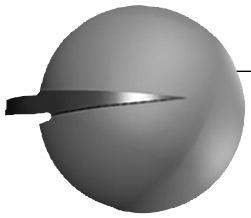

Original Article

Measuring the Effectiveness of Mentoring as a Knowledge Translation Intervention for Implementing Empirical Evidence: A Systematic Review

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Keywords
evidence-based practice, mentorship, outcome evaluation, professional issues/professional ethics/professional standards, advanced practice/advanced nursing practice, meta-analysis

ABSTRACT

Background: Mentoring as a knowledge translation (KT) intervention uses social influence among healthcare professionals to increase use of evidence in clinical practice.

Aim: To determine the effectiveness of mentoring as a KT intervention designed to increase healthcare professionals' use of evidence in clinical practice.

Methods: A systematic review was conducted using electronic databases (i.e., MEDLINE, CINAHL), grey literature, and hand searching. Eligible studies evaluated mentoring of healthcare professionals responsible for patient care to enhance the uptake of evidence into practice. Mentoring is defined as (a) a mentor more experienced than mentee; (b) individualized support based on mentee's needs; and (c) involved in an interpersonal relationship as indicated by mutual benefit, engagement, and commitment. Two reviewers independently screened citations for eligibility, extracted data, and appraised quality of studies. Data were analyzed descriptively.

Results: Of 10,669 citations from 1988 to 2012, 10 studies were eligible. Mentoring as a KT intervention was evaluated in Canada, USA, and Australia. Exposure to mentoring compared to no mentoring improved some behavioral outcomes (one study). Compared to controls or other multifaceted interventions, multifaceted interventions with mentoring improved practitioners' knowledge (four of five studies), beliefs (four of six studies), and impact on organizational outcomes (three of four studies). There were mixed findings for changes in professionals' behaviors and impact on practitioners' and patients' outcomes: some outcomes improved, while others showed no difference.

Linking Evidence to Action: Only one study evaluated the effectiveness of mentoring alone as a KT intervention and showed improvement in some behavioral outcomes. The other nine studies that evaluated the effectiveness of mentoring as part of a multifaceted intervention showed mixed findings, making it difficult to determine the added effect of mentoring. Further research is needed to identify effective mentoring as a KT intervention.

INTRODUCTION

Knowledge translation (KT) interventions are designed to support the uptake of best available evidence, including clinical guidelines into practice (Straus, Tetroe, & Graham, 2013). One category of KT intervention relies on social influence, which occurs when an individual uses interpersonal interactions to influence other individuals' or groups' thoughts, feelings, attitudes, or behaviors (Eccles & Foy, 2009; Zimbardo & Leippe, 1991). Mentoring as a KT intervention uses social influence and has the potential to increase the uptake of evidence-based practice (EBP; Gattellari et al., 2005). However, few studies have included mentoring as an intervention to support the uptake of nursing practice guidelines (Davies, Edwards, Ploeg, & Virani 2008; Gifford, Davies, Ploeg, Eldred, & Bajnok, 2013). The purpose of this paper is to examine the effects of mentoring as a KT intervention aimed at supporting the uptake of empirical evidence into clinical practice. This review offers a unique contribution to research on mentoring within the context of KT by identifying essential characteristics of mentoring interventions and providing an understanding of the effects of mentoring on practitioners, patients, and organizations.

Our definition of mentoring relied upon three essential characteristics of mentoring that were consistently identified in business and health care (Haggard, Dougherty,

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Turban, & Wilbanks, 2011; Ploeg, de Witt, Hutchison, Hayward, & Grayson, 2008; Sambunjak, Straus, & Marusic, 2006, 2010). These characteristics were (a) mentors are more experienced than mentees as related to a specific task; (b) mentors provide individualized support based on mentees' learning needs; and (c) mentoring involves an interpersonal relationship as generally indicated by mutual benefit, engagement, and commitment.

Mentoring is similar to and often confused with other social influence KT interventions, such as champions, local opinion leaders, facilitation, and educational outreach visitors. According to the diffusion of innovation theory, the ways specific individuals (i.e., champions, opinion leaders) interact and discuss ideas with others influence learning and adoption of change (Rogers, 2003). Educational outreach visitors assist healthcare professionals by providing feedback, identifying barriers to change, and developing tailored interventions to address these barriers (O'Brien et al., 2007). Local opinion leaders support organizational communication structures and advocate for organizational norms; they also informally influence peers' attitudes and behaviors (Flodgren et al., 2011). Facilitation enables implementation processes, leading to tailored interventions, problem-solving, and team building (Dogherty, Harrison, & Graham, 2010). Mentoring focuses on mentees' needs rather than on organizational or study program needs. Alternatively, champions are expected to support change processes by persuading and negotiating with people to adopt new innovations (Rogers, 2003). Champions may also spread information about clinical guidelines via education and help to implement clinical practice guideline strategies based on organizational contexts (Ploeg et al., 2010). Unlike other social influence KT interventions, mentoring specifically requires mentors to be more experienced than mentees at the specific task.

Several social influence KT interventions have been evaluated to determine effects on the uptake of evidence. Champions have had mixed influence on the uptake of evidence. For example, champions increased sepsis screening in ICU from 23% to 74%, but did not influence the percentage of patients treated for sepsis (Campbell, 2008). In another study, champions did not change childbirth outcomes, such as episiotomy rates (Hodnett et al., 1996). Educational outreach visitors and local opinion leaders have increased the implementation of research evidence by 6.0% and 12.0%, respectively (Grimshaw, Eccles, Lavis, Hill, & Squires, 2012). Evidence drawn from primary healthcare settings showed facilitation moderately affected the uptake of clinical guidelines (effect size = .56, 95% CI = .43–.68; Baskerville, Liddy, & Hogg, 2012). Little is known about how expertise, individualized support, and interpersonal relationships underpin mentoring as a KT intervention to support the uptake of evidence into clinical practice.

OBJECTIVES

The aim of this systematic review is to determine the effectiveness of mentoring as a KT intervention designed to increase the use of empirical evidence by healthcare professionals in clinical practice. Research questions were: (a) What are the characteristics of mentoring as a KT intervention? (b) Does a mentoring intervention alone increase the uptake of evidence compared to no intervention or compared to other intervention(s) without mentoring? and (c) Does mentoring as part of a multifaceted intervention increase the uptake of evidence compared to no intervention or compared to other intervention(s) without mentoring?

METHODS

A systematic review was conducted based on the Cochrane Handbook for Systematic Reviews of Interventions (Higgins & Green, 2011), and reported using the PRISMA Statement (Liberati et al., 2009). The review protocol was developed a priori.

The search strategy was designed using keywords related to PICO (population, intervention, comparator, and outcomes) with inclusion and exclusion criteria (see Table 1). Eligible intervention studies used mentoring as a KT intervention and met the definition of mentoring.

We searched electronic databases for articles published between January 1988 and December 2012. The search was limited to 1988 due to a shift toward increased use of empirical evidence in 1989 (French, 2002). Electronic databases searched were the Cochrane and DARE (Database of Abstracts of Reviews of Effectiveness), Cochrane Central Register of Controlled Trials, MEDLINE, CINAHL, PsycINFO, EMBASE, AHMD, ProQuest-Dissertation and Thesis Database, and Trials Register. A specific search strategy was developed with the librarian (LS) based on PICO for MEDLINE (see Figure S1, available with online version of this article) and adapted for other databases. Online grey literature was searched for unpublished studies and technical reports by organizations known to implement EBP. Journals and relevant conferences that examine the effectiveness of interventions and strategies related to EBP were also searched as was a reference list of included studies and relevant review articles (see Figure S1, online).

The citations identified by the search strategy were entered into a web-based tool designed to facilitate blind screening by two independent reviewers (GA, DR). The screening process involved three phases. First, titles were screened and judged as "include," "exclude," or "unsure." When at least one reviewer rated a citation as "include" or "unsure," it remained included. Second, abstracts were screened using the same process. Third, full-texts of citations were screened. There were no disagreements between reviewers. Authors for eight studies were contacted for additional information about the intervention to determine eligibility.

A standardized form was developed based on the Cochrane Effective Practice and Organisation of Care Review Group (EPOC) data collection tool (2008). The form was pilot-tested on four randomly selected included studies and then refined accordingly. Two of four authors used the form to extract

Table 1. Study Inclusion Criteria

Criteria	Included	Excluded
Population	Healthcare professionals responsible for patient care	Undergraduate medical or nonmedical students
Intervention	Mentoring to enhance use of evidence in clinical practice defined as:	• Focusing on organizational or program needs
	(a) Mentor more experienced than mentee (as related to the specific task);	• Not describing or requiring a mutually beneficial relationship
	(b) Individualized support based on mentee's needs;	
	(c) Interpersonal relationship as generally indicated by mutual benefit, engagement and commitment.	
Comparator	Intervention group compared with control group or other intervention	N/A
Outcomes	Include one of the following:	• Publishing a research paper
	• Conceptual knowledge use	• Obtaining grants for research
	• Instrumental knowledge use	• Attending Journal Club
	• Enablers of instrumental use	
	• Impact (on patients, or organizations or healthcare professionals)	
Designs	(a) Randomized controlled trials (RCT)	• Qualitative studies, descriptive studies
	(b) Controlled clinical trials (CCT)	
	(c) Controlled before and after studies (CBA)	
	(d) Interrupted time series (ITS)	
	(e) Pre/post test studies	
Language	English	

data independently based on the characteristics of the studies, mentoring interventions, outcome measures, factors influencing use of mentoring, and methodological quality of studies. The Cochrane Collaboration's Tool for Assessing Risk of Bias was used to check the quality of randomized controlled trials (Higgins & Green, 2011). The quasi-experimental studies were appraised using the Critical Appraisal Skills Program (CASP) tool (Public Health Resource Unit, 2006). Disagreements were resolved by consensus.

Due to heterogeneity across study outcomes, data were analyzed descriptively. Study comparisons were grouped to answer the research questions. Findings were synthesized based on the outcomes of knowledge use and impact (Graham, Bick, Tetroe, Straus, & Harrison, 2010). Knowledge use included (a) conceptual knowledge use (i.e., practitioner's knowledge, understanding, attitudes/beliefs); (b) instrumental knowledge use (i.e., practitioner's behavior or practice); and (c) enablers of instrumental use (i.e., organizational endorsement). Impact included impact on (a) the patient, (b) the practitioner, and (c) the organization.

RESULTS

Of 10,669 citations, 62 were potentially eligible and 10 were confirmed eligible (see Figure 2). The 52 excluded were

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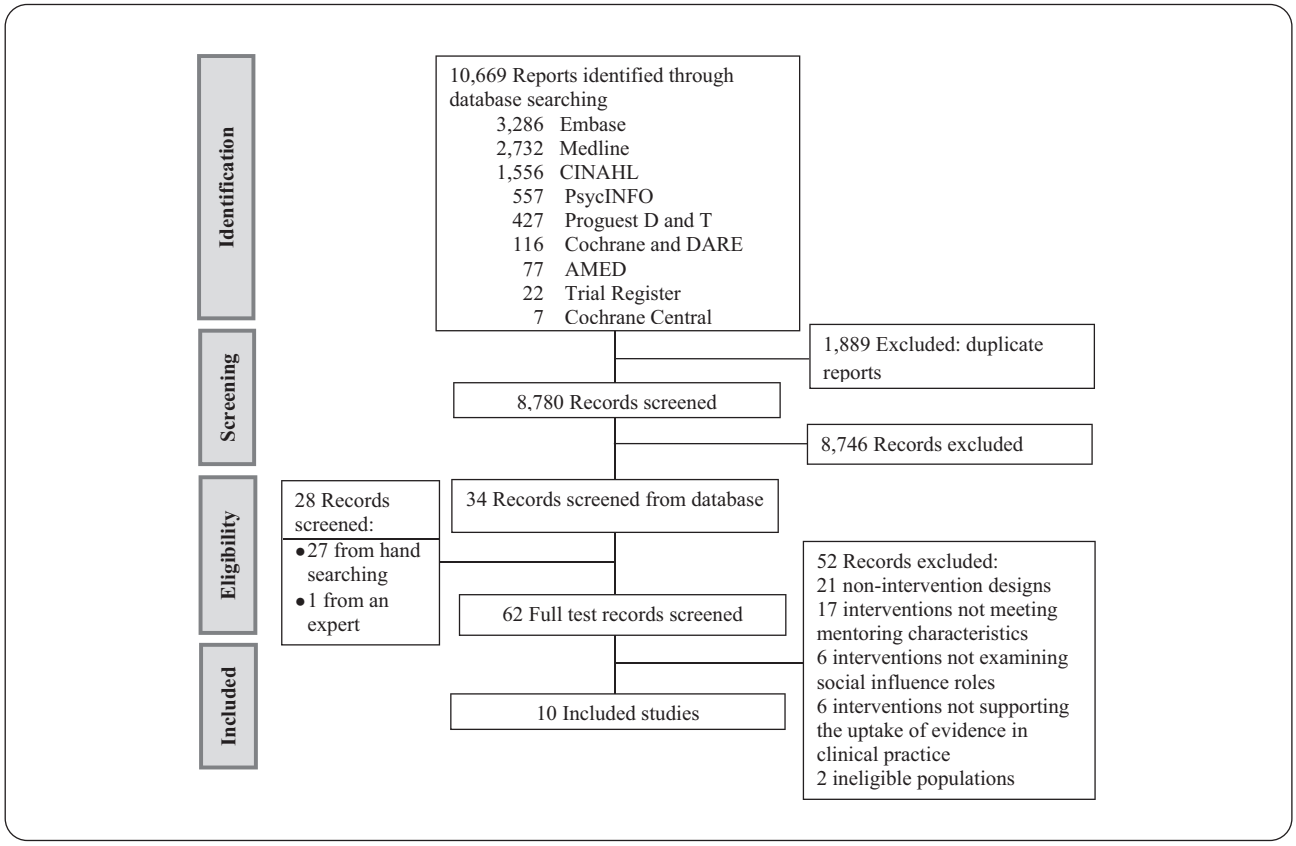

Figure 2. Flow diagram of study selection process.

nonintervention designs ($n = 21$), ineligible populations ($n = 2$), or interventions that were not examining social influence roles ($n = 6$), not meeting mentoring characteristics ($n = 17$), or not supporting the uptake of evidence in clinical practice ($n = 6$; see Table S2, online).

Characteristics of the Studies

The 10 included studies were conducted in three countries (USA, Canada, Australia) and published between 1991 and 2012 (see Table 3). Six studies were cluster-randomized controlled trials (RCTs), one a controlled clinical trial (CCT), one a controlled before and after study (CBA), and two were pre- and post test studies. Of six RCT studies, four randomized clusters by hospitals, one by physicians, and one by nurses. The cluster effect was not taken into account in the analysis of one RCT (Lomas et al. 1991). Seven studies evaluated the uptake of clinical practice guidelines, and three evaluated the uptake of nonguideline-based research evidence. The studies were conducted in tertiary care, community hospital, home care, or primary care. The median number of participants per study was 108.5 (range of 15 to 2,409). Seven were nursing studies and four were medical studies.

Of six RCTs, five were rated as low risk of bias and one as moderate risk of bias (see Table 3). For the CCT study, risk of bias was rated as unclear because there was insufficient reporting to judge risk of bias. The CBA study was rated as moderate because 70% of CASP criteria were met, while the two pre-and post test studies were rated as higher quality because 80% of CASP criteria were met (Murray et al., 2009).

Characteristics of Mentoring Interventions

Of the 10 studies, five used the term "mentoring," four "opinion leaders," and one "academic detailing" (see Table 3). Characteristics of mentoring interventions varied across studies based on (a) mode of delivery, (b) frequency and length of mentoring intervention, and (c) type of mentor selection process. Mentoring interventions were delivered via a single approach (individual or group meetings), or via mixed approach (combination of individual or group meetings, or e-mail; see Table 4). The mentoring interventions varied from 3 to 12 sessions (Median = 7.5) with each session approximately 2 hours and scheduled over 14 to 360 days (Median = 90). Some mentors were physicians nominated by their peers (Berner et al., 2003; Lomas et al., 1991; Soumerai et al., 1998). Other mentors were nurses or other healthcare professionals selected to support nurses (Johnston et al., 2007; Levin, Fineout-Overholt, Melnyk, Barnes, & Vetter, 2011; Mariano et al., 2009; Masny, Ropka, Peterson, Fetzer, & Daly, 2008; Wallen et al., 2010). Only Johnston and colleagues (2007) discussed the mentor selection process, indicating key leaders were selected as mentors.

Table 3. Characteristics of Included Studies ($N = 10$)

First author, year (country)	Design and setting	Evidence being implemented	Participants(# in intervention + comparison)	Mentoring intervention title	Study risk of bias*	
Berner, 2003 (USA)	Clustered RCT in tertiary care	Unstable angina guideline	1076 (NR+NR) physicians	Opinion leaders by trained physicians	**1.** Unclear	**2.** Low
					3. NA	**4.** Low
					5. Low	**6.** Low
					7. Low	
Gattellari, 2005 (Australia)	Clustered RCT in primary care	Lower urinary tract symptoms guideline	277 (136 + 141) physicians	Academic detailing by physicians	**1.** Low	**2.** Low
					3. NA	**4.** Low
					5. Low	**6.** Unclear
					7. Low	
Johnston, 2007 (Canada)	Clustered RCT in tertiary care	Pain management guideline	141 (NR + NR) nurses	Opinion leaders by trained nurses and other practitioners	**1.** Low	**2.** High
					3. NA	**4.** Low
					5. High	**6.** Unclear
					7. Low	
Levin, 2011 (USA)	Clustered RCT in home care	Evidence-based practice	46 (22+24) nurses	Mentor by a nurse	**1.** Low	**2.** Low
					3. NA	**4.** Low
					5. Low	**6.** Unclear
					7. Low	
Lomas, 1991 (Canada)	Clustered RCT in community hospitals	Vaginal birth after cesarean section guideline	76 (38 + 38) physicians	Opinion leaders by trained physicians	**1.** Unclear	**2.** Unclear
					3. NA	**4.** Low
					5. Low	**6.** Low
					7. Low	
Soumerai, 1998; Borbas, 2000 (USA)	Clustered RCT in community hospitals	Acute myocardial infarction guideline	2409 (Median = 43, Median = 36) physicians	Opinion leaders by physicians	**1.** Unclear	**2.** Unclear
					3. NA	**4.** Low

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Table 3. Continued

First author, year (country)	Design and setting	Evidence being implemented	Participants(# in intervention + comparison)	Mentoring intervention title	Study risk of bias*	
					5. Low	**6.** Low
					7. Low	
Masny, 2008 (USA)	CCT in primary care but outcomes pre & post only	High risk cancer guideline	41 (20 + 21) nurses	Mentor by genetic counselor	**1.** Unclear	**2.** High
					3. NA	**4.** Unclear
					5. Unclear	**6.** Unclear
					7. Unclear	
Wallen, 2010 (USA)	CBA in tertiary care	Evidence-based practice	159 (94 + 65) nurse leaders	Mentor by nurses	**7/10** met; **2/10** not met	
					1/10 not applicable	
Mariano, 2009 (USA)	Pre/post test study in tertiary care	Evidence-based communication strategies with families	20 (NA + NA) nurses	Mentor by trained nurses	**8/10** met; **1/10** not met	
					1/10 not applicable	
Morgan, 2012 (USA)	Pre/post test study in community hospital	Pressure ulcer guideline	15 (NA+NA) nurses	Mentor by expert	**8/10** met; **1/10** not met	
					1/10 not applicable	

Note. *Study Risk of Bias Quality Assessment Legend. For EPOC: 1. allocation concealment; 2. follow-up, professionals; 3. follow-up, patients; 4. blinded assessment; 5. baseline measurement; 6. reliable primary outcome measure(s); 7. protection against contamination. For CASP tool: 1. clear statement of aims; 2. methodology appropriate; 3. research design appropriate to address research aims; 4. recruitment strategy appropriate; 5. data collected appropriately; 6. relationship between researcher and participants considered; 7. ethical issues considered; 8. data analysis sufficiently rigorous; 9. clear statement of findings; 10. valuable research. NR = not reported; NA = not applicable.

Characteristics of Instruments

Twelve instruments measured knowledge use and impact (see Table 5). Of 12 instruments, 6 reported reliability and validity, 1 reported reliability only, and 5 had no psychometric properties reported. Only two instruments were used in more than one study, and they were based on the Transtheoretical Model of Health Behaviour Change and the Advancing Research and Clinical Practice Through Close Collaboration (ARCC) Model (i.e., EBP Implementation and the EBP beliefs scales; Melnyk, Fineout-Overholt, & Mays, 2008). One reliable and valid instrument was used to assess barriers and enablers influencing mentoring.

Multifaceted intervention With mentoring Versus Without mentoring ($n = 1$).

Instrumental knowledge use. Compared to a multifaceted intervention without mentoring (i.e., educational meetings combined with educational materials, and audit and feedback), physicians who received mentoring as part of the same kind of multifaceted intervention improved use of antiplatelet

Table 4. Characteristics of Interventions ($N = 10$ studies)

First author, year	Groups	Intervention description	Delivery approach	Intervention frequency and length
Berner, 2003	Intervention group 1	Mentoring	Group	NR
		Coordinator or administrative educational meetings (e.g., review of guideline, study design, implementation strategies)	Once	NR
		Coordinator or administrative educational materials	NR	NR
		Audit and feedback	NR	2 audits + 1 feedback
	group 2	Coordinator or administrative educational meetings (e.g., review of guideline)	Once	NR
		Coordinator or administrative educational materials	NR	NR
		Audit and feedback	NR	2 audits + 1 feedback
	Control	None		
Gattellari, 2005	Intervention	Peer coaching sessions by mentors	In person via telephone	3 sessions over 2 months
		Patients' educational materials	Written + in person discussion with patients	One session
		Practitioners' educational materials (e.g., guidelines, the Great Debate)	Audiotape/video/written	3 times over 3 months
		Audit and feedback	In person	Pre & post audit, each audit over 6 weeks + 3 feedbacks over 2 months.

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Table 4. Continued

First author, year	Groups	Description of intervention	Delivery approach	Frequency and length of intervention
	Control	Practitioners' educational materials (i.e., guidelines)	Written	Once
Johnston, 2007	Intervention	One-on-one coaching sessions by mentors	In person	10 sessions per participant. Most coaching 14–25 days.
		Audit and feedback	In person	10 audit and feedbacks during intervention + 2 audits, once at 2 weeks and once at 6 months after intervention completion.
		Practitioners' educational materials	Written+ verbal	As needed
	Control	Audit and feedback	NR	At least 4 audits per nurse, per month during intervention + 2 audits, once at 2 weeks and once at 6 months after intervention completion.
Levin, 2011	Intervention	Mentoring	In person + e-mail	12 sessions. 2 hour sessions, weekly over 12 weeks.
		Practitioners' educational meetings (i.e., EBP)	Group	4 sessions. 1 hour sessions, weekly over 4 weeks.
		Practitioners' educational materials	Written	NR
		Mass media (i.e., poster)	Written	NR

(Continued)

Table 4. Continued

First author, year	Groups	Description of intervention	Delivery approach	Frequency and length of intervention
Levin, 2011	Control	Practitioners' educational meetings (i.e., physical assessment)	Group	4 sessions. 1 hour sessions, weekly over 4 weeks.
Lomas, 1991	Intervention group 1	Mentoring	Group and in person	Approximately 12 sessions over 12 months.
		Practitioners' educational materials (e.g., guideline, information sheets)	Written	Twice over 5 months
		Practitioners' educational meetings	Group	One session
	Group 2	Local consensus process on the criteria of conducting caesarean section	Group	NR
		Audit and feedback	Group + mailed	1 audit + 3–4 feedbacks.
	Control	Practitioners' educational materials (i.e., guideline)	Written	Once
Morgan, 2012	Post	Mentoring	Group	5 sessions. Approximately 2 hours per session, over 6 weeks.
		Practitioners' educational materials	Written	5 times
		Wound champion taught revised medical form	NR	NR
	Pre	None		

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Table 4. Continued

First author, year	Groups	Description of intervention	Delivery approach	Frequency and length of intervention
Mariano, 2009	Post	Mentoring	In person	5 months
		Mass media (i.e., posting study updates)	Written	5 months
	Pre	None		
Masny, 2008	Intervention	Mentoring	In person by telephone or e-mail	3 sessions. One session monthly over 3 months, beginning immediately after pre-course.
		Practitioners' educational meetings	Telephone	3 sessions. One session monthly over 3 months.
		Practitioners' educational materials	E-mail	3 months
	Control	None (waitlist control)		
Soumerai, 1998	Intervention	Mentoring	Group	7 months
		Practitioners' educational materials	Group	7 months
		Establish system change (e.g., revising protocols)	NR	7 months
		Audit and feedback	Group	Twice
	Control	Audit and feedback	Mailed	Twice
Wallen, 2010	Intervention	Mentoring	In person or group	7 months
		Practitioners' educational meeting	Group (in-person and via internet forum)	2 days
	Control	None		

Note. NR= not reported.

medication within 24 hours of admission ($M = 20.2\%$ vs. $M = -3.9\%$, $p = .02$; Berner et al., 2003). There was no difference in heparin use, ECG within 20 minutes of arriving in emergency, beta-blockers during hospitalization, and antiplatelet medications at discharge.

Multifaceted intervention With mentoring compared to single intervention Without mentoring ($n = 5$).

Conceptual knowledge use. Compared to educational materials alone, physicians exposed to mentoring as part of a multifaceted intervention reported improved knowledge of prostate cancer screening ($M = 6.1/7$, 95% $CI = 5.9 - 6.3$ vs. $M = 4.8/7$, 95% $CI = 4.6 - 5.0$, $p < .001$), and changes in their beliefs regarding medico-legal risk concerning prostate-specific antigen (PSA) screening (odds ratio = .31, 95% $CI = .19–.51$, $p < .001$; Gattellari et al., 2005). In another study, there was improvement in physicians' knowledge of vaginal birth after cesarean section ($M = 6.3\%$ vs. $M = 46.2\%$), and more care provided in agreement with the guideline recommendations ($M = 54.4\%$ vs. $M = 39.7\%$; Lomas et al., 1991).

Compared to educational meetings, nurses who received mentoring as part of a multifaceted intervention had increased beliefs in EBP ($F_{1, 15} = 3\ 3.105$, $p < .001$) and had sustained beliefs at 9 months post intervention ($F_{1, 15} = 7.335$, $p = .016$; Levin et al., 2011). No differences were reported in nurses' knowledge. Compared to audit and feedback, mentoring as part of a multifaceted intervention improved nurses' knowledge of pain management ($p < .0001$; Johnston et al., 2007).

Instrumental knowledge use. Compared to educational materials alone, physicians exposed to mentoring as part of a multifaceted intervention reported improvement in their skills for supporting patients' informed decision-making ($M = 45.7/55$, 95% $CI = 44.2–47.2$ vs. $M = 37.2/55$, 95% $CI = 35.5–38.8$, $p < .001$), and increases in their provision of written and verbal information to men before making decisions about PSA ($M = 28.4/35$, 95% $CI = 27.8–29.0$ vs. $M = 23.9/35$, 95% CI = 23.1–24.7, $p < .001$; Gattellari et al., 2005). Physicians ordered fewer PSA tests (risk ratio = .52, 95% $CI = .38–.75$, $p < .0004$), but not because they were significantly influenced by their perceptions of medico-legal concerns (Gattellari et al., 2005). Physicians who received mentoring as part of a multifaceted intervention increased participation in a trial of labor rate ($M = 38.2\%$, 95% $CI = 30.6–45.7$ vs. $M = 28.3\%$, 95% $CI = 23.0–33.7$, $p < .007$), showed changes in practice in delivering women after cesarean section ($M = 30.9\%$ vs. $M = 23.1\%$), and more often offered a vaginal birth trial ($M = 74.2\%$, 95% CI = 63.1–85.2 vs. M = 51.3%, 95% $CI = 43.5–59.2$, $p < .002$; Lomas et al., 1991).

Compared to educational meetings, nurses who received mentoring as part of a multifaceted intervention improved implementation of EBP ($F_{1,15} = 10.39$, $p = .006$) and sustained implementation at 9 months post-intervention ($F_{2,30} = 5.85$, $p = .007$; Levin et al., 2011). Compared to audit and feedback, mentoring as part of a multifaceted intervention increased physicians' prescriptions of aspirin (Median = +.13 vs. –.03, $p = .04$) and beta-blocker medications (Median = +.31 vs. +.18, $p = .02$) for patients with acute myocardial infarction (Soumerai et al., 1998), and improved uptake of pain management guidelines as evidenced by enhanced nurses' pain assessment documentation (15% to 58%, $p < .0001$ vs. 24% to 9%, $p < .001$; Johnston et al., 2007). There was no difference in the use of thrombolysis and lidocaine medications (Soumerai et al., 1998) or in the administration of analgesia and nonpharmacological measures (Johnston et al., 2007).

Impact on patients. Compared to educational materials only, physicians exposed to mentoring as part of a multifaceted intervention showed improvement in infant patients' Apgar scores at 5 min ($M = .9\%$, 95% $CI = .0–.6$ vs. $M = 1.2\%$, 95% $CI = .0–2.4$, $p < .0001$), and higher rates of vaginal births for patients ($M = 25.3\%$, 95% $CI = 19.3–31.2$ vs. $M = 14.5\%$, 95% = 10.3–18.7, $p = .003$; Lomas et al., 1991). This study also reported no statistically significant difference in infant Apgar scores at 1 min, rates of unscheduled cesarean sections, and in maternal and infant deaths.

Impact on practitioners. Compared to educational materials only, physicians exposed to mentoring as part of a multifaceted intervention improved preference to share decision-making with patients about PSA screening (odds ratio = .11, 95% $CI = .04–.31$, $p < .001$; Gattellari et al., 2005). There was also a decrease in physicians' decisional conflict regarding PSA screening decisions ($M = 25.4/45$, 95% $CI = 24.5–26.3$ vs. $M = 27.8/45$, 95% $CI = 26.6–29.0$, $p < .0002$; Gattellari et al., 2005).

Compared to educational meetings, nurses who received mentoring as part of a multifaceted intervention showed no difference in group cohesion, job satisfaction, and nurses' workload (i.e., time and effort) post intervention or at 9 months (Levin et al., 2011).

Impact on organization. Compared to educational materials only, patients of physicians exposed to mentoring as part of a multifaceted intervention had shorter hospital stays ($M = 46.6\%$ days vs. $M = 32.2\%$, $p < .0001$; Lomas et al., 1991). Compared to educational meetings, nurses who received mentoring as part of a multifaceted intervention had a 50% lower attrition or turnover rate, while the control group continued to have a 35% attrition or turnover rate (Levin et al., 2011).

Multifaceted Intervention With Mentoring Compared to No Intervention ($n = 5$ studies).

Conceptual knowledge use. Compared to no intervention, nurses exposed to mentoring as part of a multifaceted intervention had increased beliefs in EBP ($M = 57.2\%–62.6\%$ vs. 58.0%–58.2%, $p = .025$; Wallen et al., 2010) or no difference (Mariano et al., 2009). Nurses also had improved perceptions of organizational culture and readiness for EBP ($M = 77.2\%–89.5\%$ vs. $M = 80.9\%–82.9\%$, $p = .025$; Wallen et al., 2010).

Instrumental knowledge use. Compared to no intervention, physicians exposed to mentoring as part of a multifaceted

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Table 5. Characteristics of Instruments ($N = 13$ Instruments)

Outcomes measure	Instruments	Reliability	Validity
Knowledge	Pediatric Nurses' Knowledge and Attitudes Survey Regarding Pain [J]	Cronbach's alpha = .72 and .79 [J]	√
	A knowledge and attitude survey [S]	NR	NR
	Obstetricians' survey [Lo]	NR	NR
	Organizational Culture and Readiness for System-Wide Implementation of EBP (OCRSIEP) scale [W]	Cronbach's alpha = .93 to .94 [W]	NR
Belief/attitude	EBP Beliefs Scale* [Le, Ma, W]	• Internal consistency = >.85 [Le]	√
		• Cronbach's alpha = .90 to .92 [W]	
	A knowledge and attitude survey [S]	NR	NR
	Obstetricians' survey [Lo]	NR	NR
Use of evidence	The Pain Management Experience Evaluation [J]	NR	NR
	EBP Implementation Scale [Le, Ma, W]	• Internal consistency = >.85 [Le]	√
		• Cronbach's alpha = .90 to .92 [W]	
	Obstetricians' survey [Lo]	NR	NR
Practitioner outcomes	Group cohesion Scale [Le, W]	• Internal consistency = .73–.83 [Le]	√
		• Cronbach's alpha = .81–.89 [W]	
	Job satisfaction questionnaire [W]	Cronbach's alpha = .84-–.88 [W]	√
	Index of Work Satisfaction [Le]	Cronbach's alpha = .80-–.90 [Le]	√
	The Provider Decision Process Assessment Instrument [G]	NR	NR
	Intention to Leave Scale [W]	NR	NR

(*Continued*)

Table 5. Continued

Outcomes measure	Instruments	Reliability	Validity
Barriers and enablers	Barriers to Research Utilization Scale [Mo]	Cronbach's alpha = .89 [Mo]	√
	A knowledge and attitude survey [S]	NR	NR

Note. *Based on The Transtheoretical Model of Health Behaviour Change, and the Advancing Research and Clinical Practice Through Close Collaboration Model (Melnyk et al., 2008). G = Gattellari, 2005; J = Johnston, 2007; Le = Levin, 2011; Lo = Lomas, 1991; Ma = Mariano, 2009; Mo = Morgan, 2012; S = Soumerai, 1998; W = Wallen, 2010. NR = not reported. √ = done.

intervention showed improved use of antiplatelet medication within 24 hours of admission ($M = 15.8\%$ vs. $M = -.4\%$, $p = .01$; Berner et al., 2003). The number of nurses who sought clinical support from mentors increased from 17 to 26 nurses at 3 months, and 33 at 6 months (Masny et al., 2008). There were no differences in the use of ECG within 20 min of arriving in emergency, beta-blockers during hospitalization, heparin use, and antiplatelet medications at discharge (Berner et al., 2003). Two studies reported no difference between groups of nurses' uptake of nonguideline-based research evidence into clinical practice (Mariano et al., 2009; Wallen et al., 2010).

Impact on practitioners. Compared to no intervention, nurses exposed to mentoring as part of a multifaceted intervention had increased self-efficacy for cancer risk counseling skills over time ($p < .001$; Masny et al., 2008). The other multifaceted study that included mentoring found no difference in nurses' job satisfaction, group cohesion, or intention to leave their positions and profession (Wallen et al., 2010).

Impact on organization. Compared to no intervention, nurses exposed to mentoring as part of a multifaceted intervention had no difference in retention (Wallen et al., 2010). Nurses' participation in mentoring as part of a multifaceted intervention also led to a 5% reduction in the prevalence of hospital acquired pressure ulcers (Morgan, 2012).

Barriers and Enablers Influencing Mentoring

Of 10 studies, four reported barriers and four reported enablers to mentoring (see Table S6, available with online version of this article). The barriers identified were staff resistance and shortage, staff lack of time, lack of knowledge and skills related to guideline recommendations, and inadequate guidance from mentors. The enablers identified were leadership support, staff involvement, and available mentors.

DISCUSSION

This systematic review is the first known synthesis of studies that measure the effectiveness of mentoring as a KT intervention. Ten studies of varying methodological quality evaluated the effectiveness of mentoring as part of multifaceted interventions. Only one study, with low risk of bias, compared a multifaceted intervention with mentoring to the same kind of intervention without mentoring. This study showed mixed effects for practitioners' behavior, with one outcome improving and others showing no difference (Berner et al., 2003). The other nine studies with mentoring as part of a multifaceted intervention showed various effects on practitioners, patients, and organizations. Of these nine, the study with consistently positive outcomes and low risk of bias used mentoring in combination with practitioners' and patients' educational materials, as well as audit and feedback (Gattellari et al., 2005). Overall, interventions with mentoring did not produce worse outcomes than controls or alternate intervention(s). Differences in intervention characteristics, such as mentoring length and frequency, may have an effect on the mixed findings observed in these studies.

Our findings can be compared and contrasted with other studies evaluating mentoring within health care. Unlike our mixed findings, some studies showed that mentees exposed to mentors consistently increased knowledge, skills, and use of EBP (Melnyk et al., 2004; Sambunjak et al., 2006). Mentoring was also consistently useful for enhancing mentees' personal and professional development (i.e., job satisfaction and productivity), and organizational outcomes (i.e., retention and recruitment; Kashiwagi, Varkey, & Cook, 2013; Melnyk, 2007). However, similar to our findings, other studies found that the use of mentoring in medical practice had mixed impacts on patients' outcomes (Augestad et al., 2013; Birch, Asiri, & de Gara, 2007).

Mentoring interventions supported the uptake of some clinical guideline recommendations in studies with unclear to low risk of bias (Berner et al., 2003; Gattellari et al., 2005; Johnston et al., 2007; Lomas et al., 1991; Masny et al., 2008; Soumerai et al., 1998). However, mentoring interventions were only shown to support the uptake of nonguideline-based research evidence in one of three studies with moderate to high quality (Levin et al., 2011; Mariano et al., 2009; Wallen et al., 2010). Nonguideline-based research evidence was often more general

and not necessarily targeted to specific issues, whereas guideline recommendations were often framed specifically around an issue, which allowed for better implementation or measuring of targeted outcomes (Turner, Misso, Harris, & Green, 2008). With so few studies evaluating nonguideline-based research evidence, it is difficult to make conclusions.

Outcomes related to conceptual and instrumental knowledge use, impact on practitioners, and barriers and enablers influencing mentoring were measured using various instruments. No instrument was used to measure mentor–mentee interaction or skills. Overall, thirteen instruments were used, with psychometric properties reported for only seven instruments. Furthermore, only three studies used the same instruments (Levin et al., 2011; Mariano et al., 2009; Wallen et al., 2010). Using consistent instruments can facilitate comparisons across studies, potentially enhancing understanding of the effectiveness of mentoring (Tian, Atkinson, Portnoy, & Lowitt, 2010).

Our understanding of mentoring within the KT context improved with the identification of three further characteristics. First, mentoring involves regular meetings over a period of time. Although studies showed regular meetings enhanced mentees' outcomes, there was little explanation of how meetings were organized (Sambunjak et al., 2010). Second, mentoring can be delivered via different approaches: individual or group meetings or e-mail. One of our included studies found that mentoring through individual meetings via telephone enhanced all measured outcomes (Gattellari et al., 2005). Mentoring delivered using a combination of individual and group meetings also improved most outcomes (Lomas et al., 1991). Consistent with other research, mentoring delivered using individual meetings enhanced practitioners' outcomes (Ploeg et al., 2008). Third, mentoring involves a selection process to match mentees and mentors. Physician mentors were selected via peers in most medical studies, while nurses' and healthcare professionals' mentors were selected via key leaders in one nursing study. The extent to which selection processes affect relationships and the uptake of evidence into practice is difficult to conclude from this review. Similar findings around selection process were reported in studies examining the effect of opinion leaders' interventions on the uptake of evidence in different healthcare settings (Flodgren et al., 2011; Grimshaw et al., 2006).

Interestingly, few of the studies reported on mentor–mentee relationships. Given that a key element of mentoring intervention is the relational aspect (LaFleur & White, 2010), understanding characteristics of mentor–mentee relationships could improve the uptake of evidence into practice. In addition, few studies reported on mentors' knowledge and skills regarding mentoring strategies and innovations. Research needs to identify effective mentor behaviors and strategies that can be used to meet mentees' individualized needs.

The act of mentoring was not consistently called mentoring in the included studies. Studies used the terms "mentoring," "opinion leaders," and "academic detailing." All terms met our definition of mentoring. The lack of a clear and well-defined taxonomy for mentoring and other social influence roles within the context of KT made determining study eligibility more challenging, as mentoring and other concepts were used synonymously. Our findings about concept confusion were similar to findings in literature reviews on facilitation (Dogherty et al., 2010) and on different concepts or roles used to support the uptake of EBP (Thompson, Estabrooks, & Degner, 2006). For example, facilitation was called different terms (e.g., "link nurses," and "opinion leaders"; Dogherty et al., 2010). A taxonomy of social influence roles would contribute to conceptual clarity.

Barriers hindering the success of mentor–mentee relationships highlighted in this review included staff resistance and shortage, lack of time, lack of knowledge and skills about guidelines, and inadequate support from mentors. These barriers are consistent with those identified in other studies exploring barriers to mentoring within the context of EBP (Gifford et al., 2013; Melnyk et al., 2004; Ploeg et al., 2008). Barriers not identified in this systematic review, but that may be relevant, include lack of incentives for mentors and lack of organizational processes to support mentees incorporating their knowledge about mentoring in organizations (Ploeg et al., 2008). Our findings about enablers (i.e., leadership support, and staff and mentor involvement) are consistent with others who identified providing educational sessions with experts and supporting mentees to practice learned skills as enablers (Melnyk et al., 2004; Ploeg et al., 2008).

LIMITATIONS

Three key limitations of this systematic review and of the included studies should be considered. First, we conducted a thorough systematic search using broad eligibility criteria, but relevant studies may have been missed due to concept confusion. Second, available studies included minimal description of mentoring interventions. Third, we may have missed relevant studies by restricting the search to English articles; however, KT studies were most likely to be conducted in English-speaking countries (Moher, Pham, Lawson, & Klassen, 2003).

IMPLICATIONS AND CONCLUSIONS

Few studies have included mentoring as a KT intervention. Those studies that include mentoring have done so as part of a multifaceted KT intervention. This review helps to fill the gap in research by identifying characteristics essential to mentoring as a KT intervention aimed at supporting the uptake of evidence into clinical practice. Mentoring as part of a multifaceted intervention had various effects on practitioners, patients, and organizations, although none were negative. Further, one of the ten studies clearly showed that mentoring, not the other elements of the multifaceted intervention, had changed some practitioners' behaviors. However, based on the studies reviewed, it is difficult to determine the effect of mentoring specifically on the uptake of evidence into practice.

Our review suggests several implications for further research, education, and clinical practice. Research is needed to understand mentoring apart from other interventions. There is a need to identify factors used to address individual mentee needs, and to explore the nature of mentor–mentee relationships and their influence on supporting the uptake of evidence. Further, studies need to better report on the mentoring intervention and psychometric properties of instruments to facilitate comparability across studies.

Mentoring has commonly been employed in clinical nursing education and in organizational change efforts (Huybrecht, Loeckx, Quaeyhaegens, De Tobel, & Mistiaen, 2011). In organizational settings, expert clinical educators and advanced practice nurses are positioned to act as mentors. They frequently provide tailored interaction with nurses via different approaches to enhance staff's involvement, knowledge, beliefs, and skills and to decrease their resistance and turnover rate. A better understanding of mentoring could allow experts to create effective KT interventions aimed at enhancing the uptake of evidence in clinical practice. **WVN**

LINKING EVIDENCE TO ACTION

When planning for mentoring to support the uptake of evidence into practice, clinical educators, advanced practice nurses, and others positioned to be mentors should consider the following:

- Plan regular meetings with mentees over a period of time.
- Deliver mentoring using the most appropriate approach (e.g., individual and/or group meetings, telephone, e-mail).
- Establish a selection process to match mentees and mentors.
- Mentoring as a KT intervention may be combined with other KT interventions (e.g., educational meetings and materials, audit, and feedback).
- Research is needed to determine the impact of mentoring on professional and patient outcomes, and the influence of the mentor–mentee relationship on outcomes.

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Ghadah Abdullah doctoral studies are funded through a scholarship from the King Abdulaziz University Hospital. The funders played no role in study design, collection, analysis, interpretation of data, writing of the report, or in the decision to submit the paper for publication. They accept no responsibility for the contents.

The authors acknowledge Anton Saarimaki, the Ottawa Hospital Research Institute (for developing the web-based screening tools used for the systematic review), Julie Wu, the Ottawa Hospital Research Institute, and Janet Jull, doctoral candidate at University of Ottawa (for duplicate data extraction).

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Accepted 23 May 2014

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doi 10.1111/wvn.12060
WVN 2014;11:284–300

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article at the publisher's web site:

Figure S1. Search strategy.
Table S2. Characteristics of Excluded Studies ($N = 52$ Studies).
Table S6. Barriers and Enablers to Mentoring ($N = 5$ Studies).