPs to change individual or organisational performance. There is no single CoP model that will fit all purposes. Given these findings, it is necessary to study CoPs in greater depth with the aim of understanding how CoPs contribute to improved performance in health care (if they do), and to identify the conditions or contexts required for CoPs to make health care more effective. Understanding these factors about CoPs will help develop a framework to systematically examine the value of CoPs in the health sector and will also assist health care organisations by providing guidance on how best to foster CoPs to improve the effectiveness of care delivered by the health sector.

1. INTRODUCTION

The term 'Community of Practice' (CoP) was first coined in 1991 by Jean Lave and Etienne Wenger as a central element of their theory of 'situated learning'. This theory accounted for workplace learning as occurring through participation in practice and interaction with colleagues, rather than through formal instruction or training. The community of practice was presented here as the group between whose members such situated learning occurred naturally during the course of individuals becoming competent in a practice. Becoming a full member of such a community was seen as dependent on competence in the eyes of other members (Lave and Wenger 1991). Over time, the concept has evolved from being an analytic aid to describing how learning occurs in the workplace towards being a tool for businesses to use to leverage the 'knowledge assets' resident in their employees.

In later works Wenger and colleagues have described CoPs as informal groups bound together by a common interest or passion (Wenger and Snyder 2000) and as having three fundamental elements - a domain, a community and a practice (Wenger, McDermott et al. 2002). The *domain* is the area of shared inquiry and "creates common ground and a sense of identity ... inspires members to contribute and participate, guides their learning and gives meaning to their action"(Wenger, McDermott et al. 2002, p29). A domain is not purely an area of interest. Rather, it is a key issue, problem or goal that members share. It is not fixed and may evolve with the CoP. "The *community* creates the social fabric of learning" (Wenger, McDermott et al. 2002, p28). "It is a group of people who interact, learn together, build relationships, and in the process develop a sense of belonging and mutual commitment" (Wenger, McDermott et al. 2002, p34). Individuals become a community by interacting regularly in relation to their domain; interactions must have continuity; members of a community don't necessarily work together on a day-to-day basis, nor do they need to be of the same profession or organisation. While participation in a community can be encouraged, the success of a CoP is determined by the passion and energy generated by the members and the community. A community provides a forum where members feel "safe to speak the truth and ask hard questions" (Wenger, McDermott et al. 2002, p37). The *practice* is the "specific knowledge the community develops, shares and maintains"(Wenger, McDermott et al. 2002, p29).

The increasing interest in CoPs is largely due to organisations needing to be competitive in a global market driven by rapid advances in knowledge and technology. In order to remain competitive, organisations need to be able to constantly review and renew organisational capabilities, which requires knowledge creation, acquisition, and sharing (Nielsen 2006). It is suggested that CoPs add tangible and intangible, short- and long-term value to the organisation and the members of the CoP (Wenger, McDermott et al. 2002, p15-16). In the short-term, CoPs provide individuals improved experience of work (by providing access to expertise, improving their level of confidence when approaching problems, or by generating a sense of belonging) and improve business outcomes for the organisation (by, for example, providing an arena for problem solving or by improving quality of decisions). In the long-term, CoPs help foster professional development of individuals (by, for example, providing access to

information) and develop organisational capabilities (by building knowledge-based alliances or by providing a forum to benchmark practice) (Wenger, McDermott et al. 2002, p16).

Hoping to replicate the benefits of CoPs claimed in the business literature as drivers of knowledge management, creating social capital and adding organisational value (Lesser and Storck 2001; APQC 2001), many healthcare organisations have promoted the creation of CoPs to foster professional development among members and to develop organisational capability. Despite the increasing investment in fostering CoPs, little is known about how best to organise and deliver CoPs to achieve change, nor about their effectiveness in the complex environment of healthcare. If CoPs are to be promoted and cultivated in the health sector, there is a need to assess the empirical evidence for CoPs improving organisational performance in this context, to understand more about the variables influencing their successful operation, and the types of improvements they can be expected to deliver.

A systematic review of CoPs in the health and business sectors published in 2009, examined literature published between 1991 and 2005 with the aim of examining the use of CoPs in these two sectors; more specifically to assess "the evidence on the effectiveness of CoPs in health care setting"(Li, Grimshaw et al. 2009, page 5). The authors identified a dearth of empirical and evaluative studies and described the existing literature base as being dominated by qualitative studies describing the operation of particular CoPs. An exploratory examination of the peer-reviewed literature published since 2005 suggests that the number of publications on CoPs in the health sector has increased since then. It is therefore timely to review the literature again, broadening the scope of the review to incorporate the evolving concept of CoPs. To this end, this report presents a systematic review of the peer-reviewed literature on CoPs in the healthcare sector.

1.1 Objective

The objective of this review is to examine the peer-reviewed literature reporting the use of CoPs in the health sector, focussing particularly on structure and function and on how effectiveness has been measured. The findings from this review will help inform the design of a framework to evaluate CoPs for their effectiveness in improving practice and for their ability to sustain improved practice initiatives (Braithwaite, Westbrook et al. 2009).

2. DEFINING COMMUNITIES OF PRACTICE

Due in part to the evolution of the concept within the writings of its originators, various definitions of CoPs are evident in the literature. To help guide this systematic review, we have used the definition presented in 2002 by Wenger and colleagues, quoted below.

> *Communities of practice are groups of people who share a concern, a set of problems or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis ... .*

These people don't necessary work together on a day-to-day basis, but they get together because they find value in their interactions, as they spend time together, they typically share information, insight, and advice. They solve problems. They think about common issues. They explore ideas and act as sounding boards to each other. They may create tools, standards, generic designs, manuals, and other documents; they may just keep what they know as a tacit understanding they share... Over time, they develop a unique perspective on their topic as well as a body of common knowledge, practices and approaches. They also develop personal relationships and established ways of interacting. They may even develop a common sense of identity. They become a community of practice.

(Wenger, McDermott et al. 2002, pages 4-5)

3. METHODS

Using the definition and characteristics of CoPs presented above and recapitulated by Li and colleagues in 2009 (Li, Grimshaw et al. 2009), the search terms presented in Figure 1 were used to identify peer-reviewed publications reporting on CoPs in the health sector.

3.1 The search strategy

In October 2009, we searched MEDLINE (biomedicine and health), CINAHL (Cumulative Index of Nursing and Allied Health Literature), EMBASE (medicine and health services database), Web of Science (Science Citation Index Expanded, Social Sciences Citation Index and the Arts & Humanities Citation Index), and EconLit (economics and business) for papers published between 1 January 1990 and 30 September 2009, using the search terms outlined in Figure 1. The year 1990 was chosen to capture the original publication by Lave and Wenger in 1991 and articles responding to and elaborating on it. The search was limited to literature published in English and with humans as subjects.

Figure 1: Search terms used to identify literature on communities of practice in the health sector

Community/Communities of practice
OR Community/Communities of interest
OR Community/Communities of learning
OR Community/Communities of knowledge
OR Learning community/communities
OR Knowledge community/communities
OR Situated learning

Limits: Language = English
Species = Humans

Date range:
01 January 1990 to 30 September 2009

Two authors (GR and JP) independently reviewed all identified abstracts using criteria presented in Figure 2, eliminated duplicates, and shortlisted abstracts for retrieval of paper and detailed review. One author (GR) reviewed all retrieved papers except for those that employed ethnographic methods; these were reviewed by JP.

Figure 2: Inclusion and exclusion criteria used to identify literature on communities of practice in the health sector

Inclusion criteria

1. Peer-reviewed empirical and case studies on communities of practice or situated learning in the health sector; and
2. Abstract makes reference to a community of practice or any search term presented in Figure 1.

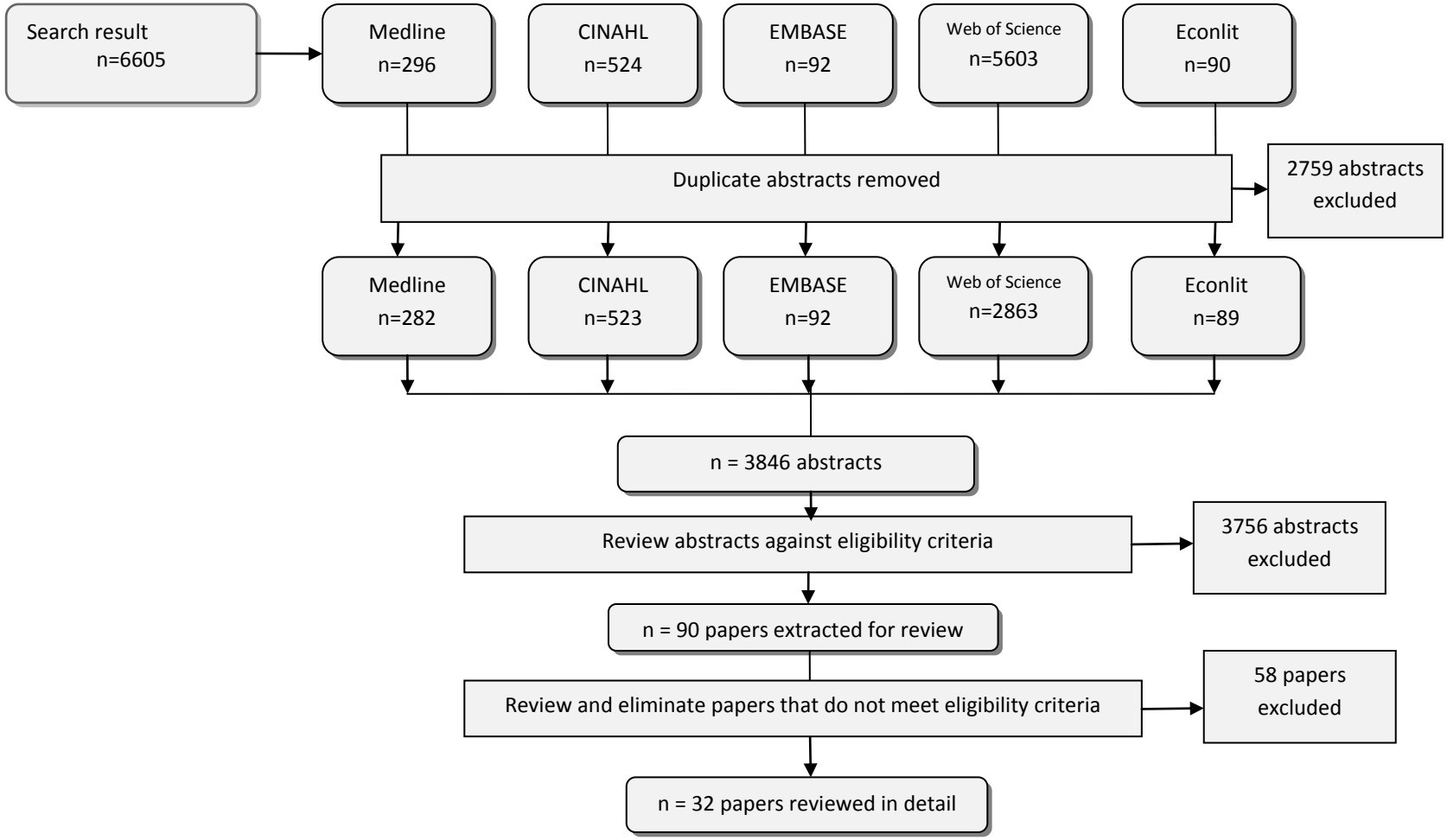
Exclusion criteria

1) Abstracts reporting on communities of practice other than in healthcare.
2) Abstracts reporting on communities of practice whose members were not directly involved in delivering healthcare, such as those focussed on
   - medical education
   - community-based learning
   - classroom and undergraduate teaching, learning and curriculum development
   - student residential learning communities
   - pharmaceutical industry
   - online communities
3) Records with no abstract unless it was clear from the title that the paper was relevant.
4) Abstracts of conference proceedings
5) News-style or opinion articles
6) Theses and dissertations

4. RESULTS

As shown in Figure 3, the search strategy described above yielded 6 605 abstracts, of which 90 abstracts were considered to be eligible for inclusion based on the selection criteria. Review of the full papers of these 90 abstracts eliminated a further 58 papers that did not meet inclusion criteria, leaving 32 full papers for detailed review. In keeping with the objectives of this review, these papers were analysed to identify features of the CoP(s) under study, the rationale for CoP establishment in each case, the methods used including the assessment and evaluation of outcomes, and the study findings.

Figure 3: Process of extracting, identifying and reviewing literature on communities of practice in the health sector



4.1 Country of origin

Excluding the two systematic reviews, most research on CoPs was undertaken in the United Kingdom followed by Canada (Table 1). Four of the 32 research papers were from Australia. One study published by a Canadian research group presented research where participants were from USA, Canada and Australasia. The two systematic reviews were published by researchers from Canada.

Table 1: Country of origin of research on communities of practice in the health sector

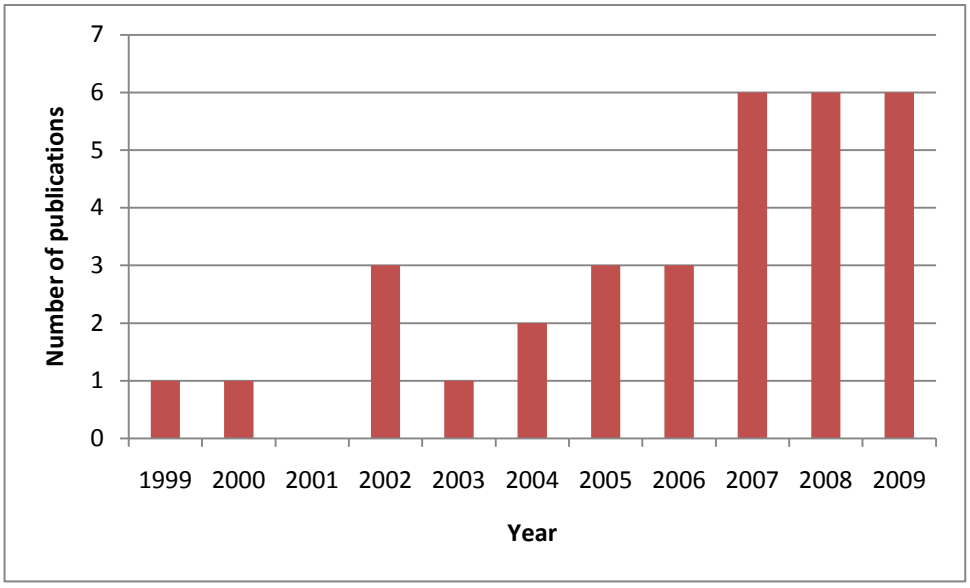
COUNTRY	NUMBER OF STUDIES (n=32)	REFERENCE
United Kingdom	13	Chandler and Fry (2009), Gabbay, le May et al. (2003), Gabbay and Le May (2004), Goodwin, Pope et al. (2005), Kelly, Tolson et al. (2005), Lathlean and le May (2002), Russell, Greenhalgh et al. (2004), Sharma, Smith et al., (2006), Sutherland and Dodd (2008), Swan, Scarbrough et al.(2002), Tolson, McAloon et al.(2005), Tolson, Irene et al. (2006), Wilson and Pirrie (1999).
Canada	6	Curran, Murphy et al. (2009), Fung-Kee-Fung, Goubanova et al. (2008), McDonald and Viehbeck (2007), Milne and Lalonde (2007), Pereles, Lockyer et al. (2002), Rossignol, Poitras et al. (2007).
USA	5	Gieselman, Stark et al. (2000), Price and Felix (2008), Render, Brungs et al. (2006), Taplin, Haggstrom et al. (2008), Wild, Richmond et al. (2004).
Australia	4	Huckson and Davies (2007), Jiwa, Deas et al. (2009), Rolls, Kowal et al. (2008), Wilding and Whiteford (2007).
USA, Canada, Australasia	1	Norman and Huerta (2006).
Denmark	1	Bossen (2007)
Systematic reviews[†]	2	Fung-Kee-Fung, Watters et al. (2009), Li, Grimshaw et al. (2009).

[†] Authors are from Canada.

4.2 Year of publication

The earliest empirical research on a CoP in the healthcare sector identified by the search strategy and included in the detailed review was published in 1999 (Figure 4). Eighteen of the 32 publications identified were published in or after 2007. The two systematic reviews were published in 2009.

Figure 4: Number of identified publications on communities of practice in the health sector from the peer-reviewed literature, by year of publication



4.3 Research setting and intended purpose of the CoPs studied

The majority of CoPs reported on in these 32 articles involved multiple organisational and/or geographical boundaries (Table 2). To help explore whether the composition of the CoP relates to the purpose of establishing the CoP, we have reviewed the setting and purpose of the CoP simultaneously.

The earliest published paper reporting on the application of CoPs in healthcare identified involved a multi-organisational and multi-professional setting. This qualitative study (Wilson and Pirrie 1999) of 10 healthcare organisations in Scotland (consisting of five matched pairs from general medical services, general dental services, accident and emergency, obstetrics and gynaecology, and laboratory medicine), explored how novices learnt from being part of a CoP. The next research paper on cross-sector CoPs in the health sector was also from the UK. This paper described an action research project that examined the potential of CoPs to promote collaboration between agencies and across professions and to develop improved delivery of healthcare services (Lathlean and le May 2002).

In 2003, Gabbay and colleagues published a paper on how people work together in two multiagency CoPs artificially created in the primary health care settings in the NHS England (Gabbay, le May et al. 2003). The researchers studied the development and functioning of the CoPs and the construct and use of knowledge in collective decision making, with the objective of facilitating better use of knowledge by

multiagency groups that come together to improve services for the elderly. The following year, Gabbay and le May published a paper presenting the findings of their research using the CoP as a conceptual tool to characterise the interaction and learning between general practitioners (in the UK) that influences decision making in clinical practice (Gabbay and le May 2004). The same year saw another publication from UK in which Russell and colleagues reported on the establishment of an email network (CHAIN - Contact, Help, Advice and Information Network) to promote the interaction between researchers and practitioners and to support persons involved in delivering healthcare in the NHS (Russell, Greenhalgh et al. 2004). CHAIN was established to enable and support the social interaction and exchange of dialogue seen as necessary to convert explicit knowledge to tacit knowledge.

In 2004, researchers from the United States published their findings of a survey of members of a CoP established to help integrate state and local, public and private health departments involved in the planning, development and integration of child health information systems (Wild, Richmond et al. 2004). In Scotland, Kelly and colleagues used a CoP of nursing practitioners and researchers as a tool to conceptualise the practice of gerontology nursing and also to guide the development of best practice guidelines (Kelly, Tolson et al. 2005). This same CoP was the subject of a subsequent paper by Tolson and colleagues presenting findings from a survey of the CoP members to explore how participation contributed to achieving evidence-based practice in their respective workplaces (Tolson, McAloon et al. 2005). Continuing this work to promote best practices and evidence-based nursing practices in Scotland, in 2006 Tolson and colleagues reported on the overarching project consisting of four cycles and described the practice development model that resulted from the action research (Tolson, Irene et al. 2006).

The emergence of a multi-sectoral CoP through the setting up of discussions amongst a disparate group of policy makers, researchers, and community- and hospital based practitioners from across geographical boundaries (USA, Canada and Australasia) was examined in 2006 by Canadian researchers (Norman and Huerta 2006). This group shared a common goal of supporting smoking cessation through a 'Web-Assisted Tobacco-Intervention (WATI)'. A follow-up survey conducted three weeks after the meeting identified that there had been communication exchange between most participants. Although a six month follow-up was not mentioned in the methods, the authors reported that "Through discussions via email with the nascent community over the 6-months that followed, it was evident that (the) group had moved into the 'coalescing stage 'demonstrated by the progress made on most of the five tasks and by the establishment of working relationships within and beyond the group to include groups with similar interest"(Norman and Huerta 2006). Another example of the emergence of a CoP following the implementation of an improvement program was published in 2008, where the CoP was a long-term outcome of senior clinical managers in the NHS in Lanarkshire, Scotland, participating in a leadership training program (Sutherland and Dodd 2008).

Milne and Lalonde describe the establishment of a multi-sectoral CoP in Canada to address patient safety in obstetrics (Milne and Lalonde 2007). A Managing Obstetrics Risks Efficiently (MORE) program was introduced emphasising effective teamwork and collaboration, and the exchange of knowledge, for the purpose of improving performance and patient safety. Working with the 120 participating hospitals

were representatives from the insurance provider, the Society of Obstetrics and Gynaecologists of Canada, and the provincial government.

Table 2: Research setting and purpose of establishing communities of practice in the health sector

SECTOR & PURPOSE	NUMBER OF STUDIES	AUTHORS
Multi-sector (n=16)		
Learning, knowledge transfer, information exchange	9	Wilson and Pirrie (1999), Lathlean and le May (2002), Wild, Richmond et al. (2004), Kelly, Tolson et al. (2005), Norman and Huerta (2006), Milne and Lalonde (2007), McDonald and Viehbeck (2007), Sutherland and Dodd (2008), Gabbay, le May et al. (2003).
Sharing and promoting good practice/evidence-based practice	7	Russell, Greenhalgh et al. (2004), Tolson, McAloon et al. (2005), Tolson, Irene et al. (2006), Tolson, Booth et al. (2008), Rossignol, Poitras et al. (2007), Taplin, Haggstrom et al. (2008), Chandler and Fry (2009).
Hospital-based or single profession (n=14)		
Change in practice / Evidence-based practice / enhancing performance / support practitioners	7	Render, Brungs et al. (2006), Huckson and Davies (2007), Wilding and Whiteford (2007), Bossen (2007), Rolls, Kowal et al. (2008), Fung-Kee-Fung, Goubanova et al. (2008), Jiwa, Deas et al. (2009).
Knowledge transfer and information exchange	4	Goodwin, Pope et al. (2005), Price and Felix (2008), Sharma (2009), Curran, Murphy et al. (2009).
Promoting of learning and innovation in clinical practice	2	Swan, Scarbrough et al. (2002), Pereles, Lockyer et al. (2002).
Teaching and learning research	1	Gieselman, Stark et al. (2000).
Systematic reviews	2	Fung-Kee-Fung, Watters et al. (2009), Li, Grimshaw et al. (2009).

Crossing geographical boundaries, a CoP enhanced exchange between academic researchers and health promotion practitioners in the context of a smoking cessation program in Canada and the United States (McDonald and Viehbeck 2007). The same year (2007) saw the use of a CoP approach to harness interdisciplinary input from physiotherapists, occupational therapists and family physicians to endorse guidelines for managing lower back pain (Rossignol, Poitras et al. 2007). Taplin and colleagues analysed the use of CoPs to improve cancer screening rates among non-insured or under-insured populations. This was a US initiative where Regional Cancer Collaboratives were established across Federally Qualified Health Centres (FQHCs) that deliver services to populations with lower rates of cancer screening and with a disproportionately high cancer burden. As one of many strategies to improve screening rates, these FQHCs were encouraged to create local CoPs (LCoPs) that were linked to regional

CoPs (RCoPs) (Taplin, Haggstrom et al. 2008). In Wales, Chandler and Fry (2009) explored the potential for CoPs to cross professional and organisational boundaries and to act as a mechanism for sharing and spreading good practice in relation to transfer of care and discharge planning. Health services included in this research included local health boards and authorities, large integrated acute care services, community and mental health trusts, and one specialist trust providing tertiary cancer care and screening services within the South East region of Wales, United Kingdom.

Of the 14 papers reporting on CoPs that were hospital-based or were limited to a single profession, half (n=7) focused specifically on supporting practitioners to change practice, to implement evidence based practice or to enhance performance (Table 2). The first of these was from the United States, where successes in implementing evidence-based patient safety practices to achieve a reduction in surgical site infections were attributed in part to the development of a CoP (Render, Brungs et al. 2006). There were also four Australian studies: Huckson et al. described the establishment of a CoP by the National Institute of Clinical Studies to facilitate the use of evidence in practice in emergency department settings (Huckson and Davies 2007). Wiliding and Whiteford (2007) described how the CoP concept was proposed as a tool within a participatory action research project with a group of occupational therapists in a large Australian metropolitan hospital. The objective of the CoP and of the research was to provide a supportive environment to the practitioners to help them reflect on how they conceptualise and describe their profession, and how they define their unique contribution to patient care within a biomedically-dominated institutional context. The following year, Rolls et al. reported on the establishment of an email Listserv providing support to nurses working in intensive care units and rural critical care units in New South Wales (Rolls, Kowal et al. 2008). The email Listserv helped create a CoP to facilitate exchange of knowledge. A Western Australian study published in 2009 and focusing again on a single profession, reported on the establishment of a CoP of general practitioners (GPs) in rural and metropolitan areas working towards improving the quality of referral letters written by GPs to specialist clinics (Jiwa, Deas et al. 2009).

The sole study from Denmark identified by our search was published in 2007, in which a CoP was used as a tool to achieve the organisational change required to make the implementation of an electronic medication plan system effective (Bossen 2007). In Canada, the CoP model was used as an implementation strategy to facilitate quality improvement in cancer care (Fung-Kee-Fung, Goubanova et al. 2008).

Focusing specifically on the nurses and doctors in anaesthetics teams in two hospital trusts in the UK, the concept of legitimate peripheral participation that underpins a CoP was used to explore how boundaries around practice are created and sustained (Goodwin, Pope et al. 2005). Also focusing on anaesthetists, this time in the North-West region of England, Sharma and colleagues (2006) examined the establishment of a CoP by 10 anaesthetists from five departments of anaesthesia to ensure user contribution to the design and development of an online incident reporting system that would support the sharing of information between practitioners.

Curran (2009) explored the potential of virtual CoPs to facilitate knowledge exchange and transfer between practitioners in geographically dispersed emergency departments in rural and urban locations

in Canada. Another hospital-based study reported on applying CoP concepts to structure Continuing Medical Education (CME) accredited journal clubs and case conferences with the aim of improving quality and implementing evidence-based practice among physicians working in six specialist medical departments providing care for members of the Colorado Permanente Medical Group in USA (Price and Felix 2008).

The CoP model has also been applied in the UK to deliver and teach an innovative treatment procedure for the management of cancer (Swan, Scarbrough et al. 2002). Canadian researchers studied a small group of physicians to help fill a gap in knowledge about how permanent small groups work, how they learn and change, and to describe their role in knowledge creation (Pereles, Lockyer et al. 2002). The situated learning model of a CoP has also been applied in the USA to promote research development among nurses who have little research experience (Gieselman, Stark et al. 2000).

Two systematic reviews of literature on CoPs were published in 2009; both by Canadian researchers (Fung-Kee-Fung, Watters et al. 2009; Li, Grimshaw et al. 2009). The first of these reviews was published in April 2009 and focused specifically on collaborative initiatives relevant to clinical surgery (Fung-Kee-Fung, Watters et al. 2009). Interestingly, despite the objective of this study being to "further inform and promote the concept of communities of practice and regional collaboration models in cancer surgery," (p566) CoP was not a term used to search the literature. Instead, the authors used terms representing characteristics of CoPs and collaborations such as partnerships, collaborations, cooperation, delivery of integrated care, benchmarking, inter-professional relations, process improvement, and quality control (p566).

The second systematic review was published in May 2009 with a focus on CoPs in the health and business sectors (Li, Grimshaw et al. 2009). The authors first examined how CoPs were defined in these two sectors and then went on to examine how CoPs in the health sector have been evaluated. The authors found that the literature on CoPs in the health sector is largely descriptive and qualitative, and given that no studies met their quantitative criteria, they concluded that the effectiveness of CoPs in the health sector was unclear.

4.4 Origin – created or spontaneous

Twenty one of the reviewed papers studied CoPs which had been artificially created for a specific purpose (Lathlean and le May 2002; Swan, Scarbrough et al. 2002; Gabbay, le May et al. 2003; Russell, Greenhalgh et al. 2004; Wild, Richmond et al. 2004; Kelly, Tolson et al. 2005; Render, Brungs et al. 2006; Sharma, Smith et al. 2006; Huckson and Davies 2007; Milne and Lalonde 2007; McDonald and Viehbeck 2007; Rossignol, Poitras et al. 2007; Rolls, Kowal et al. 2008; Bossen 2007; Fung-Kee-Fung, Goubanova et al. 2008; Taplin, Haggstrom et al. 2008; Tolson, Booth et al. 2008; Chandler and Fry 2009; Curran, Murphy et al. 2009; Jiwa, Deas et al. 2009). From information contained in the papers, these CoPs were free of organisational hierarchy and were mostly introduced as a strategy to support knowledge creation and sharing or as a change implementation tool. The absence of an organisational hierarchy within a CoP would see management playing more of facilitation as contrasted with a supervisory role.

Other research groups have used the CoP concept to examine existing groups of individuals not formally identified by the organisations or individuals concerned as CoPs. For example, Wilson (1999) surveyed staff working in 10 healthcare organisations. There is no indication that the group was formally known as a CoP; instead, the authors interviewed junior and senior clinicians working in the organisations in order to explore the process by which novice clinicians become experts and thereby become part of a CoP. In another example, a small group of physicians that met regularly were identified as having the potential to form a CoP (Pereles, Lockyer et al. 2002). Similarly, based on ethnographic observation and interviewing of clinicians from two GP practices, authors concluded that clinicians learn by acquiring knowledge from trusted sources through informal interaction individually or as part of a community of practice (Gabbay and le May 2004). The CoP concept has also been applied to CME accredited journal clubs and case studies that provide an environment to discuss new learning, leading to improved clinical practice (Price and Felix 2008). Even though not formally recognised as CoPs, the groups of people researched in these studies are members of spontaneously developed CoPs.

There was one study demonstrating the spontaneous emergence of a CoP following a 24-week long clinical leadership training program, where a follow-up survey identified that participants had formed a CoP communicating with each other regularly using "each other as sounding boards for ideas and dilemmas which they are faced with" (Sutherland and Dodd 2008). In another study, developing networks and exploring the creation of CoPs were anticipated outcomes of the bringing together of knowledge and stakeholder groups with an interest in Web Assisted Tobacco Intervention programs (Norman and Huerta 2006). At follow-up, the groups had moved to the coalescence stage of a CoP. These studies demonstrate the potential for CoPs to emerge from bringing together a group of people with a shared interest.

Gieselman et al. (2000) applied the situated model to design and implement a multifaceted workshop to help nurses understand, develop and critique research. This workshop "gave them (the nurses) legitimate access to a research community of practice in which they could participate alongside expert facilitators in small group work" (Gieselman, Stark et al. 2000, p266). While participants had expressed interest in creating an email group, there was no indication of any follow-up to ascertain whether such a group was created.

4.1 Means of communication and exchange of information/knowledge

The lack of consistency in reporting made it difficult to differentiate the various methods used by members of CoPs to communicate and interact. Based on information provided in the papers, face-to-face communication was the most popular method; 10 papers reported the use of face-to-face communication within the usual workplace with a further three also using face-to-face methods but external to their usual place of work (see Table 3)**.** In CoPs where members interacted using face-to-face methods, but external to the usual workplace, interaction was through participation in a multifaceted workshop that was designed to simulate situated learning (Gieselman, Stark et al. 2000); or the regular meetings of multiagency and/or multi-professional CoPs (Lathlean and le May 2002) (Gabbay, le May et

al. 2003). While these papers make particular reference to face-to-face means of interaction, it is not possible to know whether other means of communication (such as email) were used as well.

Table 3: Means of communication used by members of communities of practice in the health sector

MEANS OF COMMUNICATION	NUMBER OF STUDIES	AUTHORS
Face-to-face within usual workplace	10	Wilson and Pirrie (1999), Pereles, Lockyer et al. (2002), Swan, Scarbrough et al. (2002), Gabbay and le May (2004), Goodwin, Pope et al. (2005), Render, Brungs et al. (2006), Bossen (2007), Milne and Lalonde (2007), Wilding and Whiteford (2007), Price and Felix (2008).
Face-to-face external to usual workplace	3	Gieselman, Stark et al. (2000), Lathlean and le May (2002), Gabbay, le May et al. (2003).
Virtual	6	Russell, Greenhalgh et al. (2004), Tolson, Booth et al. (2008), Sharma (2009), Rolls, Kowal et al. (2008), Curran, Murphy et al. (2009), Jiwa, Deas et al. (2009).
Combination of methods	11	Wild, Richmond et al. (2004), Kelly, Tolson et al. (2005), Tolson, McAloon, et al. (2005), McDonald and Viehbeck (2007), Rossignol, Poitras et al. (2007), Fung-Kee-Fung, Goubanova et al. (2008), Fung-Kee-Fung, Goubanova et al. (2008), Taplin, Haggstrom et al. (2008), Chandler and Fry (2009), Rossignol, Poitras et al. (2007), Huckson and Davies (2007).
Face-to-face but likely to continue as virtual	2	Norman and Huerta (2006), Sutherland and Dodd (2008).
Systematic reviews	2	Fung-Kee-Fung, Watters et al. (2009), Li, Grimshaw et al. (2009)

Six of the 30 papers reviewed (excluding the two systematic reviews) reported on CoPs that depended totally on virtual methods of communication. In the UK NHS, an informal email network was used to facilitate interaction across professions and organisations and to remove the barriers between researchers and practitioners (Russell, Greenhalgh et al. 2004). These authors concluded that this virtual network enabled knowledge for evidence-based healthcare to be personalised and meaningful. Also in the UK, a web-based system was established to help anaesthetists anonymously submit and receive feedback on incidents (Sharma, Smith et al. 2006); and to effectively promote evidence-based practice among nurses (Tolson, Booth et al. 2008). In Australia, virtual means of communication have suited CoPs attempting to address professional isolation that occur due to vast geographical distances. For example, an email Listserv was established to reduce professional isolation experienced by nursing staff working in small intensive care units in New South Wales (Rolls, Kowal et al. 2008). In Nova Scotia, Canada, a web-based learning project was introduced to address the isolation and knowledge needs of emergency department clinicians disadvantaged in terms of access to information and knowledge (Curran, Murphy et al. 2009). In Western Australia, a CoP of general practitioners (GPs) in rural and metropolitan settings reported limited success in “achieving and sustaining membership of a CoP” (Jiwa,

Deas et al. 2009). The objective was to improve the quality of referral letters written by GPs to specialists. Referral letters were rated using benchmarks set by members of the CoP and feedback on quality ratings was provided to the respective GPs. It is not clear whether there was any communication between the CoP participants.

Of the 30 individual research papers reviewed, 11 papers reported using a combination of methods (such as seminars, workshops, newsletters, teleconferences, web-based programs, email lists) for members to communicate and interact with each other. For example, a CoP established to integrate early child health information systems met for face-to-face discussions and also had site visits to members' organisations. In between meetings, members communicated by teleconference, and also via a List-serve and a dedicated interactive website (Wild, Richmond et al. 2004). The subject of two papers, the CoP of nursing practitioners and researchers working on the description of gerontological nursing met face-to-face on four occasions over a period of 14 months, but much of the communication, learning and development activities occurred via a virtual practice development college (Kelly, Tolson et al. 2005; Tolson, McAloon, et al. 2005). A CoP established to enhance the exchange of information between researchers and practitioners working on smoking cessation programs utilised web-based seminars, teleconferences, occasional face-to-face seminars, electronic newsletters and targeted emails (McDonald and Viehbeck 2007). Another example of a CoP used to ensure interdisciplinary input into the development and endorsement of clinical guidelines on low back pain also used a combination of methods; a survey of the members of the CoP revealed that the online discussion forums were the most often used, while the symposia and the anonymous questionnaires were the least used methods of communication (Rossignol, Poitras et al. 2007).

A combination of face-to-face and virtual methods was also used by members of the CoP established to facilitate quality improvement in cancer surgery (Fung-Kee-Fung, Goubanova et al. 2008) and to improve cancer screening rates among those at high risk (Taplin, Haggstrom et al. 2008). A multi-organisational CoP established as a mechanism to share and spread good practice in discharge planning used half day workshops bringing together all members of the CoP on a bimonthly basis (Chandler and Fry 2009). This CoP had requested an online forum be established, but this was found to be the least used mode of communication within the CoP. Reporting on a CoP established to ensure interdisciplinary input into all processes leading to the endorsement of clinical guidelines, the authors state that the recommendations (for the guidelines) were submitted to members of the CoP via "postal mail, email and website simultaneously" and that "two web-based communication mechanisms were offered to the participants" (Rossignol, Poitras et al. 2007). It is not clear however whether the means of communication and interaction were limited to these methods.

The study by Norman and Huerta is illuminating in this regard as it describes the creation of a CoP following a face-to-face meeting of individuals with a common interest. This initial meeting was identified as the first phase of developing a CoP – labelled the 'Potential' phase (Norman and Huerta 2006). While this first interaction was not virtual, the authors identify that "the group seems poised to move forward into the *Maturing* stage" (p8 of 11), and a virtual CoP is suggested as a potential solution to the geographical spread (p9). A similar situation is evident in the emergence of a CoP following attendance at a leadership training course in the UK (Sutherland and Dodd 2008). The authors do not

provide sufficient information to determine whether the resulting CoP was virtual even though this is suggested in their statement: "...where it is suggested that staff undertaking this training became a CoP on the basis that the graduates professed to regular communication and using each other as sounding boards for exchange of ideas and problem solving" (Sutherland and Dodd 2008 p580).

Methods used were not clear in some studies. For example, in the paper by Huckson et al. (2007) describing the establishment of a CoP to improve the uptake of evidence-based practice in emergency departments, the methods used to share and exchange information are not clearly stated. It is however known to the authors of this literature review that this CoP utilises a combination of methods including a newsletter, website and blog, and occasional face-to-face events to assist the exchange of information and knowledge (personal communication).

While there is insufficient information in the papers reviewed to assess the suitability and impact of the various communication methods, given the variations in purpose and composition of CoPs and the geographical diversity of the groups, it is likely that the methods of communication and interaction would be dependent on the objective and on the characteristics of the group. The following statement by Chandler and Fry (2009: p45) may suggest that the level of maturity of the CoP is also an important determinant of the optimal method of communication: "This would support the findings of the literature that emphasise the need to allow time to build personal relationships based on face-to-face interaction, before being able to move towards more virtual communication methods."

4.2 Study design

Consistent with the findings in the systematic review by Li et al., the present review found that all research published on CoPs in the health sector up to and including the year 2005 was qualitative (see Table 4). In 2006, the first quantitative paper on CoPs was published. This research used mixed methods, applying evaluation and social network methodologies to examine CoPs and to help inform the decisions about organising a geographically dispersed multi-professional CoP (Norman and Huerta 2006). This was the only empirical research on CoPs that was extracted by our search that applied social network analysis methods to map and examine the relationship, reciprocal and trans-sectoral networks of a CoP.

A second quantitative paper was published the same year. This was an intervention trial that reports on the implementation of evidence-based practice to reduce catheter-related blood stream infections (CR-BSI) (Render, Brungs et al. 2006). The paper presents findings from a component of a larger randomised controlled trial where a part of the trial was to test the implementation of evidence based patient safety practices that reduced surgical site infections. The randomisation determined whether the intervention was to begin in the operating room or in the intensive care unit (ICU). The outcome measure compared between the intervention and control ICUs, the number of CR-BSI in 2004 (the study period) as a proportion of CR-BSI reported the year before (2003). CoPs were established to assist with the implementation process.

Qualitative studies continued to be published describing the establishment of CoPs or presenting findings from CoP member surveys and semi-structured interviews (Table 4). The year 2007 saw another quantitative paper from Canada presenting findings from an intervention trial to manage obstetrics risks. The intervention was a collaborative program that was built on systems error theory, team function and CoPs in the workplace with the objective of changing the culture from that of blame to one focussed on patient safety (Milne and Lalonde 2007). Pre- and post-intervention measures demonstrated an increase in clinical core knowledge and liability claims over a three-year follow-up period, with the development and annual operating costs of the program recovered by the end of the three-years. Three other intervention trials followed with outcomes being measured objectively (Tolson, Booth et al. 2008; Taplin, Haggstrom et al. 2008; Jiwa, Deas et al. 2009). These studies have been reviewed in more detail in the next section of the report and in Table 5.

Table 4: Research methods used to study communities of practice in the health sector, by chronological order

AUTHOR, YEAR	RESEARCH METHOD	OUCOME/EFFECT MEASURE				
			Ethnography	Focus groups	Self-reported (interviews/ surveys)	Document review
Wilson and Pirrie (1999)	Qualitative		Observations		Yes - in-depth interviews	
Gieselman, Stark et al. (2000)	Qualitative intervention study. intervention = multifaceted workshop				Yes – feedback from participants	
Lathlean and le May (2002)	Qualitative - action research				Yes - interviews	
Pereles, Lockyer et al. (2002)	Qualitative				Yes - interviews	
Swan, Scarbrough et al. (2002)	Qualitative - case study				Yes – interviews with managers pivotal in mobilising the innovation, and sales representatives	
Gabbay, le May et al. (2003)	Qualitative – case study		Observations		Yes – interviews	Review of CoP notes and outputs

AUTHOR, YEAR	RESEARCH METHOD	OUCOME/EFFECT MEASURE				
			Ethnography	Focus groups	Self-reported (interviews/ surveys)	Document review
Gabbay and le May (2004)	Qualitative		Yes (non-participant observation)		Yes - semi-structured formal and informal interviews	Document review
Russell, Greenhalgh et al. (2004)	Qualitative – case study				Yes - interviews	Tracking of email messages
Wild, Richmond et al. (2004)	Qualitative – case study				Yes – individual and group interviews and web-based survey	
Goodwin, Pope et al. (2005)	Qualitative		Yes			
Kelly, Tolson et al. (2005)	Qualitative – action research					Review of online discussions
Tolson, McAloon et al. (2005)	Qualitative - descriptive				Yes - semi-structured telephone interviews	
Norman and Huerta (2006)	Mixed methods including network mapping. Case study	Perceived impact of meeting on (WATI)[†] knowledge			Yes - survey	

AUTHOR, YEAR	RESEARCH METHOD	OUCOME/EFFECT MEASURE				
			Ethnography	Focus groups	Self-reported (interviews/ surveys)	Document review
Render, Brungs et al. (2006)	RCT (implementation of evidence-based practice)	i) Process adherence ii) CS-BRI rates/1000 line dates‡				
Sharma, Smith et al. (2006)	Qualitative - descriptive		Yes – observations of audit meetings and anaesthetic practice		Yes – semi-structured interviews	
Huckson and Davies (2007)	Qualitative – case study					
McDonald and Viehbeck (2007)	Qualitative – case study					
Rossignol, Poitras et al. (2007)	Qualitative				Yes - on-line survey	
Bossen (2007)	Qualitative – case study		Observation		Yes - semi-structured interviews	

AUTHOR, YEAR	RESEARCH METHOD	OUCOME/EFFECT MEASURE				
			Ethnography	Focus groups	Self-reported (interviews/ surveys)	Document review
Milne and Lalonde (2007)	Intervention trial (Managing Obstetrics Risk Efficiently program)	Number of liability claims				
Wilding and Whiteford (2007)	Qualitative – action research				Yes – in-depth interviews	
Rolls, Kowal et al. (2008)	Qualitative – case study				Yes - survey	
Price and Felix (2008)	Descriptive case-study (applying CoP concept to CME accredited journal clubs and case studies)	Implementation of learnings from previous session			Yes – uncertain whether survey or interview	
Tolson, Booth et al. (2008)	Prospective intervention study	Pre- and post-intervention facility and patient audits		Yes		
Fung-Kee-Fung, Goubanova et al. (2008)	Qualitative – descriptive					
Taplin, Haggstrom et al. (2008)	Intervention trial (regional collaborative to implement a learning module)	Cancer screening rates				

AUTHOR, YEAR	RESEARCH METHOD	OUCOME/EFFECT MEASURE				
			Ethnography	Focus groups	Self-reported (interviews/ surveys)	Document review
Sutherland and Dodd (2008)	Qualitative - descriptive			Yes	Yes – self-completing questionnaire and in-depth interviews.	
Chandler and Fry (2009)	Qualitative – descriptive				Yes - survey	
Curran, Murphy et al. (2009)	Qualitative - descriptive				Yes - survey	Content analysis of on-line discussion boards
Jiwa, Deas et al. (2009)	Intervention trial (CoP of GPs)	Scoring quality of referral letters		-		
Li, Grimshaw et al. (2009)	Systematic review	Evaluation of effectiveness of CoPs				
Fung-Kee-Fung, Watters et al. (2009)	Systematic review	Identifying regional collaborations in surgical practice examining practices related to quality improvement.				

† WATI = Web assisted tobacco interventions.

‡ CR-BSI = Catheter related-Blood Stream Infections

4.3 Assessment of Effectiveness

One of the objectives of the systematic review published by Li et al (2009) was "to evaluate the evidence of effectiveness on the health sector CoPs for improving the uptake of best practices and mentoring new practitioners." They identified and reviewed in detail 13 papers reporting primary studies in the health sector. Due to the different search strategies that included different databases and search terms, and also due to the significant increase in peer-reviewed publications on CoP since 2005 (the end of the review period for the Li paper) (see Figure 4), only five of the 30 independent studies identified by our search were included in the Li review (Pereles, Lockyer et al. 2002; Lathlean and le May 2002; Gabbay, le May et al. 2003; Wild, Richmond et al. 2004; Tolson, McAloon et al. 2005). Our search identified a further five papers that had been published between 1999 and 2005 (Wilson and Pirrie 1999; Gieselman, Stark et al. 2000; Swan, Scarbrough et al. 2002; Russell, Greenhalgh et al. 2004; Goodwin, Pope et al. 2005: Kelly, Tolson et al. 2005), demonstrating the effect of the different search strategies used in the two reviews.

One of Li et al.'s main findings was that CoPs in the health sector tended to "focus mainly on fostering social interactions at the workplace or during task oriented activities (e.g. journal clubs)"(Li, Grimshaw et al. 2009). They also highlighted the fact that in common with CoPs from the business sector, CoPs in the health sector demonstrated (to a varying degree) a role in knowledge creation and sharing and building professional identity. However, when it came to examining the effectiveness of CoPs in the health sector, they stated that:

> *"...there was a lack of empirical research that examined if CoP groups indeed improved the uptake of best practices in the health sector."* (Li et al., 2009, page 16)

As identified in section 4.2, the current review identified a significant increase in publications on CoPs in the healthcare sector since 2005. Despite this, there remains no conclusive evidence demonstrating the impact of CoPs on improving the effectiveness or efficiency of healthcare. The published research continues to consist predominantly of qualitative research presenting case studies. Studies that examine effectiveness do so by presenting the findings from ethnographic observations, interviews and survey of members (Norman and Huerta 2006; Wilson and Pirrie 1999), and by content analysis of emails, discussion forums and reports.

More recent research studies have attempted to use quantitative methods to objectively assess effectiveness of CoPs on changing practice in the health sector (see Table 5). In the USA, a 50 per cent reduction in catheter-related blood stream infections was demonstrated following an intervention to implement evidence-based practice. The success of this intervention across nine health care systems and 10 hospitals has been attributed to the direct involvement of the hospital leadership (within each hospital) in marketing and promoting the intervention and the development of local CoPs (Render, Brungs et al. 2006). As with most complex interventions in the health sector, the intervention was multifaceted and it is not possible to differentiate the effects of the CoP being established from the effects of other components of the intervention (such as the presentation of evidence for practice by

experts at the start of the intervention program or the drawing up of a 90 goal and action plan.) Another example where a quantitative measure has been used to demonstrate impact is from Canada where a program based on the principles of "effective team function and communities of practice as cornerstones to enhance performance and the promotion of a patient safety culture", was used to manage obstetrics risks efficiently (Milne and Lalonde 2007, page 567). This study demonstrated a reduction in the number of liability claims across 28 participating hospitals that are covered by one insurance company in Canada. The intervention (Managing Obstetric Risk Efficiently or MORE program) was multifaceted and involved more than forming or belonging to a CoP; it also comprised evaluation (including a self assessment pre- and post-test), participation in formal education activities (delivered through an interactive online session and a second face-to-face workshop), practice modification (through the introduction of tools to assist in decision making), and reflective learning (that involved event tracking and review of events). The implementation at each of the 28 hospitals was led by a core inter-professional team, and the authors state that "the leadership provided by the members of the core team is pivotal for the successful implementation of the $MORE_{OB}$ program" (Milne and Lalonde 2007, page 570). Given the multifaceted nature of the intervention program, it is not possible to attribute directly the outcomes to the CoP component of the program, however, given that there were multiple teams at each site and the final result was achieved through changed practice in teams other than just the lead teams, it may be feasible to attribute some component of the success to CoP principles that occur in such championing situations.

Taplin and colleagues (2008) report on a study from the USA that used regional collaborative initiatives to implement a learning module with the objective of improving cancer screening rates. This study reports improved implementation of process and some success in increasing one of the three cancer screening rates examined (see Table 5). A study conducted in Western Australia reported a significant increase in the quality of letters (scored using benchmarks set by members of the CoP) written by GPs following the establishment of a CoP (Jiwa, Deas et al. 2009). Even though a significant improvement in scores was reported, the effectiveness of this study is questionable given the difficulty experienced in sustaining the CoP and the high drop-out rate with only five of the original 15 members submitting pre- and post-intervention letters for scoring.

The following studies attempted to demonstrate impact through quantifiable measurements, but as they are based on members of the CoP self-reporting measures and are therefore subjective, these studies are not included in Table 5. In an attempt to quantify change resulting from applying the CoP principles to structure CME accredited journal clubs and case series, CoP facilitators ascertained at the start of each session which learnings from the previous session had been implemented in practice (Price and Felix 2008). It is not clear from this paper whether the information was acquired through an anonymous survey instrument administered individually, or verbally in the group setting. It is also important to note that at the end of each session "facilitators solicited key concepts and learnings" (Price and Felix 2008). Using the learnings ascertained at the beginning of each session, the authors report 200 learnings, which were then categorised into 10 categories (information, diagnosis, screening, treatment, treatment-medicine, quality improvement, safety, communication, documentation, and patient education). Fifty-five percent of these learnings were self-reported by members as

implemented. In another study, the Caledonian Development Model was introduced to promote evidence-based practice (Tolson, Booth et al. 2008). One feature of the model was establishing a CoP.

Four of the seven research papers included in the systematic review specific to regional collaborations in surgical practice (Fung-Kee-Fung, Watters et al. 2009) assessed effectiveness through process indicators such as compliance with evidence-based care processes, establishment of a database as a process to assist clinicians be proactive in improving clinical care, compliance with program standards, and by measuring attitude change in clinicians. One study examined changed mortality rates, and two studies reported changed clinical practice by demonstrating such changes in line with regional guidelines observed over a one-year period, and changes in medication prescription at two year follow-up. As these studies were reported as collaborative initiatives and not CoPs, they were not extracted by our search strategy.

Table 5: Quantitative studies assessing impact of communities of practice on changing practice in the health sector

AUTHOR	INTERVENTION	OUTCOME	FINDINGS
Render, Brungs et al. (2006)	Project leaders and teams were established to implement evidence-based practice to reduce central line infections.	Adherence to evidence-based process indicators. Catheter-related blood stream infections (CR BSI).	Process adherence increased from 0% to 85%. CR BSI dropped by more than 50% (from 1.7 to 0.4 per 1000 line days, $p<0.05$).
Milne and Lalonde (2007)	Managing Obstetric Risk Efficiently (MORE) program.	Core clinical knowledge assessment. Culture change assessed using a culture change assessment tool. Frequency of liability claims and liability carrier (hospital) incurred costs.	Clinical core knowledge increased significantly demonstrated by increase in test scores following completion of training modules. Improvement in the six elements - empowering people, learning, open communication, patient safety, teamwork, valuing individuals – was demonstrated using a culture change assessment tool developed for the program. In all of 28 hospitals that provided data, the frequency of liability claims dropped, and liability carrier (hospital) costs showed a reduction trend compared to pre- MORE program. This is in contrast to all other health care services which showed a trend towards increase in costs.
Taplin, Haggstrom et al. (2008)	Establish regional cancer collaborative that implemented a regional approach to learning. Care process leaders worked with teams to plan and implement practice change. Regional CoPs were established as a forum for sharing ideas, identifying resources, and encouraging action. Establishment of regional and local CoPs was encouraged.	Process evaluation of implementation activities. Breast, cervical and colon cancer screening rates	Some processes were more difficult to get implemented than other, and implementation was easier at some and not other sites. Three of the four participating organisations implemented local CoPs. Screening documentation increased with all four cancers. Colon cancer screening rates increased from 8.6% to 21.2%. This increase was seen in 3 of the 4 sites (the 4th showed a drop). Authors concluded that improvements may be achieved in carefully selected organisations.

AUTHOR	INTERVENTION	OUTCOME	FINDINGS
Jiwa, Deas et al. (2009)	Establish a CoP to address standards in general practice, focussing specifically on quality of referral letters	Scoring of the quality of letters written by GPs, using benchmarks established by members of the CoP. History and examination findings were identified as being necessary components of a referral letter.	Only five of the 15 recruited GPs completed the study, and 102 referral letters were submitted by these 5 GPs. Statistical significant improvements in scores were reported from the scoring of the history and examinations components in the referral letters.

5. SUSTAINABILITY OF EFFECT

None of the research identified in this review addressed sustainability of the change in practice towards improving the effectiveness of healthcare. Demonstrating long-term sustainability requires longitudinal follow-up. When planning the implementation of CoPs, it is important that researchers and service providers recognise the need to set in place processes that will allow the long-term effects to be assessed.

6. DISCUSSION

The number of empirical research papers on CoPs in the health sector being published in peer-reviewed journals is increasing. Researchers are moving beyond describing the establishment of CoPs to attempting to examine the effectiveness of CoPs on knowledge sharing and learning. These early attempts are limited to interviewing or surveying members of the CoP to assess the value to the individual and do not demonstrate the impact at an organisational level. The exception is the research from Canada where the effect of an obstetric risk management program has been linked at an organisational level to a decrease in liability claims and liability career incurred costs, and at an individual level to increased core clinical knowledge and changed culture (Milne and Lalonde 2007). However, given the multifaceted nature of the intervention program, the capacity to link the achieved change to a CoP is limited.

No single CoP model is being adopted in the healthcare sector. The structure and delivery of CoPs depend on the intended purpose, underscoring that one model does not fit all contexts. This finding is important in that it indicates the need to understand what it is about CoPs, and the elements of the context in which they emerge or are established, that makes them successful in changing practice. A related question is how is it that CoPs achieve these changes? Understanding CoPs in this manner requires conceptualising them as more than a conglomeration of characteristics (such as community, domains and practice). It is necessary to dig deeper and identify contextual factors, including enablers and barriers that determine success in changing practice. For example, while some of the studies reviewed here made reference to the key role of a CoP facilitator in ensuring success, it was not a feature that was reported on consistently by researchers.

As a consequence of the inconsistency in the reporting and evaluation of CoPs in the healthcare sector, the evidence for the effectiveness of CoPs in improving the effectiveness and efficiency of healthcare is not conclusive. Investing further in CoPs at a time of economic constraint and promoting the use of CoPs in the healthcare sector as a tool to improve organisational performance requires persuasive evidence of its value. Obtaining this evidence requires a systematic approach to evaluation (Braithwaite, Westbrook et al. 2009).

7. CONCLUSION

Overall, there is not sufficient information in the peer-reviewed literature to determine the role of CoPs in improving organisational value and capability beyond immediate benefits to members of the CoP. While empirical research on CoPs in the healthcare sector is increasing, there is a need to adopt a systematic approach to examining the impact of effectiveness of CoPs in terms of changing practice to make healthcare more effective. Developing such a system requires understanding more about CoPs, focussing particularly on identifying structural and functional aspects that determine level of success. Building on a statement made by researchers testing the impact of CoPs on increasing cancer screening rates**,** "More evaluation is needed to understand what aspects of the collaborative approach contribute to the success and why success is not universal" (Taplin, Haggstrom et al. 2008), we conclude that there is a need to systematically evaluate CoPs; and a framework is required to assist this process.

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Gieselman, J. A., N. Stark, et al. (2000). "Implications of the situated learning model for teaching and learning nursing research." Journal of Continuing Education in Nursing **31**(6): 263-268; quiz 284-265.

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APPENDIX 1: ABSTRACTS OF PAPERS REVIEWED IN DETAIL

Bossen, C. (2007). Test the artefact-Develop the organization. *International Journal of Medical Informatics* 76(1): 13-21. Objective and methods: The paper aims to develop further insights into the process of implementation of IT in health care by describing findings from a study of a trial implementation of a newly developed electronic medication plan (EMP) in three hospitals in a county in Denmark. A sociotechnical perspective is applied to data acquired by the qualitative methods of participant observation and semi-structured open-ended interviews. Conclusions: The achievement of fit between IT technology and work processes in health care involves the establishment of new organizational structures that cut across the existing divisionalized hospital organization and a detailed alignment of artefact, functionality and work process. This process can be furthered by supporting 'communities of practice', i.e. informal groups of engaged clinicians. A sociotechnical perspective is beneficial to the analysis of such processes.

Chandler, L. and Fry, A. (2009). Can communities of practice make a meaningful contribution to sustainable service improvement in health and social care? *Journal of Integrated Care* 17(2): 41-48. A Community of Practice (CoP) on discharge planning was established in South East Wales to test whether it could support sustainable service improvement. We describe the methodology, and report on its piloting and the lessons learnt. A member survey produced positive feedback, but the response rate was low and contained no data on improvements generated.

Curran, J. A., Murphy, A. L., Abidi, S. S., Sinclair, D. and McGrath, P. J. (2009). Bridging the gap: knowledge seeking and sharing in a virtual community of emergency practice. *Evaluation & the Health Professions* 32(3): 314-327. Disparities exist between rural and urban emergency departments with respect to knowledge resources such as online journals and clinical specialists. As knowledge is a critical element in the delivery of quality care, a web-based learning project was proposed to address the knowledge needs of emergency clinicians. One objective of this project was to evaluate the effectiveness of the online environment for knowledge exchange among rural and urban emergency clinicians. Descriptive and content analysis of the online discussion board revealed 202 postings with rural participants contributing the largest number of postings (75%; 152/202). Postings were used to establish a clinical presence (87/202), seek clinical information (52/202), and share clinical information (63/202). Postintervention survey results indicate that this modality introduced participants to new clinical experts and resources. The results provide direction for design of a virtual community of practice, which may reduce current knowledge resource disparities.

Fung-Kee-Fung, M., Goubanova, E., Sequeira, K., Abdulla, A., Cook, R., Crossley, C., Langer, B., Smith, A. J. and Stern, H. (2008). Development of communities of practice to facilitate quality improvement initiatives in surgical oncology. *Quality Management in Health Care* 17(2): 174-185. BACKGROUND: The process of developing clinical guidelines and standards for cancer treatment and screening is well established in the Ontario health care system; however, the dissemination and implementation of such guidelines and standards are more recent undertakings. Traditional implementation strategies to improve surgical practice and the delivery of cancer care have not been consistently effective. There is a recognized need to develop integrated models that offer direct support for implementation strategies. Such a model should be feasible, adaptable, and open to evaluation across diverse surgical settings. DISCUSSION: Research suggests that successful implementation should consider tools and expertise from other disciplines. This article considers a community of practice (COP) model to provide a supportive infrastructure for quality improvements in cancer surgery. The COP model was adapted for cancer surgeons. It is supported by 5 enablers referred to as tools: communication system, project

development support, access to data, access to evidence review, and accreditation with continued medical education and continued professional development. These tools need to be part of an infrastructure that is both provided and supported by a team of administrators and health care professionals, who have active roles and responsibilities. Therefore, the primary objective of this article is to describe our COP model in cancer surgery including the key success factors necessary for providing the infrastructure and tools. The secondary objective is to offer the integrated COP model as a basis for future research and the evaluation of various collaborative improvement projects. SUMMARY: Building on knowledge management concepts, we identified the 4 essential processes that should be targeted by implementation strategies. A common COP evaluation framework uses the outcomes of 4 knowledge conversion modes-organizational memory, social capital, innovation, and knowledge transfer-as proxies for actual provider and organizational behavior. Insights from different collaborative improvement projects described in a consistent way could inform future research and assist in the collation of systematic reviews on this topic.

Gabbay, J. and Le May, A. (2004). Evidence based guidelines or collectively constructed "mindlines? " Ethnographic study of knowledge management in primary care. *British Medical Journal* 329(7473): 1013-1016. Objective: To explore in depth how primary care clinicians (general practitioners and practice nurses) derive their individual and collective healthcare decisions. Design: Ethnographic study using standard methods (non-participant observation, semistructured interviews, and documentary review) over two years to collect data, which were analysed thematically. Setting: Two general practices, one in the south of England and the other in the north of England. Participants: Nine doctors, three nurses, one phlebotomist, and associated medical staff in one practice provided the initial data; the emerging model was checked for transferability with general practitioners in the second practice. Results: Clinicians rarely accessed and used explicit evidence from research or other sources directly, but relied on "mindlines" - collectively reinforced, internalised, tacit guidelines. These were informed by brief reading but mainly by their own and their colleagues' experience, their interactions with each other and with opinion leaders, patients, and pharmaceutical representatives, and other sources of largely tacit knowledge. Mediated by organisational demands and constraints, mindlines were iteratively negotiated with a variety of key actors, often through a range of informal interactions in fluid "communities of practice," resulting in socially constructed "knowledge in practice." Conclusions: These findings highlight the potential advantage of exploiting existing formal and informal networking as a key to conveying evidence to clinicians.

Gabbay, J., le May, A., Jefferson, H., Webb, D., Lovelock, R., Powell, J. and Lathlean, J. (2003). A case study of knowledge management in multi-agency consumer-informed 'communities of practice': implications for evidence-based policy development in health and social services. *Health* 7(3): 283-310. We report a study that facilitated and evaluated two multiagency Communities of Practice (CoPs) working on improving specific aspects of health and social services for older people, and analysed how they processed and applied knowledge in formulating their views. Data collection included observing and tape-recording the CoPs, interviewing participants and reviewing documents they generated and used. All these sources were analysed to identify knowledge-related behaviours. Four themes emerged from these data: (1) the way that certain kinds of knowledge became privileged and accepted; (2) the ways in which the CoP members transformed and internalized new knowledge; (3) how the haphazard processing of the available knowledge was contingent upon the organizational features of the groups; and (4) the ways in which the changing agendas, roles and power-relations had differential effects on collective sense making. We conclude by recommending ways in which the process of evidence-based policy development in such groups may be enhanced.

Gieselman, J. A., Stark, N. and Farruggia, M. J. (2000). Implications of the situated learning model for teaching and learning nursing research. *Journal of Continuing Education in Nursing* 31(6): 263-268; quiz 284-265. Situated learning theory is gaining increased attention in the fields of human cognition and learning. The authors discuss the key researchers and basic assumptions of situated learning, and outline implications for the design and development of instruction. The authors describe how they applied the situated model to teaching and learning nursing research, an area identified as problematic for staff, administrators, and educators. They describe their personal observations and discuss feedback from participants at the workshop. The authors conclude that the situated model is useful for exposing nurses with little prior research experience to this domain of knowledge.

Goodwin, D., Pope, C., Mort, M. and Smith, A. (2005). Access, boundaries and their effects: legitimate participation in anaesthesia. *Sociology of Health & Illness* 27(6): 855-871. The distribution of work, knowledge and responsibilities in the delivery of anaesthesia has attained particular significance recently as attempts to meet the demands of the European Working Times Directive intensify existing pressures to reorganise anaesthetic services. Using Lave and Wenger's (1991) notions of 'legitimate peripheral participation' in 'communities of practice' (and Wenger 1998) to analyse ethnographic data of anaesthetic practice we illustrate how work and knowledge are currently configured, and when knowledge may legitimately be taken as the basis for action. The ability to initiate action, to prescribe healthcare interventions, we suggest, is a critical element in the organisation of anaesthetic practices and therefore central to any attempts to reshape the delivery of anaesthetic services.

Huckson, S. and Davies, J. (2007). Closing evidence to practice gaps in emergency care: the Australian experience. *Academic Emergency Medicine* 14(11): 1058-1063. The National Institute of Clinical Studies (NICS) was established in 2000 by the Australian government to improve health care by closing evidence-practice gaps. Improving emergency care through use of evidence is a priority area of work for NICS. This article describes the NICS Emergency Care Program and the current application of a "Community of Practice" to support emergency clinicians to implement best practices research. This approach combines aspects of evidence implementation science, quality improvement techniques, and knowledge management within a social network model to provide a mechanism for rapid sharing of explicit and tacit knowledge. Through the Community of Practice, the clinical community guides the priorities for the Emergency Care Program and is actively engaged in the development and implementation of initiatives.

Jiwa, M., Deas, K., Ross, J., Shaw, T., Wilcox, H. and Spilsbury, K. (2009). An inclusive approach to raising standards in general practice: working with a 'community of practice' in Western Australia. *BMC Medical Research Methodology* 9(13. BACKGROUND: In this study we explored the challenges to establishing a community of practice (CoP) to address standards in general practice. We focused on the issue of improving referral letters which are the main form of communication between general practitioners (GPs) and specialists. There is evidence to suggest that the information relayed to specialists at the time of referral could be improved. METHODS: We aimed to develop a community of practice consisting of GPs in Western Australia to improve the quality of referral letters to six specialty clinics. Three phases included: establishing the CoP, monitoring the progress of the CoP and sustaining and managing the CoP. The CoP's activity centred on referral letters to each of six selected specialties. A local measure for the quality of the referral letters was developed from a survey of participants about specific items of history and weighted for their perceived importance in the referral letter. Referral letters by participants written before and after the benchmarking exercise were scored for quality based on the standards set by the CoP. Feedback to participants regarding the 'quality' of their individual referrals was provided by a nominated member of the CoP, including a comparison of before and after

scores. RESULTS: 15 GPs were recruited. Only five GPs submitted referral letters both before and after benchmarking. The five GPs that participated in both study phases submitted a total of 102 referral letters (53 before and 49 after). There was a 26 point (95% CI 11-41) improvement in the average scores of the second set of letters after taking clustering by speciality into account, indicating the quality of referral letters improved substantially after feedback. CONCLUSION: There are many challenges to forming a CoP to focus on improving a specific issue in general practice. However we were able to demonstrate that those practitioners who participated in all aspects of the project substantially improved the quality of their referral letters. For recruitment it was important to work with a champion for the project from within the practice. The project took several months to complete therefore some GPs became disengaged. Some were very disappointed by their performance when compared to colleagues. This reaction may be an important motivation to change, however it needs to be sensitively handled if participants are not to become disillusioned or disheartened.

Kelly, T. B., Tolson, D., Schofield, I. and Booth, J. (2005). Describing gerontological nursing: an academic exercise or prerequisite for progress? *Journal of Clinical Nursing* 14 Suppl 1(13-23. AIMS AND OBJECTIVES: To develop a practitioner-led description of gerontological nursing and articulate the principles which underpin its practice. BACKGROUND: As the population ages expertise in gerontological nursing will become increasingly important. However, a complete and widely accepted delineation of the rationale, philosophy, knowledge base and special skills for gerontological nursing is yet to be developed. METHODS: As one cycle of a larger action research project informed by realistic evaluation, a representative sample of 30 Scottish nurses worked together as a Community of Practice to develop a description of gerontological nursing that would have utility in their practice and in the development of best practice care guidance. Data collection involved group interviews and records of on-line discussions. Data were analysed using content analysis. The emerging description was verified through external consultation with other nursing colleagues and older people. RESULTS: Nursing older people within Scotland was perceived as low status and participants reported that a positive reframing of gerontological nursing was needed. A description and underlying principles were developed by nurses and used as a lens to shape best practice statements. The description embraces a person-centred and enabling approach to evidenced-based gerontological nursing. CONCLUSIONS: Gerontological practice requires an accessible consensus view and description to support its development. Practising nurses developed such a view and its utility has been seen in the development of best practice statements. Relevance to clinical practice. The description and principles of gerontological nursing can be used to guide nursing practice, practice development and research.

Lathlean, J. and le May, A. (2002). Communities of practice: an opportunity for interagency working. *Journal of Clinical Nursing* 11(3): 394-398. A particular approach to collaborative interagency working is that of multiprofessional "communities of practice". Four such groups are described in the context of two action research projects, one relating to primary care and the other to outpatient services for dermatology and ENT. The facilitating features, and the challenges and the potential of working in this way, are discussed, both from the point of view of understanding how knowledge is used and valued in such groups and as a useful mechanism for the development of services that span different professional perspectives and involve consumer interests.

Li, L. C., Grimshaw, J. M., Nielsen, C., Judd, M., Coyte, P. C. and Graham, I. D. 2009. Use of communities of practice in business and health care sectors: A systematic review. *Implementation Science* 4(Background: Since being identified as a concept for understanding knowledge sharing, management, and creation, communities of practice (CoPs) have become increasingly popular within the health sector. The CoP concept has been used in the business sector for over 20 years, but the use of CoPs in the

health sector has been limited in comparison. Objectives: First, we examined how CoPs were defined and used in these two sectors. Second, we evaluated the evidence of effectiveness on the health sector CoPs for improving the uptake of best practices and mentoring new practitioners. Methods: We conducted a search of electronic databases in the business, health, and education sectors, and a hand search of key journals for primary studies on CoP groups. Our research synthesis for the first objective focused on three areas: the authors' interpretations of the CoP concept, the key characteristics of CoP groups, and the common elements of CoP groups. To examine the evidence on the effectiveness of CoPs in the health sector, we identified articles that evaluated CoPs for improving health professional performance, health care organizational performance, professional mentoring, and/or patient outcome; and used experimental, quasi-experimental, or observational designs. Results: The structure of CoP groups varied greatly, ranging from voluntary informal networks to work-supported formal education sessions, and from apprentice training to multidisciplinary, multi-site project teams. Four characteristics were identified from CoP groups: social interaction among members, knowledge sharing, knowledge creation, and identity building; however, these were not consistently present in all CoPs. There was also a lack of clarity in the responsibilities of CoP facilitators and how power dynamics should be handled within a CoP group. We did not find any paper in the health sector that met the eligibility criteria for the quantitative analysis, and so the effectiveness of CoP in this sector remained unclear. Conclusion: There is no dominant trend in how the CoP concept is operationalized in the business and health sectors; hence, it is challenging to define the parameters of CoP groups. This may be one of the reasons for the lack of studies on the effectiveness of CoPs in the health sector. In order to improve the usefulness of the CoP concept in the development of groups and teams, further research will be needed to clarify the extent to which the four characteristics of CoPs are present in the mature and emergent groups, the expectations of facilitators and other participants, and the power relationship within CoPs.

McDonald, P. W. and Viehbeck, S. (2007). From evidence-based practice making to practice-based evidence making: creating communities of (research) and practice. *Health Promotion Practice* 8(2): 140-144. Models of research translation frequently emphasize independent roles for research producers and intended users. This article describes a novel approach for enhancing exchange between researchers and practitioners. The framework is based on Wenger's notion of Communities of Practice (CoP) where knowledge is regarded as a social enterprise at the center of member interactions. Research-based practices and policies emerge when research producers and users mutually engage one another about specific health promotion problems through negotiation and by creating and sharing technical standards and other resources. CoPs are more than loose networks or task-oriented teams. They aim to create both social and intellectual capital through mutual negotiation, reciprocity, trust, and cohesion. A Consortium of Quitline Operators across North America and a Canadian project to enhance research capacity for tobacco control research serve as examples of how the model has been successfully operationalized.

Milne, J. K. and Lalonde, A. B. (2007). Patient safety in women's health-care: professional colleges can make a difference. *Best Practice and Research in Clinical Obstetrics and Gynaecology* 21(4): 565-579. The Society of Obstetricians and Gynaecologists of Canada has played a leadership role in advancing patient safety at the national level with the launching of their obstetric patient safety program 'Managing Obstetric Risks Efficiently' (MORE^{OB}). Developed over a 2-year period and launched as a pilot in 2002, the program has extended to 126 hospitals in five provinces that provide care for 48% of the births in Canada. The end-point for the program is to change the culture of blame to a focused and sustained patient safety culture, where patient safety is everyone's responsibility, with observed reductions in events and improved quality of care. The program has integrated the principles of high reliability organizations (HROs), systems error theory, team function, and communities of practice (CoPs)

as values for the work environment. In this chapter we describe how the program was developed, the role of the national specialty society in the development, and the funding, structure and implementation of the program, and we report on the impact of the program over the first 3 years. In these first 3 years, knowledge enhancement in all disciplines and in all practice environments, with a significant reduction in variance among the disciplines, has been demonstrated. Culture change has occurred in all practice settings and has continued to improve over time. Using liability claims information from the hospitals, a reduction trend has been observed in liability carrier (hospital) incurred costs.

Norman, C. D. and Huerta, T. (2006). Knowledge transfer & exchange through social networks: building foundations for a community of practice within tobacco control. *Implementation Science* 1(Background: Health services and population health innovations advance when knowledge transfer and exchange (KTE) occurs among researchers, practitioners, policy-makers and consumers using high-quality evidence. However, few KTE models have been evaluated in practice. Communities of practice (CoP) - voluntary, self-organizing, and focused groups of individuals and organizations - may provide one option. This paper outlines an approach to lay the foundation for a CoP within the area of Web-assisted tobacco interventions (WATI). The objectives of the study were to provide a data-driven foundation to inform decisions about organizing a CoP within the geographically diverse, multi-disciplinary WATI group using evaluation and social network methodologies. Methods: A single-group design was employed using a survey of expectations, knowledge, and interpersonal WATI-related relationships administered prior to a meeting of the WATI group followed by a 3-week post-meeting Web survey to assess short-term impact on learning and networking outcomes. Results: Twenty-three of 27 WATI attendees (85%) from diverse disciplinary and practice backgrounds completed the baseline survey, with 21 (91%) of those participants completing the three-week follow-up. Participants had modest expectations of the meeting at baseline. A social network map produced from the data illustrated a centralized, yet sparse network comprising of interdisciplinary teams with little trans-sectoral collaboration. Three-week follow-up survey results showed that participants had made new network connections and had actively engaged in KTE activities with WATI members outside their original network. Conclusion: Data illustrating both the shape and size of the WATI network as well as member's interests and commitment to KTE, when shared and used to frame action steps, can positively influence the motivation to collaborate and create communities of practice. Guiding KTE planning through blending data and theory can create more informed transdisciplinary and trans-sectoral collaboration environments.

Pereles, L., Lockyer, J. and Fidler, H. (2002). Permanent small groups: group dynamics, learning, and change. *Journal of Continuing Education in the Health Professions* 22(4): 205-213. INTRODUCTION: The concept of "communities of practice," a special facet of social constructivist learning theory, provides a new template against which we can examine the learning that goes on within permanent small groups of physicians. We interviewed participants and facilitators about the dynamics of these groups, their learning in conjunction with these groups, and the role the facilitator played to see the extent to which they captured the essence of communities of practice. METHODS: Semistructured interviews were conducted with physicians known to be participants or facilitators of small groups that met regularly. A constant comparative method was used for data gathering and analysis leading to coded themes, categories, and subcategories. The coding schemas were tested, the analyses were reviewed, and data were recoded as necessary. To ensure accuracy, interviewees were provided with a preliminary copy of the manuscript to ensure that the interpretation of the data was appropriately handled. RESULTS: Interviews were conducted with 10 facilitators and 22 group members representing 24 different groups of physicians. The groups appeared to function as communities of practice in which the members were supportive of each other's learning and respectful of one another, reporting little conflict. Members

preferred to agree to disagree rather than pursue a "right" answer or consensus. Most of the discussion focused on scientific information and the way in which their colleagues approached common problems. Practice refinement rather than new directions in patient care appeared to be the goal. The facilitators in these groups played a key role in providing administrative support for the group and often the energy needed to sustain them. DISCUSSION: Small groups that meet regularly provide a supportive network to share knowledge and validate clinical experience. There is some evidence that the groups have the potential to become communities of practice but do not actually achieve that level of sharing. Research needs to be done to determine how these groups could become more powerful as communities of practice and vehicles for more substantive learning and change.

Price, D. W. and Felix, K. G. (2008). Journal clubs and case conferences: from academic tradition to communities of practice. *Journal of Continuing Education in the Health Professions* 28(3): 123-130. INTRODUCTION: As small group learning sessions, Journal Clubs (JCs) and Case Conferences (CCs), if structured interactively, have potential as educational formats that can change practice. However, the degree to which these formats, as currently typically structured, lead to practice change is unknown. METHODS: We used concepts of communities of practice (COPs) to structure JCs and CCs. We conducted an observational descriptive study of the learnings, implemented learnings, and barriers to implementing learnings identified in JC and CC sessions conducted in 2005-2006. RESULTS: Two hundred learnings in 10 different categories emerged from 73 JC or CC sessions. By self-report, over half of identified learnings were implemented in practice; 60 barriers to implementing learnings (8 different categories) were also identified. Patterns of learnings, implemented learnings, and barriers varied among sessions. DISCUSSION: JCs and CCs can be structured with explicit intent to articulate learnings and facilitate implementation of learnings in practice. Further work is needed to validate the learning and barrier categories we identified, objectively verify short- and longer-term practice outcomes, explore the role of JCs and CCs in addressing barriers to learning, and facilitate sustainability of learning in practice.

Render, M. L., Brungs, S., Kotagal, U., Nicholson, M., Burns, P., Ellis, D., Clifton, M., Fardo, R., Scott, M. and Hirschhorn, L. (2006). Evidence-based practice to reduce central line infections. *Joint Commission Journal on Quality & Patient Safety* 32(5): 253-260. BACKGROUND: In 2003, through the Greater Cincinnati Health Council nine health care systems agreed to participate and fund 50% of a two-year project to reduce hospital-acquired infections among patients in intensive care units (ICU) and following surgery (SIP). METHODS: Hospitals were randomized to either the CR-BSI or SIP project in the first year, adding the alternative project in year 2. Project leaders, often the infection control professionals, implemented evidence-based practices to reduce catheter-related blood stream infections (CR-BSIs; maximal sterile barriers, chlorhexidine) at their hospitals using a collaborative approach. Team leaders entered process information in a secure deidentifled Web-based database. RESULTS: Of the four initial sites randomized to CR-BSI reduction, all reduced central line infections by 50% (CR-BSI, 1.7 to 0.4/1000 line days, $p < .05$). At the project midpoint (3 quarters of 2004), adherence to evidence-based practices increased from 30% to nearly 95%. DISCUSSION: The direct role of hospital leadership and development of a local community of practice, facilitated cooperation of physicians, problem solving, and success. Use of forcing functions (removal of betadine in kits, creation of an accessory pack and a checklist for line insertion) improved reliability. The appropriate floor for central line infections in ICUs is < 1 infection /1,000 line days.

Rolls, K., Kowal, D., Elliott, D. and Burrell, A. R. (2008). Building a statewide knowledge network for clinicians in intensive care units: knowledge brokering and the NSW Intensive Care Coordination and Monitoring Unit (ICCMU). *Australian Critical Care* 21(1): 29-37. PURPOSE: This paper describes the initial

establishment of the Intensive Care Coordination and Monitoring Unit (ICCMU), and reports on the implementation of a state-based intensive care Listserv, ICUConnect, for staff in ICUs in New South Wales, Australia. The aim of the Listserv was to decrease professional isolation in smaller and less resourced ICUs by developing a network based on professional peer support. The Listserv was launched in December 2003 with 130 clinical nurse consultants and nurse managers. The emphasis was on exchange of both codified and experiential information. MATERIAL AND METHODS: Evaluation of the Listserv was undertaken with a user survey piloted in 2004 and conducted in 2005. The survey explored the penetration, activity patterns and opinions of members of the Listserv. Members of the Listserv were mostly Australian intensive care clinicians and academics. RESULTS: At the time of the survey, Listserv membership had grown to over 433 users. As expected rural members tended to ask questions of clinical support and advice, while nurse educators in metropolitan ICUs were the most active members on-list. The free exchange of information, especially in the form of policies and procedures, has led to the development of an information repository on the ICCMU website. CONCLUSIONS: The Listserv has created a beginning community of practice with ICCMU taking an active approach to knowledge management by facilitating exchange of information. The creation of ICCMU as a clinician-led resource has developed a structure that is ideally placed to act as a knowledge broker within a network of ICUs. A collaborative process to produce generic guidelines is now underway.

Rossignol, M., Poitras, S., Dionne, C., Tousignant, M., Truchon, M., Arsenault, B., Allard, P., Cote, M. and Neveu, A. (2007). An interdisciplinary guideline development process: the Clinic on Low-back pain in Interdisciplinary Practice (CLIP) low-back pain guidelines. *Implementation Science* 2(Background: Evaluation of low-back pain guidelines using Appraisal of Guidelines Research and Evaluation (AGREE) criteria has shown weaknesses, particularly in stakeholder involvement and applicability of recommendations. The objectives of this project were to: 1) develop a primary care interdisciplinary clinical practice guideline aimed at preventing prolonged disability from low-back pain, using a community of practice approach, and 2) assess the participants' impressions with the process, and evaluate the relationship between participant characteristics and their participation. Methods: Ten stakeholder representatives recruited 136 clinicians to participate in this community of practice. Clinicians were drawn from the following professions: physiotherapists (46%), occupational therapists (37%), and family physicians (17%). Using previously published guidelines, systematic reviews, and meta-analyses, a first draft of the guidelines was presented to the community of practice. Four communication tools were provided for discussion and exchanges with experts: a web-based discussion forum, an anonymous comment form, meetings, and a symposium. Participants were prompted for comments on interpretation, clarity, and applicability of the recommendations. Clinical management recommendations were revised following these exchanges. At the end of the project, a questionnaire was sent to the participants to assess satisfaction towards the guidelines and the development process. Results: Twelve clinical management recommendations on management of low-back pain and persistent disability were initially developed. These were discussed through 188 comments posted on the discussion forum and 103 commentary forms submitted. All recommendations were modified following input of the participants. A clinical algorithm summarizing the guidelines was also developed. A response rate of 75% was obtained for the satisfaction questionnaire. The majority of respondents appreciated the development process and agreed with the guideline content. Most participants thought recommendations improved between versions, and that participant comments contributed to this improvement. All stakeholders officially endorsed the guidelines. Conclusion: The community of practice approach was a successful method to develop guidelines on low-back pain, with participants providing information to improve guideline recommendations. The information technology infrastructure that was developed remains for continuous interdisciplinary exchanges and updating of the guidelines.

Russell, J., Greenhalgh, T., Boynton, P. and Rigby, M. (2004). Soft networks for bridging the gap between research and practice: Illuminative evaluation of CHAIN. *British Medical Journal* 328(7449): 1174-1177. Objectives: To explore the process of knowledge exchange in an informal email network for evidence based health care, to illuminate the value of the service and its critical success factors, and to identify areas for improvement. Design: Illuminative evaluation. Setting: Targeted email and networking service for UK healthcare practitioners and researchers. Participants: 2800 members of a networking service. Main outcome measures: Tracking of email messages, interviews with core staff, and a qualitative analysis of messages, postings from focus groups, and invited and unsolicited feedback to the service. Results: The informal email network helped to bridge the gap between research and practice by serving as a rich source of information, providing access to members' experiences, suggestions, and ideas, facilitating cross boundary collaboration, and enabling participation in networking at a variety of levels. Ad hoc groupings and communities of practice emerged spontaneously as members discovered common areas of interest. Conclusion: This study illuminated how knowledge for evidence based health care can be targeted, personalised, and made meaningful through informal social processes. Critical success factors include a broad based membership from both the research and service communities; a loose and fluid network structure; tight targeting of messages based on members' interests; the presence of a strong network identity and culture of reciprocity; and the opportunity for new members to learn through passive participation.

Sharma, S., Smith, A. F., Rooksby, J. and Gerry, B. (2006). Involving users in the design of a system for sharing lessons from adverse incidents in anaesthesia. *Anaesthesia* 61(4): 350-354. In this qualitative study using observation and interviews, 10 anaesthetists from five Departments of Anaesthesia in the North-West region of England were enlisted to participate in the design of an online system to allow the sharing of critical incidents. Respondents perceived that existing schemes had differing and sometimes conflicting aims. Reporting was used for reasons other than simply logging incidents in the interests of promoting patient safety. No existing scheme allowed the lessons learned from incidents to be shared between members of the professional group from which they arose. Using participants' suggestions, we designed a simple, secure, anonymous system favouring free-text description, intended to enable the on-line sharing and discussion of selected incidents. Seven incidents were posted during the 6-month pilot period. The practitioners in our study valued the opportunity to share and discuss educational incidents 'horizontally' within their community of practice. We suggest that large-scale reporting systems either incorporate such a function or allow other systems that permit such sharing to co-exist.

Sutherland, A. M. and Dodd, F. (2008). NHS Lanarkshire's leadership development programme's impact on clinical practice. *International Journal of Health Care Quality Assurance* 21(6): 569-584. PURPOSE: The purpose of this paper is to explore the effect of a clinical leadership programme on senior clinicians within National Health Service Lanarkshire, in terms of key constituents for fostering leadership development, specific skills developed and impact this has had on clinical practice. DESIGN/METHODOLOGY/APPROACH: A qualitative research design was employed over several stages, involving 44 senior clinical managers, with member validation substantiating findings and thematic analysis used to analyse data collected. FINDINGS: The programme's impact was evident in acknowledged change to participants' attitude, behaviour and performance with examples conveyed to demonstrate both the effect on clinical practice and perceived organisational benefits gained. The use of role play, scenario planning and enquiry-based learning approaches were deemed critical in achieving such change. RESEARCH LIMITATIONS/IMPLICATIONS: Time constraints merited two different cohorts being examined simultaneously during the various stages of the programme. A longitudinal study is underway encompassing the evaluations of several cohorts through various stages of the programme to enable time-based comparisons to be made and enhance the rigour and scrutiny of the programme's

impact on clinical practice. ORIGINALITY/VALUE: The paper is foremost in determining structure and processes employed on the programme, specific leadership skills developed, subsequent effect on clinical practice and perceived organisational benefits gained but not necessarily contemplated by staff prior to embarking on the programme, such as the emergence of communities of practice.

Swan, J., Scarbrough, H. and Robertson, M. (2002). The construction of 'communities of practice' in the management of innovation. *Management Learning* 33(4): 477-496. Communities of practice have been identified as playing a critical role in the promotion of Learning and innovation in organizations. Yet, while innovation may be facilitated within communities of practice, radical innovations frequently occur at the interstices across communities. Here, the performative advantages of communities of practice are less clear Moreover, while it has been suggested that managers play a critical role in constructing, aligning or supporting communities of practice, there is little empirical evidence for these assertions. This article contributes to these debates on the construction of communities of practice and their role in the innovation process. It does this through a case study of a radical innovation for the treatment of prostate cancer. The case focuses on Medico-the company that manufactured a product for the new treatment-and explores attempts by managers to construct a new 'community of practice' as a vehicle for innovation. While the case highlights attempts by managers to construct communities as 'social objects, it also underlines the shift in management strategies and practices associated with such a construction. Faced with powerful professions, and limited organizational support, managers employed a strategy centred on constructing a community focused on the disease (rather than the product) using 'community of practice' as a rhetorical device to enrol key professionals and to mobilize and legitimize changes in work practice. Thus community building reflected managers' lack of power to intensify innovation by other means.

Taplin, S. H., Haggstrom, D., Jacobs, T., Determan, A., Granger, J., Montalvo, W., Snyder, W. M., Lockhart, S. and Calvo, A. (2008). Implementing colorectal cancer screening in community health centers: addressing cancer health disparities through a regional cancer collaborative. *Medical Care* 46(9 Suppl 1): S74-83. BACKGROUND: The population served by Federally Qualified Health Centers (FQHCs) has lower levels of cancer screening compared with the general population and suffers a disproportionate cancer burden. To address these disparities, 3 federal agencies and a primary care association established and tested the feasibility of a Regional Cancer Collaborative (RCC) in 2005. METHODS: RCC faculty implemented a learning model to improve cancer screening across 4 FQHCs that met explicit organizational readiness criteria. Regional faculty trained "care process leaders," who worked with primary care teams to plan and implement practice changes. FQHCs monitored progress across the following measures of screening implementation: self-management goal-setting; number and percent screened for breast, cervical, and colorectal cancer; percent timely results notification; and percent abnormal screens evaluated within 90 days. Progress and plans were reviewed in regular teleconferences. FQHCs were encouraged to create local communities of practice (LCOP) involving community resources to support cancer screening and to participate in a monthly teleconference that linked the LCOPs into a regional community of practice. Summary reports and administrative data facilitated a process evaluation of the RCC. chi test and test of trends compared baseline and follow-up screening rates. RESULTS: The RCC taught the collaborative process using process leader training, teleconferences, 2 regional meetings, and local process improvement efforts. All organizations created clinical tracking capabilities and 3 of the 4 established LCOPs, which met monthly in an regional community of practice. Screening documentation increased for all 3 cancers from 2005 to 2007. Colorectal cancer screening increased from 8.6% to 21.2%. CONCLUSIONS: A regional plan to enable collaborative learning for cancer screening implementation is feasible, and improvements in screening rates can occur among carefully selected organizations.

Tolson, D., Irene, S., Booth, J., Kelly, T. B. and James, L. (2006). Constructing a new approach to developing evidence-based practice with nurses and older people. *Worldviews on Evidence-Based Nursing* 3(2): 62-72. PURPOSE: Providing evidence-based nursing care to older people is central to the international development agenda. This paper is a report on the first 5 years (2000-2005) of a participatory research project, the purpose of which was to collaborate with practitioners and older people to develop approaches to promote the attainment of evidence-based nursing care across Scotland. DESIGN: Many theoretical influences shaped the design of this action research study including realistic evaluation, participatory social learning theory, and descriptions of communities of practice. Multiple methods of data collection were used during four action cycles. The inaugural community of practice comprised 30 nurses, a second group of 30 nurses joined midway, followed by a third group of 15 nurses, and finally, an older person-carer community of 21 members was established. FINDINGS: Project outputs included the construction of an internet-based, practice-development college. A procedural model for developing and demonstrating care guidance drawn from a diversity of evidence and reflective of an agreed set of principles was piloted and endorsed by the national standard setting agency. A preliminary version of a promising approach to practice development, "the Caledonian Model," was delineated for future testing and refinement. CONCLUSION: This work indicates the merits of using participatory research to find solutions to the challenge of promoting evidence-based practice. Evaluation data suggest that in combination, the approaches developed in this project empower nurses to work with older people to champion developments even in seemingly unfavorable conditions.

Tolson, D., McAloon, M., Hotchkiss, R. and Schofield, I. (2005). Progressing evidence-based practice: an effective nursing model? *Journal of Advanced Nursing* 50(2): 124-133. AIMS: This paper presents findings from telephone interviews completed with link nurses 2 years into the project to explore how participation progressed achievement of evidence-based practice where the link nurses worked. BACKGROUND: In 2001, an innovative practice development initiative was launched in Scotland. A national network of experienced nurses from across the country was recruited to form the inaugural Community of Practice. This involved describing gerontological nursing, pioneering a nurse-sensitive methodology to craft care guidance that reflects the agreed practice model, and constructing a virtual college based on a situated learning model. METHODS: A volunteer sample of link nurses took part in telephone interviews exploring experiences of using the virtual college and the extent to which the description of gerontological nursing and the first best practice statement on nutrition had influenced practice. FINDINGS: Five components (themes) were identified as facilitating the attainment of evidence-based practice. These focussed on confidence-building and the positive benefits of achieving vision and clarity for gerontological nursing. Membership of a national Community of Practice afforded status and strengthened sense of professional identity. The inclusive knowledge synthesis methodology used to prepare, pilot and support implementation of the best practice statement was highly valued. Progress towards evidence-based practice in all affiliated areas was reported. Major challenges for nurses in participating in the virtual college included the absence of a learning-at-work culture, lack of time and doubts about the legitimacy of internet-based learning. CONCLUSION: The evaluation indicates the potential merits of e-practice development, particularly for nurses who feel geographically and professionally isolated or disenchanted with available continuing professional development opportunities. Participation in the virtual college appeared to enrich practice and foster a culture of change.

Wild, E. L., Richmond, P. A., de Mero, L. and Smith, J. D. (2004). All Kids Count Connections: a community of practice on integrating child health information systems. *Journal of Public Health Management & Practice* S61-65. Integrated child health information systems consolidate data about multiple health care services a child receives into information useful to families, private health care

providers, public health officials, and others. The challenges to successful integration faced by public health agencies are similar, yet system integration projects have historically struggled in isolation to overcome these barriers. All Kids Count created a community of practice called Connections to bring together 11 state and local public health agencies engaged in child health information system integration projects to learn from each other, capture best practices, and collaboratively address challenges. As demonstrated by All Kids Count Connections, communities of practice can be employed by geographically distributed public health agencies to address complex issues.

Wilding, C. and Whiteford, G. (2007). Occupation and occupational therapy: Knowledge paradigms and everyday practice. *Australian Occupational Therapy Journal* 54(3): 185-193. Aims: This article presents sonic preliminary findings from an action research study into the everyday practice of a group of occupational therapists working in a large metropolitan hospital delivering a range of acute services. Methods and Findings: Narrative data gathered from 10 individual interviews were analysed through numerous iterative cycles to reveal salient themes. These include epistemological tensions associated with working in a hospital environment, antagonistic reasoning processes, overinclusive descriptions of practice, and communication challenges. Conclusions: The findings suggest that occupational therapists in acute settings may experience challenges in describing occupational therapy and engaging in occupation-based practice. This is because of a range of factors, including, but not limited to, the paradigmatic conflict that arises between a profession informed by occupation and a predominantly biomedical setting. However, through in-depth, reflective processes undertaken collectively within a supportive community of practice milieu, significant changes in everyday practices can be activated.

Wilson, V. and Pirrie, A. (1999). Developing Professional Competence: lessons from the emergency room. *Studies in Higher Education* 24(2): 211-224. This article begins by reassessing the nature and value of practice-based learning in the health professions. The role and status of work-based learning are then examined in the context of recent policy developments in the field of health care. The authors report the findings from a 1-year qualitative study, of clinicians' perceptions of the workplace as an environment for learning, funded by the Scottish Council for Postgraduate in Medical and Dental Education (SCPMDE). Focusing in particular upon ill-depth interviews with junior and senior clinicians in two hospital specialties, they explore the process through which novice clinicians become part of a 'community of practice', and their senior colleagues continue to learn in an environment which poses fewer professional challenges. Finally, the implications for the development of competent professionals are discussed.