Policy framework to implement evidence-based practice: a systematic review

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Policy framework to implement evidence-based practice: a systematic review

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ABSTRACT

Objectives: Evidence-based practice (EBP) may help improve healthcare quality. However, not all healthcare professionals and managers use EBP in their daily practice. We systematically reviewed the literature to summarise self-reported appreciation of EBP and organisational infrastructure solutions proposed to promote EBP.

Design: Systematic review. Two investigators independently performed the systematic reviewing process.

Information sources: MEDLINE and Cochrane Library were sought for publications between 2000 and 2011.

Eligibility criteria for included studies: Reviews and surveys of EBP attitude, knowledge, awareness, skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.

Results: We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming. Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions were proposed at various organizational levels, including (inter)national associations and hospital management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-mentors on the wards to move EBP from the classroom to the bedside.

Conclusions: More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Article focus:

- Systematic review of the literature to summarise self-reported appreciation of evidence-based practice (EBP) and organisational infrastructure solutions proposed to promote EBP.

Key messages:

- More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient.
- Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Strength and limitations of this study:

- Worldwide overview of EBP appreciation and implementation strategies useful for all centres striving at a better EBP implementation.
- Self-reporting may have led to an overestimation of the results.
- The success of implementation strategies is still unclear.

INTRODUCTION

Evidence-Based Practice (EBP) provides a structure for the bedside use of research and consideration of patient values and preferences to optimize clinical decision-making and to improve patient care.[1 2] EBP could potentially be used to improve quality of healthcare.[3 4] In 2001, the Institute of Medicine's Quality Chasm series suggested EBP as one of the five core competencies for professional healthcare curricula.[5] More recently, the growing societal demand for quality, safety, equality and accountability of healthcare, and credentialing programs as exerted by the Joint Commission International and Magnet hospitals have further promoted EBP.[6 7] To date, hospital executive boards, insurance companies and consumers recognize EBP may help prevent unsafe or inefficient practices, as part of a strategy to achieve quality improvement in healthcare.[8]

Thus far, however, educational efforts have failed to achieve EBP at the bedside or in daily clinical problem-solving. While there is an ongoing debate on how to measure quality of care in general, attitude, awareness, knowledge or behaviour are relevant to understand application of EBP. Various questionnaires have been developed and used for this purpose (e.g. McColl, Funk). This information suggested the implementation of EBP by doctors is hampered by a perceived lack of time, knowledge or EBP resources,[9 10] while in the nursing realm EBP awareness, the body of knowledge and research utilization, as well as managerial support is yet burgeoning.[11 12] Based on these findings, many different recommendations for improvement have been proposed. Hence, it is timely to synthesise these recommendations for more structural organisational initiatives that may help overcome barriers and facilitate the uptake of EBP.

Therefore, the purpose of this study was to summarize surveys of self-reported attitude, knowledge, awareness, skills and behaviour regarding EBP among clinical doctors, nurses and managers, the barriers they report in practicing EBP, and to collect proposed recommendations for improvement. We subsequently used the findings of this review to propose a framework for implementation of EBP, tailor-made for different managerial levels and suitable to structurally facilitate and sustain evidence-based behaviour in clinical healthcare organisations.

METHODS

Literature search and study selection

Two of the authors (DTU, HV) searched the MEDLINE (using PubMed) and Cochrane databases from 2000 through 2011 for surveys or reviews of EBP attitude, knowledge, awareness, barriers and facilitators among nurses and physicians in any clinical setting. Reference lists of the included studies and reviews were checked for additional eligible papers.

Our search strategy was: (evidence-based[ti] practice OR evidence-based medicine OR EBM OR EBP) AND (questionnaire* OR survey OR inventory) AND ((barriers OR McColl) AND (knowledge OR attitude* OR aware* OR behavio*) AND (hospital* OR clinic* OR medical cent*)). No language restrictions were applied. Papers in foreign languages, if any, would be translated if necessary.

We excluded studies in an undergraduate educational setting, studies with a purely qualitative design, studies not including clinical doctors or nurses, and those focusing on a specific disorder, guideline, model or technique. We focused on surveys rather than the latter studies, because merely following (particularly expert-based) guidelines or focusing on a specific disorder or technique does not necessarily indicate the general application of the five steps of EBP. Studies before 2000 were also excluded because in these years the EBP paradigm was in an early phase with a limited dispersion among healthcare professionals. Study selection and quality assessment was performed by two investigators independently.

Quality assessment

Judgment of the quality of the surveys was based on the number of centres and respondents involved, response rates, and robustness of the questionnaires used (through pilot testing, prior validation or internal consistency based on a Cronbach's alpha).

Data items and synthesis of results

By means of a structured form two researchers independently extracted data on study characteristics (including country of origin, publication year, type and number of respondents and type of clinics included), questionnaires used and EBP characteristics studied, in particular EBP attitude, knowledge, skills, and awareness, and perceived barriers and facilitating factors for EBP implementation. We extracted in a qualitative manner the reported recommendations, if any, on how to overcome these barriers or how to exploit facilitators. These were grouped into solutions to be executed at various organisational levels. Extracted data were checked independently by a second investigator.

Meta-analysis was not planned because of the expected large range in geographical locations, caregivers investigated and questionnaires used. To summarise the results of the studies reporting on EBP-attitudes and knowledge, we calculated the medians and report the ranges of the scores given for each item, for doctors and nurses separately. A possible association between response rate, year of publication and attitude towards EBP was calculated using Spearman's correlation coefficient. Statistical analysis was performed using PASW Statistics, version 18.0 (IBM Inc., Armonk, New York, USA).

RESULTS

Study inclusion

Our search yielded 252 potentially relevant studies. We also found two recent reviews of studies on barriers towards EBP,[13 14] from which other relevant studies were derived. Some more recent studies not included in these reviews were also found by hand-searching the references of included studies. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on

nurses. Three out of the 30 studies enrolled both doctors and nurses.[15-17] Wherever possible, results from doctors and nurses are presented separately.

All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and awareness, most questionnaires used those developed by McColl, Upton or Estabrooks.[10 18 19] To assess EBP barriers and facilitators, most investigators used the Funk questionnaire.[20] Half of the studies investigated both EBP attitude and barriers.

Study characteristics

The studies enrolled from 19[21] up to 1156[15] respondents (median 273), consisting of doctors (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates varied from 9% in nationwide surveys to 100% in interviews, with a median of 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table 1).

EBP attitude

Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire. Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and appreciated the use of research evidence in daily clinical practice. However, they considered only half of their clinical practice to be evidence-based, although what they meant by this was, in most cases, not specified and unclear. These findings were consistent among the various countries. We did not find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-0.286; p=0.321) and attitude towards EBP.

EBP knowledge and skills

The majority (median 64%) of doctors and nurses reported they considered their EBP knowledge was insufficient. Similarly, a median of 70% of the respondents regarded their skills as insufficient, even in the most recent studies, and desired (more) EBP training. The percentage of doctors who had had EBP training ranged from 13% (Indian surgical trainees) to 80% (Iranian internal medicine doctors). The most appropriate way respondents thought to move towards EBP was through evidence-based guidelines (median 68%), evidence summaries (median 39%), or critical appraisal skills (median 36%). PubMed accessibility was high (at least 88%, except for India, 58%, and Jordan, 70%), either at home or at work. However, clinical decision-making was based on consulting textbooks and colleagues rather than by searching electronic databases.

Figure 2 depicts the knowledge of common EBP terms among doctors. Not all studies used the same EBP terms but in general, half of the doctors had at least some knowledge about 83% (20/24) of the presented EBP-terms. Three out of the four terms they were unfamiliar with were meaningless dummy terms. Hence, the results of this part of the questionnaire seemed not biased by socially desired answering.

Only one study examined the nurses' knowledge of EBP terms (figure 3).[17] Half of the nurses had at least some knowledge of 4 (40%) of the 10 terms presented. The dummy terms appeared more familiar than terms like 'bias', 'power calculation' and 'number needed to treat', suggesting some socially desired answering.

Awareness of common sources of evidence

About a quarter of the responding doctors used the *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two studies showed this awareness was even less among nurses.[15 17]

EBP barriers and facilitators

Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised, i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the barriers found among nurses in the systematic review by Kajermo et al.[13] These barriers are summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language barrier for non-English speaking countries and the limited access to electronic databases in some countries.

The major facilitating initiatives as desired by doctors and nurses were mostly collected through open questions (table 5). These include continuing EBP-teaching efforts in pre- and postgraduate curricula, constant involvement by colleagues in daily practice, staff and management support to learn and apply EBP in daily clinical practice, structural promotion and facilitation of EBP activities by the management, and clear and easily accessible protocols and guidelines.

Recommendations reported to implement EBP

All studies gave recommendations to overcome or address the identified barriers (Table 6). From macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific interventions at ward level, including availability of computers and internet.

A qualitative evaluation of the recommendations shows they mainly focused on education for both pre- and postgraduates. The following aspects were considered important: how and with whom to build EBP curricula, tiered education based on needs assessments, learning by interaction, and transfer of the education from the classroom to the bedside.

Regarding preconditions to strategically implement EBP, authors put emphasis on the role of the management in terms of facilitating prerequisites as well as creating a positive culture

towards EBP. They also suggested that solutions to the problems encountered when implementing EBP should start with an analysis of the organisation to identify problems at both local and organisational levels to tailor the interventions.

DISCUSSION

Our systematic review shows that worldwide many professionals in clinical healthcare welcome EBP, although the awareness of, education in, and actual bedside application of, EBP leaves room for improvement. Based on the reasons found for the limited uptake of EBP, a structural implementation of EBP in clinical healthcare organisations will require a culture change at various organisational levels, i.e. patient care, education, and management. The evidence-based policy framework of recommendations, as presented here, encompasses the wide range of possible entries to implement in a multifocal manner and sustain EBP. Because recommendations were found for virtually all levels of management, a general policy seems indicated to address and govern these EBP implementation issues. Some recommendations might also be useful as indicators to monitor the usage of EBP in daily clinical practice.

Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP is progressing,[22] important barriers are still obstructing the full implementation of EBP in daily clinical practice. These findings occur consistently among the various medical specialists and nurses alike, and in many specific settings and specialties throughout the world. However, Brown et al. found in a multiple regression analysis that perceived barriers to research use predicted only a fraction of practice, attitude and knowledge/skills associated with EBP.[23] Apparently, the most frequently encountered barriers are not necessarily the main reason for a poor implementation of EBP. Rather, a change in mind set seems indicated among the various healthcare professionals who perceive these barriers. Additional barriers to EBP implementation may lie at the organisational level.[4] Hence,

an integrative approach, involving all professionals and supported by initiatives from various organisational levels, may be a more fitting solution.

An integrative approach to overcome perceived barriers to EBP has also been suggested by other authors,[24] who reasoned that the best implementation strategy should be a multifocal, comprehensive programme involving all professionals and should be tailored to their desires and perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation strategies presented imperfect evidence to support decisions about which guideline dissemination and implementation strategies are likely to be efficient under different circumstances.[25] Opinion leaders and role models appear to have a key function.[26] A recent systematic review, comprising seven observational studies, described the relation between EBP implementation and leadership among nurses.[27] The evidence suggested that initiatives on the level of leadership, organisation and culture are pivotal for the process of implementing EBP in nursing. However, available evidence for the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.[4] In the medical realm such evidence is also limited.[28-31]

Other frameworks or multi-dimensional programs have been proposed to improve research utillisation,[12] or to stimulate the use of EBP by nurses,[32] or on specific wards.[33] Others have promoted a dedicated research agenda,[34] integrated EBP education,[30 35] or the implementation of EBP in specific medical specialties.[14 36] Clinically integrated rather than stand-alone EBP teaching initiatives have shown to improve EBP behaviour and may therefore help implement EBP in clinical practice.[37] These initiatives per se seem defective because none of these aspects can be omitted to arrive at a truly evidence-based healthcare: If EBP-education falls short, managers do not facilitate EBP activities, doctors do not apply EBP in their daily practice, or nurses are lagging behind in EBP knowledge, optimum evidence-based healthcare eventually will not (fully) reach the patients who deserve it. This has been one of the reasons why a European teaching project has started to incorporate evidence-based medicine in clinical practice.[38]

Limitations

Although not all studies found were performed in teaching hospitals, the majority may have been performed in centres that already had the aim, or were in the process of implementing EBP. Many other centres are likely to be lagging further behind. However, higher response rates were not associated with more positive attitudes towards EBP. Given the settings and types of respondents in the studies included here, the inferences of our review appear primarily valid for clinical doctors and nurses from various specialties in centres that aim at implementing EBM.

Second, the questionnaires used were self-reported and response rates varied considerably. For both reasons, our results may overestimate enthusiasm, knowledge, and uptake of EBP. On the other hand, the framework of implementation recommendations we derived from these studies will be useful for all centres striving at a better EBP implementation.

Third, in our review we searched for surveys of EBP attitude, knowledge, awareness, barriers and facilitators rather than studies specifically focusing on testing alternatives to improve implementation of EBP. Such studies, however, are rare.[4 27 31] The implementation factors these studies mentioned also became clear from our review, while the success of these implementation strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing actual EBP behaviour during daily practice.[37,39]

Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if clinicians are aware of available evidence, the right thing to do does not always happen. Continuous quality improvement strategies also involve active implementation of available evidence and existing guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the first step towards quality improvement.

Conclusion

Our review of all available surveys on the barriers for, and promotion of, EBP-activities suggesting that EBP-implementation needs a multilevel approach, involving interventions in the policy-making,

managerial, educational, and practical areas. We offer a summary of the possible interventions at these different levels. These may be used not only to implement, but also to monitor the usage of EBP in daily clinical practice. This requires a joint effort and cultural change within the whole healthcare organisation, but is likely to result in a better quality of care.

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Table 1. Characteristics of included studies

Author	Year	Country	Teaching hospital(s)	Respondents	EBP aspects studied*
Ahmadi[40]	2008	Iran	Yes	Internal medicine interns, residents and fellows	1,2,3
Al-Almaie[41]	2004	Saudi Arabia	No	Doctors from various specialties	5
Al-Omari[42]	2009	Jordan	Both	Specialists, fellows, residents from various specialties	1,2,4,5,6
Al-Omari[43]	2006	Saudi Arabia	Both	Consultant physicians from various specialties	1,2,3,5
Amin[21]	2007	Ireland	Yes	Otorhinolaryngology surgical trainees	1,4
Andersson[44]	2007	Sweden	Yes	Trainee and specialist paediatric nurses	5
Brown[45]	2009	USA	Yes	Nurses from various specialties	5,6
Brown[23]	2010	USA	Both	Nurses from various specialties	5
Chiu[15]	2010	Taiwan	No	Doctors and nurses from various specialties	1,2,5
Gale[46]	2009	USA	No	Staff nurses and nurse managers from 8 ICUs	1,5,6
Gerrish[47]	2008	UK	Both	Nurses from various specialties	5
Hadley[48]	2007	UK	No	Junior doctors	1,2
Kitto[31]	2007	Australia	No	Surgeons	5
Koehn[49]	2008	USA	No	Staff nurses, unit managers, clinical advisors	1,5
Lai[16]	2010	Malaysia	No	Doctors, nursing and allied health staff before attending EBM workshop	1,5
Melnyk[50]	2004	USA	Unknown	Nurses before attending EBP workshops	1,5
Mehrdad[51]	2008	Iran	Yes	Clinical nurses and nurse educators	5,6
Mittal[52]	2010	India	No	Surgical trainees attending continuing education meeting	1,2,3,4,5
Nwagwu[53]	2008	Nigeria	Yes	Consultants in tertiary health care institutions	2,3
Olivieri[54]	2004	Denmark	Yes	Doctors from various specialties	2,4
Oranta[55]	2002	Finland	No	Staff and ward nurses	5,6
Palfreyman[56]	2003	UK	Yes	Nurses and physiotherapists from various specialties	2,5
Parahoo[57]	2001	N-Ireland	No	Medical and surgical nurses	1,5,6
Poolman[58]	2007	Netherlands	Unknown	Orthopaedic surgeons	1,2,4
Roth[59]	2010	Canada	Unknown	English-speaking urology residents participating in national review course	2,3,4,5
Scales[60]	2008	USA	Both	American Urology Association members	1,5
Sur[61]	2006	USA	Unknown	American Urology Association members	1,3,4
Ubbink[17]	2011	Netherlands	Yes	Doctors and nurses from various specialties	1,2,3,4,5,6
Ulvenes[62]	2009	Norway	Unknown	Reference panel of Norwegian physicians	1,2
Upton[63]	2005	UK	Unknown	Doctors from various specialties	2,5,6
Veness[64]	2003	Australia & NZ	Unknown	Radiation oncologists and registrars	1,2,3,4,6

*: 1= attitude; 2= skills; 3=awareness; 4=knowledge; 5=barriers; 6=facilitators

Table 2. Quality characteristics of included studies

Author	Centres (N)	Respondents (N)	Response rate (%)	Questionnaire robustness*
Ahmadi[40]	1	104	80	±
Al-Almaie[41]	3	273	67	-
Al-Omari[42]	5	386	97	+
Al-Omari[43]	9	178	86	+
Amin[21]	countrywide	19	95	+
Andersson[44]	2	113	80	+
Brown[45]	1	458	45	+
Brown[23]	4	974	75	+
Chiu[15]	61	1156	69	+
Gale[46]	1	92	22	+
Gerrish[47]	2	598	42	+
Hadley[48]	several	317	100	+
Kitto[31]	several	25	50	±
Koehn[49]	1	422	41	+
Lai[16]	2	144	72	±
Melnyk[50]	several	160	100	±
Mehrdad[51]	15	410	70	+
Mittal[52]	22	93	85	+
Nwagwu[53]	10	89	89	-
Olivieri[54]	1	225	60	+
Oranta[55]	2	253	80	+
Palfreyman[56]	1	106	24	+
Parahoo[57]	10	479	53	+
Poolman[58]	countrywide	367	60	+
Roth[59]	several	29	100	+
Scales[60]	countrywide	365	72	+
Sur[61]	countrywide	714	9	+
Ubbink[17]	1	701	72	+
Ulvenes[62]	countrywide	976	70	-
Upton[63]	countrywide	381	76	+
Veness[64]	countrywide	191	79	+
TOTAL	**24 (77%) >1 centre**	**25 (81%) >100 respondents**	**23 (74%) ≥60% response**	**24 (77%)**

***:** Robustness based on pilot testing, previous validation, or Cronbach's alpha.

Table 3. Attitudes of doctors and nurses towards EBP. Scores can range from 0 to 100.

	Doctors Median (range)	**Nurses** Median (range)
Your current attitude towards EBP *Least positive (0) to Extremely positive (100)*	72.3 (49-97)	66.7 (55-85)
Attitude of your colleagues towards EBP *Least positive (0) to Extremely positive (100)*	61.0 (41-89)	48.0 (48-48)
How useful are research findings in daily practice? *Useless (0) to Extremely useful (100)*	80.0 (46-97)	62.0 (34-82)
What percentage of your clinical practice is evidence-based? *0% to 100%*	52.6 (40-80)	44.9 (44-46)
Practicing EBP improves patient care *Completely disagree (0) to Fully agree (100)*	80.1 (52-97)	80.7 (74-87)
EBP is of limited value in clinical practice, because a scientific basis is lacking *Completely disagree (0) to Fully agree (100)*	36.3 (3-43)	48.3 (48-49)
Implementing EBP, however worthwhile as an ideal, places another demand on already overloaded surgeons/nurses *Completely disagree (0) to Fully agree (100)*	51.4 (37-56)	55.2 (17-61)
The amount of evidence is overwhelming *Completely disagree (0) to Fully agree (100)*	53.5 (50-57)	No data
EBP fails in practice *Completely disagree (0) to Fully agree (100)*	39.7 (15-84)	41.0 (39-63)
EBP is important for my profession *Completely disagree (0) to Fully agree (100)*	68.3 (52-95)	61.6 (30-93)

Table 4. Barriers to apply EBP as mentioned by doctors and nurses. Stated are those ranked among the top ten in most studies.

Doctors and nurses alike	
• Lack of time to read evidence or implement new ideas • Lack of facilities or resources • Lack of staff experienced in EBP • Lack of training in EBP • EBP is insufficiently supported by staff and management • Evidence is not easily available • Unawareness of research • Evidence is not generalisable to own setting	
Doctors	**Nurses**
• Lack of evidence • Conflicting evidence • Evidence is not incorporated in clinical practice • EBP negatively impacts medical skills and freedom	• Evidence is written in foreign language • Lack of authority to change practice • Statistics or research is unintelligible • Implications for practice are unclear

Table 5. Major facilitating factors to apply EBP as stated by both doctors and nurses

- Workshops and courses on EBP and research
- Culture change to apply EBP in daily clinical practice
- EBP mentor or expert available
- Easy access to research papers
- Protocols and guidelines in own / English language
- Evidence on clinically relevant topics

Table 6. Structural incorporation of EBP at various levels as stated by the authors of the individual studies

LEVEL	INTERVENTION by	EFFECT	AUTHOR
Worldwide	International collaboration	Expansion and acceleration of the production and maintenance of Cochrane Systematic Reviews	Oliveri
	Global and international associations	Promotion of EBP Making EBP courses available	Olivieri Sur
	Scientific journals	Educational efforts Publishing high quality research	Poolman, Veness Scales, Sur
National	Governmental enforcement	EBP in all undergraduate and postgraduate healthcare educational institutions	Melnyk, Ubbink
	Installing and financing regulatory professional bodies	Quality assurance Practicing EBP Use of guidelines	Al-Almaie Melnyk Ubbink
	Installing and financing a national institute	Development of evidence based guidelines	Al-Almaie
	Arranging and financing	Free use of the Cochrane Library	Oliveri
	Policy makers, professional associations, health insurance companies, and regulatory bodies	Promotion of EBP	Scales, Oliveri, Poolman, Melnyk
Board of hospital directors	Incorporating EBP in strategic aims	Goals tailored on systematic evaluations Implementation of EBP and research utilization	Brown 2009, Ubbink
	Installing research councils	High-quality research	Brown 2009, Melnyk
	Allocating budget	High-quality research	Mehrdad
	Performing systematic evaluations during working visits, quarterly meetings with managers	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Incorporating performance of EBP activities by directors, managers and administrators in annual interviews	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Providing management, administrators, and directors with tools and means	Effective learning and practising EBP	Al Ohmari 2006, Lai
Managers	Integrating EBP and policy setting	Evidence-based management	Al Ohmari 2009
	Recruitment, selection, employment of new personnel Identifying EBP role-models among current personnel	EBP-minded working force	Ubbink, Brown 2010
	Building an infrastructure and environment with an atmosphere that supports, promotes and embraces EBP (i.e. incentives, prizes or rewards, positive attitude)	Effective tools for implementing, learning and practising EBP Knowledgeable (nurse) researchers, (nurse) specialists, master' prepared professionals, faculty, research departments	Al-Almaie, Al Ohmari 2006, Brown 2009, Chui, Gale, Gerrish, Melnyk, Mehrdad, Mittal, Oranta, Parahoo, Ubbink
	Collaborating with educators	Organizational barriers and education addressed	Brown 2009
	Allocating budget	(More) dedicated EBP personnel, education, activities, computers and facilities at each point of care. Attending continuous education, (inter)national conferences	Brown 2009, Gale, Gerrish, Mehrdad, Melnyk, Lai
	Provide non-patient hours to personnel	Time for EBP activities and implementation, changing practice, and quality care development	Brown 2009, Gale, Mehrad, Palfeyman
	Regular evaluation (audit and feedback) of ward-level EBP activities, knowledge, skills, behaviour and research utilization during annual interviews	Annual evaluation of implementing EBP-activities	Ahmandi, Al-Almaie, Al Ohmari 2009, Ubbink
Educators	Incorporating and inflating time spent on EBP by refining and modifying curriculum and education style in postgraduate and undergraduate medical and nursing curricula	Each non-academic degree professional produces a Cochrane Systematic review Improved audit and feedback, systematic evaluation, and needs assessment Tiered, feasible and realistic education	Ahmandi, Al-Almaie, Al-Ohmari 2006, Amin, Andersson, Brown 2009, Gale, Gerrish, Hadley, Kitto, Koehn, Lai, Mehrdad, Melnyk, Mittal, Nwagwu, Oliveri, Parahoo, Poolman, Scales, Sur, Ubbink, Upton
	Formulating the curriculum and educating in collaboration with healthcare professionals	EBP integration	Al-Almaie, Al Ohmari 2006, Brown 2009, Gale, Gerrish, Lai
	Interactive, face-to-face education in clinical practice and at the bed side	EBP integration	Ahmandi, Al-Almaie, Amin, Al Ohmari 2006, Kitto, Melnyk, Poolman
	Interactive education	E-learning modules	Kitto, Poolman, Ubbink
	EBP internship programme In-service training	Extended EBP education	Brown 2009 Gerrish

	Accessing, appraising and interpreting guidelines, research and protocols, basic statistical analysis, research training, IT-technology, quality development, change management, being a role model, English language	Optimum content of education	Al Ohmari 2006, Andersson, Gerrish, Lai, Mehrdad, Mittal, Nwagwu, Oranta, Parahoo
	Educating all educators in EBP	Well-equipped educators	Oranta
	Emphasizing professionals' own responsibility	Professional skills and competencies maintained	Oranta
	Evaluating effectiveness of EBP teaching	Optimum EBP education	Ulvenes, Veness
Faculty and researchers	Documenting, analysing and interpreting the effectiveness of actions undertaken	EBP implementation	Brown 2009
	Support professionals in clinical setting by simple and clear (written) communication	EBP implementation	Mehrdad, Brown 2009
	Using a variety of strategies	Dissemination of research findings Valorisation of results in practice	Brown 2009 Melnyk
	Close collaboration with practicing professionals	Shared language and understanding of concepts Actual relevant clinical questions are addressed	Oranta
	Being a role model	Real-life discussions about patients	Poolman
	Performing and promoting research	Well-designed high quality research	Scales, Sur
Services	Medical library facilities	Service for searching databases Clinical letters, journals and guidelines	Al Ohmari 2006, Melnyk, Mittal, Parahoo, Ubbink, Al Ohmari 2006,
	Computer and internet facilities at point of care, ward, or in EBP suites	Liberal access to databases Tailored to EBP level of professionals	Al Ohmari 2006, Gale, Lai, Mehrdad, Nwagwu, Chui, Melnyk, Ubbink
	Content management system allowing access to guidelines, protocols, critically appraised topics and condensed recommendations	User-friendly and reliable, readable and pre-appraised information Provide work-based information	Al Ohmari 2009, Gerrish, Lai, Ubbink
	Computer based decision support system with priority to systematic reviews	Computer-based guideline implementation Alerts and reminders	Al-Almaie, Al Ohmari 2009
	Accessible critical appraisal committee	Easy assessment of relevant literature	Mehrdad
	Implementation guidance	Overcomes obstacles to implement EBP or recommendation Change in practice	Chui, Mehrdad
Local workplace	Journal clubs, grand rounds, handovers, regular (research) meetings	EBP implementation	Oranta, Poolman, Ubbink
	Dedicated time and personnel for EBP activities	Individual support at the units	Andersson, Ubbink
	Easy access to EBP mentors, change mentors, innovators and educators, computers, databases, and relevant EBP websites or links	EBP implementation	Al-Almaie, Chui, Gale, Lai, Mehrdad, Ubbink, Veness
Culture	Emphasis on EBP in day-to-day practice		Amin
	Emphasis on patient benefit of EBP		Gale, Melnyk
	Sharing experience, knowledge and support		Andersson
	Activating autonomy and empower nurses to influence change		Brown 2009, Gerrish
	Shared governance structures		Brown 2009
	Engaging in research		Gerrish
	Willingness to facilitate the process of implementing		Koehn
	Innovative strategies including a culture of research implementation		Mehrdad
	Displaying interest and belief in value of research utilization		Mittal
	Enlightening professionals to use EBP in decision making		Nwagwu
	Supportive culture to research		Parahoo

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1, 2
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	n.a.
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	n.a.

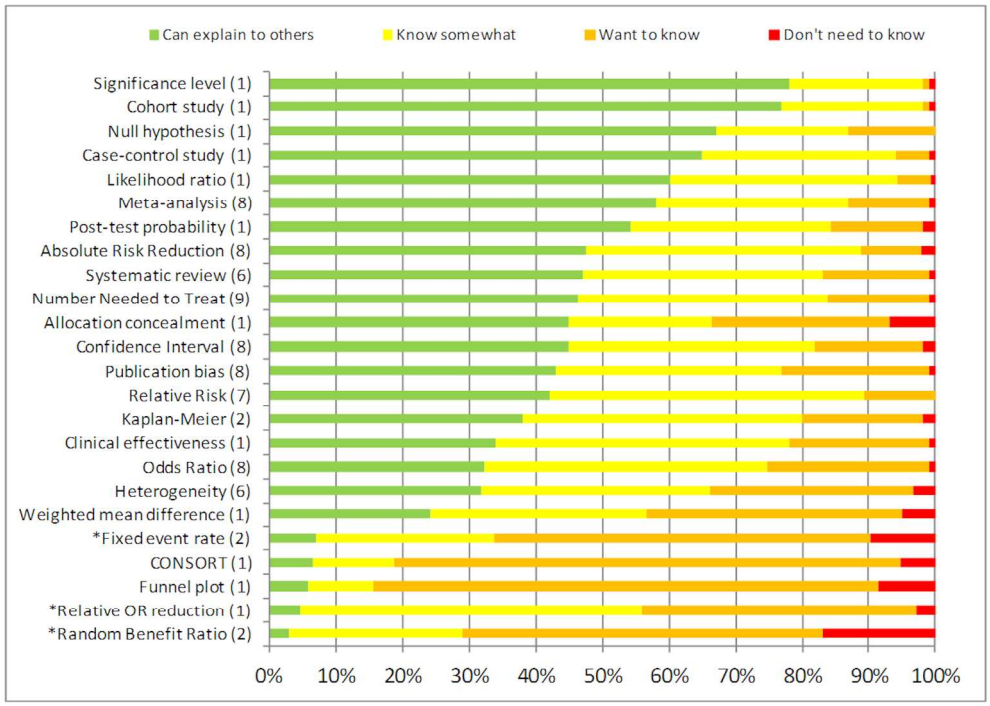
PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6, 20, 21
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	7, 21
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	22-25
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n.a.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	7
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	7
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	10, 11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	12, 13
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	13

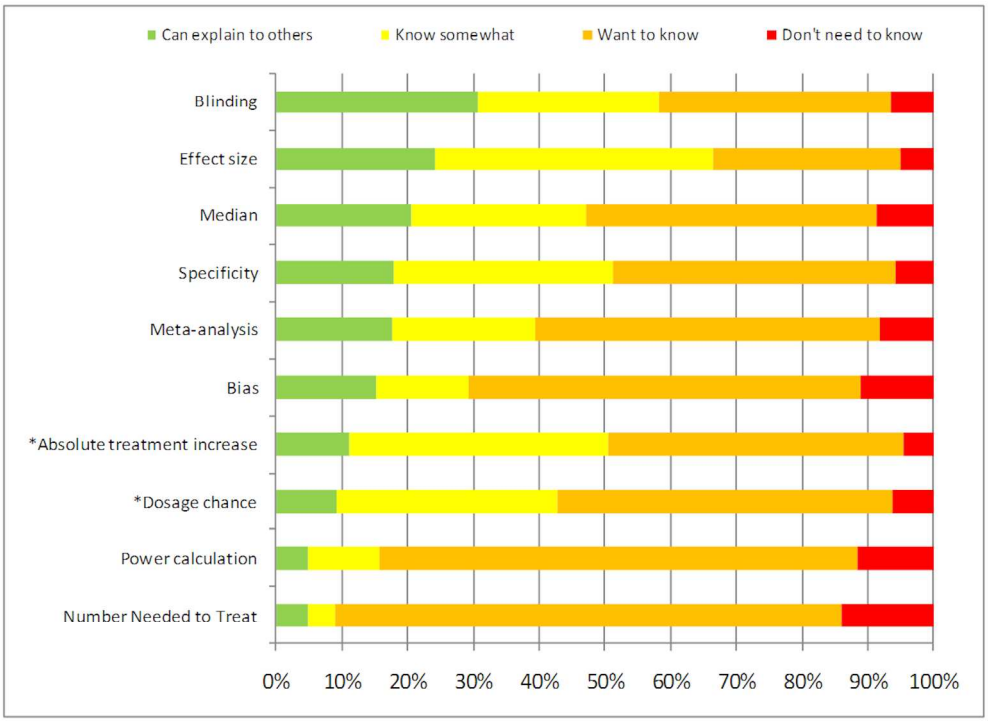
From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

Countries from which studies were included.
297x210mm (300 x 300 DPI)



Doctors' knowledge of common EBP terms. The numbers between brackets indicate the number of studies that used this term. Terms with an asterisk are meaningless dummy terms.
291x208mm (300 x 300 DPI)



Nurses' knowledge of common EBP terms. Terms with an asterisk are meaningless dummy terms.
291x211mm (300 x 300 DPI)

Framework of policy recommendations for implementation of EBP: a systematic scoping review

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Framework of policy recommendations for implementation of EBP: a systematic scoping review

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ABSTRACT

Objectives: Evidence-based practice (EBP) may help improve healthcare quality. However, not all healthcare professionals and managers use EBP in their daily practice. We systematically reviewed the literature to summarise self-reported appreciation of EBP and organisational infrastructure solutions proposed to promote EBP.

Design: Systematic review. Two investigators independently performed the systematic reviewing process.

Information sources: MEDLINE, EMBASE and Cochrane Library were searched for publications between 2000 and 2011.

Eligibility criteria for included studies: Reviews and surveys of EBP attitude, knowledge, awareness, skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.

Results: We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming. Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions were proposed at various organizational levels, including (inter)national associations and hospital management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-mentors on the wards to move EBP from the classroom to the bedside.

Conclusions: More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Article focus:

- Systematic review of the literature to summarise self-reported appreciation of evidence-based practice (EBP) and organisational infrastructure solutions proposed to promote EBP.

Key messages:

- More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient.
- Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Strength and limitations of this study:

- Worldwide overview of EBP appreciation and implementation strategies useful for all centres striving at a better EBP implementation.
- Self-reporting may have led to an overestimation of the results.
- The success of implementation strategies is still unclear.

INTRODUCTION

Evidence-Based Practice (EBP) provides a structure for the bedside use of research and consideration of patient values and preferences to optimize clinical decision-making and to improve patient care.[1 2] EBP could potentially be used to improve quality of healthcare.[3 4] In 2001, the Institute of Medicine's Quality Chasm series suggested EBP as one of the five core competencies for professional healthcare curricula.[5] More recently, the growing societal demand for quality, safety, equality and accountability of healthcare, and credentialing programs as exerted by the Joint Commission International and Magnet hospitals have further promoted EBP.[6 7] To date, hospital executive boards, insurance companies and consumers recognize EBP may help prevent unsafe or inefficient practices, as part of a strategy to achieve quality improvement in healthcare.[8]

Thus far, however, educational efforts have failed to achieve EBP at the bedside or in daily clinical problem-solving. While there is an ongoing debate on how to measure quality of care in general, attitude, awareness, knowledge or behaviour are relevant to understand application of EBP. Various questionnaires have been developed and used to appreciate these aspects (e.g. McColl, Funk).[9,10] This information suggested the implementation of EBP by doctors is hampered by a perceived lack of time, knowledge or EBP resources,[9 11] while in the nursing realm EBP awareness, the body of knowledge and research utilization, as well as managerial support are still developing.[12 13] Based on these findings, many different recommendations for improvement have been proposed. Hence, it is timely to synthesise these recommendations for more structural organisational initiatives that may help overcome barriers and facilitate the uptake of EBP.

Therefore, the purpose of this study was to collect surveys of healthcare professionals' views on EBP in terms of self-reported attitude, knowledge, awareness, skills, barriers and behaviour regarding EBP among clinical doctors, nurses and managers, and to summarise proposed recommendations as derived from these views to improve the use of EBP. We subsequently used the findings of this review to propose a framework for implementation of EBP, tailor-made for different managerial

levels and suitable to structurally facilitate and sustain evidence-based behaviour in clinical healthcare organisations.

METHODS

Literature search and study selection

Two of the authors (DTU, HV) searched the MEDLINE (using PubMed), EMBASE (using Ovid) and Cochrane databases from 2000 through 2011 for surveys or reviews of EBP attitude, knowledge, awareness, barriers and facilitators among nurses, physicians and managers in any clinical setting, i.e. hospitals or other healthcare institutions, rather than general practice settings, on which a review has recently been published.[14] Reference lists of the included studies and reviews were checked for additional eligible papers.

In brief, our search strategy was: (evidence-based[ti] practice OR evidence-based medicine OR EBM OR EBP) AND (questionnaire* OR survey OR inventory) AND ((barriers OR McColl) AND (knowledge OR attitude* OR aware* OR behavio*) AND (hospital* OR clinic* OR medical cent*)). No language restrictions were applied. Papers in foreign languages, if any, would be translated if possible.

We excluded studies in an undergraduate educational setting, studies with a purely qualitative design, studies not including clinical doctors or nurses, and those focusing on a specific disorder, guideline, model or technique. We focused on surveys rather than the latter studies, because merely following (particularly expert-based) guidelines or focusing on a specific disorder or technique does not necessarily indicate the general application of the five steps of EBP. Studies before 2000 were also excluded because in these years the EBP paradigm was in an early phase with a limited dispersion among healthcare professionals. Study selection and quality assessment was performed by two investigators independently.

Quality assessment

Judgment of the quality of the surveys was based on the number of centres and respondents involved, response rates, and robustness of the questionnaires used (through pilot testing, prior validation or internal consistency based on a Cronbach's alpha).

Data items and synthesis of results

By means of a structured form two researchers independently extracted data on study characteristics (including country of origin, publication year, type and number of respondents and type of clinics included), questionnaires used and EBP characteristics studied, in particular EBP attitude, knowledge, skills, and awareness, and perceived barriers and facilitating factors for EBP implementation. We extracted in a qualitative manner the reported recommendations, if any, on how to overcome these barriers or how to exploit facilitators. These were grouped into solutions to be executed at various organisational levels. After one investigator had entered the data in the database, these data were checked for accuracy by a second.

Meta-analysis was not planned because of the expected large range in geographical locations, caregivers investigated and questionnaires used. To summarise the results of the studies reporting on EBP-attitudes and knowledge, we calculated the medians and report the ranges of the scores given for each item, for doctors and nurses separately. A possible association between response rate, year of publication and attitude towards EBP was calculated using Spearman's correlation coefficient. Statistical analysis was performed using PASW Statistics, version 18.0 (IBM Inc., Armonk, New York, USA).

RESULTS

Study inclusion

Our search yielded 286 potentially relevant studies. We also found two recent reviews of studies on barriers towards EBP,[15 16] from which other relevant studies were derived. Some more recent studies not included in these reviews were also found by hand-searching the references of included studies.

Four surveys among medical postgraduates were excluded because these publications were in Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on nurses. Three out of the 31 studies enrolled both doctors and nurses.[17-19] Wherever possible, results from doctors and nurses are presented separately.

All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and awareness, most studies used the questionnaires developed by McColl, Upton or Estabrooks.[9 20 21] To assess EBP barriers and facilitators, most investigators used the Funk questionnaire.[10] Half of the studies investigated both EBP attitude and barriers.

Study characteristics

The studies enrolled from 19[22] up to 1156[17] respondents (median 273), consisting of doctors (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates varied from 9% in nationwide surveys to 100% in questionnaires during trainings, with a median of 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table 1).

EBP attitude

Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire. Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and appreciated the use of research evidence in daily clinical practice. However, they considered only half

of their clinical practice to be evidence-based, although what they meant by this was, in most cases, not specified and unclear. These findings were consistent among the various countries. We did not find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-0.286; p=0.321) and attitude towards EBP.

EBP knowledge and skills

The majority (median 64%) of doctors and nurses reported they considered their EBP knowledge was insufficient. Similarly, a median of 70% of the respondents regarded their skills as insufficient, even in the most recent studies, and desired (more) EBP training. The percentage of doctors who had had EBP training ranged from 13% (Indian surgical trainees) to 80% (Iranian internal medicine doctors). The most appropriate way respondents thought to move towards EBP was through evidence-based guidelines (median 68%), evidence summaries (median 39%), or critical appraisal skills (median 36%). PubMed accessibility was high (at least 88%, except for India, 58%, and Jordan, 70%), either at home or at work. However, clinical decision-making was based on consulting textbooks and colleagues rather than by searching electronic databases.

Figure 2 depicts the knowledge of common EBP terms among doctors. Not all studies used the same EBP terms but in general, half of the doctors had at least some knowledge about 83% (20/24) of the presented EBP-terms. Three out of the four terms they were unfamiliar with were meaningless dummy terms. Hence, the results of this part of the questionnaire seemed not biased by socially desired answering.

Only one study examined the nurses' knowledge of EBP terms (figure 3).[19] Half of the nurses had at least some knowledge of 4 (40%) of the 10 terms presented. The dummy terms appeared more familiar than terms like 'bias', 'power calculation' and 'number needed to treat', suggesting some socially desired answering.

Awareness of common sources of evidence

Eight studies addressed this issue (table 1). About a quarter of the responding doctors used the *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two studies showed this awareness was even less among nurses.[17 19]

EBP barriers and facilitators

Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised, i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the barriers found among nurses in the systematic review by Kajermo et al.[15] These barriers are summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language barrier for non-English speaking countries and the limited access to electronic databases in some countries.

The major facilitating initiatives as desired by doctors and nurses were mostly collected through open questions. These facilitators include continuing EBP-teaching efforts in pre- and postgraduate curricula, constant involvement by colleagues in daily practice, staff and management support to learn and apply EBP in daily clinical practice, structural promotion and facilitation of EBP activities by the management and experts, and clear and easily accessible sources of evidence, protocols and guidelines.

Recommendations reported to implement EBP

All studies gave recommendations to overcome or address the identified barriers (Table 5). From macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various

solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific interventions at ward level, including availability of computers and internet.

A qualitative evaluation of the recommendations shows they mainly focused on education for both pre- and postgraduates. The following aspects were considered important: how and with whom to build EBP curricula, tiered education based on needs assessments, learning by interaction, and transfer of the education from the classroom to the bedside.

Regarding preconditions to strategically implement EBP, authors put emphasis on the role of the management in terms of facilitating prerequisites as well as creating a positive culture towards EBP. They also suggested that solutions to the problems encountered when implementing EBP should start with an analysis of the organisation to identify problems at both local and organisational levels to tailor the interventions.

DISCUSSION

Our systematic review shows that worldwide many professionals in clinical healthcare welcome EBP, although the awareness of, education in, and actual bedside application of, EBP leaves room for improvement. Based on the reasons given for the limited uptake of EBP, a structural implementation of EBP in clinical healthcare organisations will require a culture change at various organisational levels, i.e. patient care, education, and management. The framework of policy recommendations, as presented here, encompasses the wide range of possible entries to implement in a multifocal manner and sustain EBP. Because recommendations were found for virtually all levels of management, a general policy seems indicated to address and govern these EBP implementation issues. Some recommendations might also be useful as indicators to monitor the usage of EBP in daily clinical practice.

Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP is progressing,[23] important barriers are still obstructing the full implementation of EBP in daily clinical practice. These findings occur consistently among the various medical specialists and nurses alike, and in many specific settings and specialties throughout the world. However, Brown et al. found in a multiple regression analysis that perceived barriers to research use predicted only a fraction of practice, attitude and knowledge/skills associated with EBP.[24] Apparently, the most frequently encountered barriers are not necessarily the main reason for a poor implementation of EBP. Rather, a change in mind set seems indicated among the various healthcare professionals who perceive these barriers. Additional barriers to EBP implementation may lie at the organisational level.[4] Hence, an integrative approach, involving all professionals and supported by initiatives from various organisational levels, may be a more fitting solution.

An integrative approach to overcome perceived barriers to EBP has also been suggested by other authors,[25] who reasoned that the best implementation strategy should be a multifocal, comprehensive programme involving all professionals and should be tailored to their desires and perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation strategies presented imperfect evidence to support decisions about which guideline dissemination and implementation strategies are likely to be efficient under different circumstances.[26] Opinion leaders and role models appear to have a key function.[27] A recent systematic review, comprising seven observational studies, described the relation between EBP implementation and leadership among nurses.[28] The evidence suggested that initiatives on the level of leadership, organisation and culture are pivotal for the process of implementing EBP in nursing. However, available evidence for the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.[4] In the medical realm such evidence is also limited.[29-32]

Other frameworks or multi-dimensional programs have been proposed to improve research utillisation,[13] or to stimulate the use of EBP by nurses,[33] or on specific wards.[34] Others have promoted a dedicated research agenda,[35] integrated EBP education,[31 36] or the implementation of EBP in

specific medical specialties.[16 37] Clinically integrated rather than stand-alone EBP teaching initiatives have shown to improve EBP behaviour and may therefore help implement EBP in clinical practice.[38] These initiatives per se seem defective because none of these aspects can be omitted to arrive at a truly evidence-based healthcare: If EBP-education falls short, managers do not facilitate EBP activities, doctors do not apply EBP in their daily practice, or nurses are lagging behind in EBP knowledge, optimum evidence-based healthcare eventually will not (fully) reach the patients who deserve it. This has been one of the reasons why a European teaching project has started to incorporate evidence-based medicine in clinical practice.[39]

Limitations

Although not all studies found were performed in teaching hospitals, the majority may have been performed in centres that already had the aim, or were in the process of implementing EBP. Many other centres are likely to be lagging further behind. However, higher response rates were not associated with more positive attitudes towards EBP. Given the settings and types of respondents in the studies included here, the inferences of our review appear primarily valid for clinical doctors and nurses from various specialties in centres that aim at implementing EBM.

Second, the questionnaires used were self-reported and response rates varied considerably. For both reasons, our results may overestimate enthusiasm, knowledge, and uptake of EBP. On the other hand, the framework of implementation recommendations we derived from these studies may be useful for all centres striving at a better EBP implementation.

Third, in our review we searched for surveys of EBP attitude, knowledge, awareness, barriers and facilitators rather than studies specifically focusing on testing alternatives to improve implementation of EBP. Such studies, however, are rare.[4 28 32] The implementation factors these studies mentioned also became clear from our review, while the success of these implementation strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing actual EBP behaviour during daily practice.[38 40 41]

Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if clinicians are aware of available evidence, the right thing to do does not always happen. Continuous quality improvement strategies also involve active implementation of available evidence and existing guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the first step towards quality improvement.

Conclusion

Our review of all available surveys on the barriers for, and promotion of, EBP-activities as perceived by clinical doctors and nurses suggests that EBP-implementation needs a multilevel approach, involving interventions in the policy-making, managerial, educational, and practical areas. We offer a summary of the suggested interventions at these different levels. These may be used not only to implement, but also to monitor the usage of EBP in daily clinical practice. This requires a joint effort and cultural change within the whole healthcare organisation, but is likely to result in a better quality of care.

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Table 1. Characteristics of included studies

Author	Year	Country	Teaching hospital(s)	Respondents	EBP aspects studied*
Ahmadi[42]	2008	Iran	Yes	Internal medicine interns, residents and fellows	1,2,3
Al-Almaie[43]	2004	Saudi Arabia	No	Doctors from various specialties	5
Al-Omari[44]	2009	Jordan	Both	Specialists, fellows, residents from various specialties	1,2,4,5,6
Al-Omari[45]	2006	Saudi Arabia	Both	Consultant physicians from various specialties	1,2,3,5
Amin[22]	2007	Ireland	Yes	Otorhinolaryngology surgical trainees	1,4
Andersson[46]	2007	Sweden	Yes	Trainee and specialist paediatric nurses	5
Brown[47]	2009	USA	Yes	Nurses from various specialties	5,6
Brown[24]	2010	USA	Both	Nurses from various specialties	5
Chiu[17]	2010	Taiwan	No	Doctors and nurses from various specialties	1,2,5
Gale[48]	2009	USA	No	Staff nurses and nurse managers from 8 ICUs	1,5,6
Gerrish[49]	2008	UK	Both	Nurses from various specialties	5
Hadley[50]	2007	UK	No	Junior doctors	1,2
Kitto[32]	2007	Australia	No	Surgeons	5
Koehn[51]	2008	USA	No	Staff nurses, unit managers, clinical advisors	1,5
Lai[18]	2010	Malaysia	No	Doctors, nursing and allied health staff before attending EBM workshop	1,5
Melnyk[52]	2004	USA	Unknown	Nurses before attending EBP workshops	1,5
Mehrdad[53]	2008	Iran	Yes	Clinical nurses and nurse educators	5,6
Mittal[54]	2010	India	No	Surgical trainees attending continuing education meeting	1,2,3,4,5
Nwagwu[55]	2008	Nigeria	Yes	Consultants in tertiary health care institutions	2,3
Olivieri[56]	2004	Denmark	Yes	Doctors from various specialties	2,4
Oranta[57]	2002	Finland	No	Staff and ward nurses	5,6
Palfreyman[58]	2003	UK	Yes	Nurses and physiotherapists from various specialties	2,5
Parahoo[59]	2001	N-Ireland	No	Medical and surgical nurses	1,5,6
Poolman[60]	2007	Netherlands	Unknown	Orthopaedic surgeons	1,2,4
Roth[61]	2010	Canada	Unknown	English-speaking urology residents participating in national review course	2,3,4,5
Scales[62]	2008	USA	Both	American Urology Association members	1,5
Sur[63]	2006	USA	Unknown	American Urology Association members	1,3,4
Ubbink[19]	2011	Netherlands	Yes	Doctors and nurses from various specialties	1,2,3,4,5,6
Ulvenes[64]	2009	Norway	Unknown	Reference panel of Norwegian physicians	1,2
Upton[65]	2005	UK	Unknown	Doctors from various specialties	2,5,6
Veness[66]	2003	Australia & NZ	Unknown	Radiation oncologists and registrars	1,2,3,4,6

*: 1= attitude; 2= skills; 3=awareness; 4=knowledge; 5=barriers; 6=facilitators

Table 2. Quality characteristics of included studies

Author	Centres (N)	Respondents (N)	Response rate (%)	Questionnaire robustness*
Ahmadi[42]	1	104	80	+
Al-Almaie[43]	3	273	67	-
Al-Omari[44]	5	386	97	++
Al-Omari[45]	9	178	86	++
Amin[22]	countrywide	19	95	++
Andersson[46]	2	113	80	++
Brown[47]	1	458	45	++
Brown[24]	4	974	75	++
Chiu[17]	61	1156	69	++
Gale[48]	1	92	22	++
Gerrish[49]	2	598	42	++
Hadley[50]	several	317	100	++
Kitto[32]	several	25	50	+
Koehn[51]	1	422	41	++
Lai[18]	2	144	72	+
Melnyk[52]	several	160	100	+
Mehrdad[53]	15	410	70	++
Mittal[54]	22	93	85	++
Nwagwu[55]	10	89	89	-
Olivieri[56]	1	225	60	++
Oranta[57]	2	253	80	++
Palfreyman[58]	1	106	24	++
Parahoo[59]	10	479	53	++
Poolman[60]	countrywide	367	60	++
Roth[61]	several	29	100	++
Scales[62]	countrywide	365	72	++
Sur[63]	countrywide	714	9	++
Ubbink[19]	1	701	72	++
Ulvenes[64]	countrywide	976	70	-
Upton[65]	countrywide	381	76	++
Veness[66]	countrywide	191	79	++
TOTAL	**24 (77%) >1 centre**	**25 (81%) >100 respondents**	**23 (74%) ≥60% response**	**24 (77%)**

***:** Robustness based on pilot testing, previous validation, or Cronbach's alpha.

Table 3. Attitudes of doctors and nurses towards EBP. Scores can range from 0 to 100.

	Doctors Median (range)	**Nurses** Median (range)
Your current attitude towards EBP *Least positive (0) to Extremely positive (100)*	72.3 (49-97)	66.7 (55-85)
Attitude of your colleagues towards EBP *Least positive (0) to Extremely positive (100)*	61.0 (41-89)	48.0 (48-48)
How useful are research findings in daily practice? *Useless (0) to Extremely useful (100)*	80.0 (46-97)	62.0 (34-82)
What percentage of your clinical practice is evidence-based? *0% to 100%*	52.6 (40-80)	44.9 (44-46)
Practicing EBP improves patient care *Completely disagree (0) to Fully agree (100)*	80.1 (52-97)	80.7 (74-87)
EBP is of limited value in clinical practice, because a scientific basis is lacking *Completely disagree (0) to Fully agree (100)*	36.3 (3-43)	48.3 (48-49)
Implementing EBP, however worthwhile as an ideal, places another demand on already overloaded surgeons/nurses *Completely disagree (0) to Fully agree (100)*	51.4 (37-56)	55.2 (17-61)
The amount of evidence is overwhelming *Completely disagree (0) to Fully agree (100)*	53.5 (50-57)	No data
EBP fails in practice *Completely disagree (0) to Fully agree (100)*	39.7 (15-84)	41.0 (39-63)
EBP is important for my profession *Completely disagree (0) to Fully agree (100)*	68.3 (52-95)	61.6 (30-93)

Table 4. Barriers to apply EBP as mentioned by doctors and nurses. Stated are those ranked among the top ten in most studies.

Doctors and nurses alike	
• Lack of time to read evidence or implement new ideas • Lack of facilities or resources • Lack of staff experienced in EBP • Lack of training in EBP • EBP is insufficiently supported by staff and management • Evidence is not easily available • Unawareness of research • Evidence is not generalisable to own setting	
Doctors	**Nurses**
• Lack of evidence • Conflicting evidence • Evidence is not incorporated in clinical practice • EBP negatively impacts medical skills and freedom	• Evidence is written in foreign language • Lack of authority to change practice • Statistics or research is unintelligible • Implications for practice are unclear

1

2

3

4

Table 5. Structural incorporation of EBP at various levels as stated by the authors of the individual studies

LEVEL	INTERVENTION by	EFFECT	AUTHOR
Worldwide	International collaboration	Expansion and acceleration of the production and maintenance of Cochrane Systematic Reviews	Oliveri
	Global and international associations	Promotion of EBP Making EBP courses available	Olivieri Sur
	Scientific journals	Educational efforts Publishing high quality research	Poolman, Veness Scales, Sur
National	Governmental enforcement	EBP in all undergraduate and postgraduate healthcare educational institutions	Melnyk, Ubbink
	Installing and financing regulatory professional bodies	Quality assurance Practicing EBP Use of guidelines	Al-Almaie Melnyk Ubbink
	Installing and financing a national institute	Development of evidence based guidelines	Al-Almaie
	Arranging and financing	Free use of the Cochrane Library	Oliveri
	Policy makers, professional associations, health insurance companies, and regulatory bodies	Promotion of EBP	Scales, Oliveri, Poolman, Melnyk
Board of hospital directors	Incorporating EBP in strategic aims	Goals tailored on systematic evaluations Implementation of EBP and research utilization	Brown 2009, Ubbink
	Installing research councils	High-quality research	Brown 2009, Melnyk
	Allocating budget	High-quality research	Mehrdad
	Performing systematic evaluations during working visits, quarterly meetings with managers	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Incorporating performance of EBP activities by directors, managers and administrators in annual interviews	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Providing management, administrators, and directors with tools and means	Effective learning and practising EBP	Al Ohmari 2006, Lai
Managers	Integrating EBP and policy setting	Evidence-based management	Al Ohmari 2009
	Recruitment, selection, employment of new personnel Identifying EBP role-models among current personnel	EBP-minded working force	Ubbink, Brown 2010
	Building an infrastructure and environment with an atmosphere that supports, promotes and embraces EBP (i.e. incentives, prizes or rewards, positive attitude)	Effective tools for implementing, learning and practising EBP Knowledgeable (nurse) researchers, (nurse) specialists, master' prepared professionals, faculty, research departments	Al-Almaie, Al Ohmari 2006, Brown 2009, Chui, Gale, Gerrish, Melnyk, Mehrdad, Mittal, Oranta, Parahoo, Ubbink
	Collaborating with educators	Organizational barriers and education addressed	Brown 2009
	Allocating budget	(More) dedicated EBP personnel, education, activities, computers and facilities at each point of care. Attending continuous education, (inter)national conferences	Brown 2009, Gale, Gerrish, Mehrdad, Melnyk, Lai
	Provide non-patient hours to personnel	Time for EBP activities and implementation, changing practice, and quality care development	Brown 2009, Gale, Mehrad, Palfeyman
	Regular evaluation (audit and feedback) of ward-level EBP activities, knowledge, skills, behaviour and research utilization during annual interviews	Annual evaluation of implementing EBP-activities	Ahmandi, Al-Almaie, Al Ohmari 2009, Ubbink
Educators	Incorporating and inflating time spent on EBP by refining and modifying curriculum and education style in postgraduate and undergraduate medical and nursing curricula	Each non-academic degree professional produces a Cochrane Systematic review Improved audit and feedback, systematic evaluation, and needs assessment Tiered, feasible and realistic education	Ahmandi, Al-Almaie, Al-Ohmari 2006, Amin, Andersson, Brown 2009, Gale, Gerrish, Hadley, Kitto, Koehn, Lai, Mehrdad, Melnyk, Mittal, Nwagwu, Oliveri, Parahoo, Poolman, Scales, Sur, Ubbink, Upton
	Formulating the curriculum and educating in collaboration with healthcare professionals	EBP integration	Al-Almaie, Al Ohmari 2006, Brown 2009, Gale, Gerrish, Lai
	Interactive, face-to-face education in clinical practice and at the bed side	EBP integration	Ahmandi, Al-Almaie, Amin, Al Ohmari 2006, Kitto, Melnyk, Poolman
	Interactive education	E-learning modules	Kitto, Poolman, Ubbink
	EBP internship programme In-service training	Extended EBP education	Brown 2009 Gerrish

	Accessing, appraising and interpreting guidelines, research and protocols, basic statistical analysis, research training, IT-technology, quality development, change management, being a role model, English language	Optimum content of education	Al Ohmari 2006, Andersson, Gerrish, Lai, Mehrdad, Mittal, Nwagwu, Oranta, Parahoo
	Educating all educators in EBP	Well-equipped educators	Oranta
	Emphasizing professionals' own responsibility	Professional skills and competencies maintained	Oranta
	Evaluating effectiveness of EBP teaching	Optimum EBP education	Ulvenes, Veness
Faculty and researchers	Documenting, analysing and interpreting the effectiveness of actions undertaken	EBP implementation	Brown 2009
	Support professionals in clinical setting by simple and clear (written) communication	EBP implementation	Mehrdad, Brown 2009
	Using a variety of strategies	Dissemination of research findings Valorisation of results in practice	Brown 2009 Melnyk
	Close collaboration with practicing professionals	Shared language and understanding of concepts Actual relevant clinical questions are addressed	Oranta
	Being a role model	Real-life discussions about patients	Poolman
	Performing and promoting research	Well-designed high quality research	Scales, Sur
Services	Medical library facilities	Service for searching databases Clinical letters, journals and guidelines	Al Ohmari 2006, Melnyk, Mittal, Parahoo, Ubbink, Al Ohmari 2006,
	Computer and internet facilities at point of care, ward, or in EBP suites	Liberal access to databases Tailored to EBP level of professionals	Al Ohmari 2006, Gale, Lai, Mehrdad, Nwagwu, Chui, Melnyk, Ubbink
	Content management system allowing access to guidelines, protocols, critically appraised topics and condensed recommendations	User-friendly and reliable, readable and pre-appraised information Provide work-based information	Al Ohmari 2009, Gerrish, Lai, Ubbink
	Computer based decision support system with priority to systematic reviews	Computer-based guideline implementation Alerts and reminders	Al-Almaie, Al Ohmari 2009
	Accessible critical appraisal committee	Easy assessment of relevant literature	Mehrdad
	Implementation guidance	Overcomes obstacles to implement EBP or recommendation Change in practice	Chui, Mehrdad
Local workplace	Journal clubs, grand rounds, handovers, regular (research) meetings	EBP implementation	Oranta, Poolman, Ubbink
	Dedicated time and personnel for EBP activities	Individual support at the units	Andersson, Ubbink
	Easy access to EBP mentors, change mentors, innovators and educators, computers, databases, and relevant EBP websites or links	EBP implementation	Al-Almaie, Chui, Gale, Lai, Mehrdad, Ubbink, Veness
Culture	Emphasis on EBP in day-to-day practice		Amin
	Emphasis on patient benefit of EBP		Gale, Melnyk
	Sharing experience, knowledge and support		Andersson
	Activating autonomy and empower nurses to influence change		Brown 2009, Gerrish
	Shared governance structures		Brown 2009
	Engaging in research		Gerrish
	Willingness to facilitate the process of implementing		Koehn
	Innovative strategies including a culture of research implementation		Mehrdad
	Displaying interest and belief in value of research utilization		Mittal
	Enlightening professionals to use EBP in decision making		Nwagwu
	Supportive culture to research		Parahoo

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~~Policy framework to implement evidence-based practice~~Framework of policy recommendations for implementation of EBP: a systematic scoping review

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ABSTRACT

Objectives: Evidence-based practice (EBP) may help improve healthcare quality. However, not all healthcare professionals and managers use EBP in their daily practice. We systematically reviewed the literature to summarise self-reported appreciation of EBP and organisational infrastructure solutions proposed to promote EBP.

Design: Systematic review. Two investigators independently performed the systematic reviewing process.

Information sources: MEDLINE, EMBASE and Cochrane Library were searched~~ought~~ for publications between 2000 and 2011.

Eligibility criteria for included studies: Reviews and surveys of EBP attitude, knowledge, awareness, skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.

Results: We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming. Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions were proposed at various organizational levels, including (inter)national associations and hospital management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-mentors on the wards to move EBP from the classroom to the bedside.

Conclusions: More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Article focus:

- Systematic review of the literature to summarise self-reported appreciation of evidence-based practice (EBP) and organisational infrastructure solutions proposed to promote EBP.

Key messages:

- More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient.
- Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Strength and limitations of this study:

- Worldwide overview of EBP appreciation and implementation strategies useful for all centres striving at a better EBP implementation.
- Self-reporting may have led to an overestimation of the results.
- The success of implementation strategies is still unclear.

INTRODUCTION

Evidence-Based Practice (EBP) provides a structure for the bedside use of research and consideration of patient values and preferences to optimize clinical decision-making and to improve patient care.[1 2] EBP could potentially be used to improve quality of healthcare.[3 4] In 2001, the Institute of Medicine's Quality Chasm series suggested EBP as one of the five core competencies for professional healthcare curricula.[5] More recently, the growing societal demand for quality, safety, equality and accountability of healthcare, and credentialing programs as exerted by the Joint Commission International and Magnet hospitals have further promoted EBP.[6 7] To date, hospital executive boards, insurance companies and consumers recognize EBP may help prevent unsafe or inefficient practices, as part of a strategy to achieve quality improvement in healthcare.[8]

Thus far, however, educational efforts have failed to achieve EBP at the bedside or in daily clinical problem-solving. While there is an ongoing debate on how to measure quality of care in general, attitude, awareness, knowledge or behaviour are relevant to understand application of EBP. Various questionnaires have been developed and used to appreciate these aspects~~for this purpose~~ (e.g. McColl, Funk).[9,10] This information suggested the implementation of EBP by doctors is hampered by a perceived lack of time, knowledge or EBP resources,[9 10~~1~~] while in the nursing realm EBP awareness, the body of knowledge and research utilization, as well as managerial support ~~is~~ are still developing~~yet burgeoning~~.[11~~2~~ 12~~3~~] Based on these findings, many different recommendations for improvement have been proposed. Hence, it is timely to synthesise these recommendations for more structural organisational initiatives that may help overcome barriers and facilitate the uptake of EBP.

Therefore, the purpose of this study was to collect surveys of healthcare professionals' views on EBP in terms ~~summarize surveys~~ of self-reported attitude, knowledge, awareness, skills, barriers and behaviour regarding EBP among clinical doctors, nurses and managers, and ~~the barriers they report in practicing EBP, and to collect~~ to summarise proposed recommendations as derived from these views to improve the use of EBP.~~for improvement.~~ We subsequently used the findings of this review

to propose a framework for implementation of EBP, tailor-made for different managerial levels and suitable to structurally facilitate and sustain evidence-based behaviour in clinical healthcare organisations.

METHODS

Literature search and study selection

Two of the authors (DTU, HV) searched the MEDLINE (using PubMed), EMBASE (using Ovid) and Cochrane databases from 2000 through 2011 for surveys or reviews of EBP attitude, knowledge, awareness, barriers and facilitators among nurses, ~~and~~ physicians and managers in any clinical setting, i.e. hospitals or other healthcare institutions, rather than general practice settings, on which a review has recently been published.[14] ~~.~~ Reference lists of the included studies and reviews were checked for additional eligible papers.

In brief, o~~O~~ur search strategy was: (evidence-based[ti] practice OR evidence-based medicine OR EBM OR EBP) AND (questionnaire* OR survey OR inventory) AND ((barriers OR McColl) AND (knowledge OR attitude* OR aware* OR behavio*) AND (hospital* OR clinic* OR medical cent*)). No language restrictions were applied. Papers in foreign languages, if any, would be translated if possible~~necessary~~.

We excluded studies in an undergraduate educational setting, studies with a purely qualitative design, studies not including clinical doctors or nurses, and those focusing on a specific disorder, guideline, model or technique. We focused on surveys rather than the latter studies, because merely following (particularly expert-based) guidelines or focusing on a specific disorder or technique does not necessarily indicate the general application of the five steps of EBP. Studies before 2000 were also excluded because in these years the EBP paradigm was in an early phase with a limited dispersion among healthcare professionals. Study selection and quality assessment was performed by two investigators independently.

Quality assessment

Judgment of the quality of the surveys was based on the number of centres and respondents involved, response rates, and robustness of the questionnaires used (through pilot testing, prior validation or internal consistency based on a Cronbach's alpha).

Data items and synthesis of results

By means of a structured form two researchers independently extracted data on study characteristics (including country of origin, publication year, type and number of respondents and type of clinics included), questionnaires used and EBP characteristics studied, in particular EBP attitude, knowledge, skills, and awareness, and perceived barriers and facilitating factors for EBP implementation. We extracted in a qualitative manner the reported recommendations, if any, on how to overcome these barriers or how to exploit facilitators. These were grouped into solutions to be executed at various organisational levels. After one investigator had entered the data in the database, these dataExtracted data were checked for accuracyindependently by a second. investigator. Meta-analysis was not planned because of the expected large range in geographical locations, caregivers investigated and questionnaires used. To summarise the results of the studies reporting on EBP-attitudes and knowledge, we calculated the medians and report the ranges of the scores given for each item, for doctors and nurses separately. A possible association between response rate, year of publication and attitude towards EBP was calculated using Spearman's correlation coefficient. Statistical analysis was performed using PASW Statistics, version 18.0 (IBM Inc., Armonk, New York, USA).

RESULTS

Study inclusion

Our search yielded 28652 potentially relevant studies. We also found two recent reviews of studies on barriers towards EBP,[15 46] from which other relevant studies were derived. Some more recent

studies not included in these reviews were also found by hand-searching the references of included studies. Four surveys among medical postgraduates were excluded because these publications were in Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on nurses. Three out of the 301 studies enrolled both doctors and nurses.[175-179] Wherever possible, results from doctors and nurses are presented separately.

All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and awareness, most studiesquestionnaires used those questionnaires developed by McColl, Upton or Estabrooks.[109 1820 1921] To assess EBP barriers and facilitators, most investigators used the Funk questionnaire.[120] Half of the studies investigated both EBP attitude and barriers.

Study characteristics

The studies enrolled from 19[212] up to 1156[157] respondents (median 273), consisting of doctors (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates varied from 9% in nationwide surveys to 100% in interviewsquestionnaires during trainings, with a median of 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table 1).

EBP attitude

Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire. Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and

appreciated the use of research evidence in daily clinical practice. However, they considered only half of their clinical practice to be evidence-based, although what they meant by this was, in most cases, not specified and unclear. These findings were consistent among the various countries. We did not find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-0.286; p=0.321) and attitude towards EBP.

EBP knowledge and skills

The majority (median 64%) of doctors and nurses reported they considered their EBP knowledge was insufficient. Similarly, a median of 70% of the respondents regarded their skills as insufficient, even in the most recent studies, and desired (more) EBP training. The percentage of doctors who had had EBP training ranged from 13% (Indian surgical trainees) to 80% (Iranian internal medicine doctors). The most appropriate way respondents thought to move towards EBP was through evidence-based guidelines (median 68%), evidence summaries (median 39%), or critical appraisal skills (median 36%). PubMed accessibility was high (at least 88%, except for India, 58%, and Jordan, 70%), either at home or at work. However, clinical decision-making was based on consulting textbooks and colleagues rather than by searching electronic databases.

Figure 2 depicts the knowledge of common EBP terms among doctors. Not all studies used the same EBP terms but in general, half of the doctors had at least some knowledge about 83% (20/24) of the presented EBP-terms. Three out of the four terms they were unfamiliar with were meaningless dummy terms. Hence, the results of this part of the questionnaire seemed not biased by socially desired answering.

Only one study examined the nurses' knowledge of EBP terms (figure 3).[179] Half of the nurses had at least some knowledge of 4 (40%) of the 10 terms presented. The dummy terms appeared more familiar than terms like 'bias', 'power calculation' and 'number needed to treat', suggesting some socially desired answering.

Awareness of common sources of evidence

Eight studies addressed this issue (table 1). About a quarter of the responding doctors used the *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two studies showed this awareness was even less among nurses.[15 17 19]

EBP barriers and facilitators

Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised, i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the barriers found among nurses in the systematic review by Kajermo et al.[13 35] These barriers are summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language barrier for non-English speaking countries and the limited access to electronic databases in some countries.

The major facilitating initiatives as desired by doctors and nurses were mostly collected through open questions (table 5). These facilitators include continuing EBP-teaching efforts in pre- and postgraduate curricula, constant involvement by colleagues in daily practice, staff and management support to learn and apply EBP in daily clinical practice, structural promotion and facilitation of EBP activities by the management and experts, and clear and easily accessible sources of evidence, protocols and guidelines.

Recommendations reported to implement EBP

All studies gave recommendations to overcome or address the identified barriers (Table 5 6). From macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various

solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific interventions at ward level, including availability of computers and internet.

A qualitative evaluation of the recommendations shows they mainly focused on education for both pre- and postgraduates. The following aspects were considered important: how and with whom to build EBP curricula, tiered education based on needs assessments, learning by interaction, and transfer of the education from the classroom to the bedside.

Regarding preconditions to strategically implement EBP, authors put emphasis on the role of the management in terms of facilitating prerequisites as well as creating a positive culture towards EBP. They also suggested that solutions to the problems encountered when implementing EBP should start with an analysis of the organisation to identify problems at both local and organisational levels to tailor the interventions.

DISCUSSION

Our systematic review shows that worldwide many professionals in clinical healthcare welcome EBP, although the awareness of, education in, and actual bedside application of, EBP leaves room for improvement. Based on the reasons given~~found~~ for the limited uptake of EBP, a structural implementation of EBP in clinical healthcare organisations will require a culture change at various organisational levels, i.e. patient care, education, and management. The ~~evidence-based policy~~ framework of policy recommendations, as presented here, encompasses the wide range of possible entries to implement in a multifocal manner and sustain EBP. Because recommendations were found for virtually all levels of management, a general policy seems indicated to address and govern these EBP implementation issues. Some recommendations might also be useful as indicators to monitor the usage of EBP in daily clinical practice.

Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP is progressing,[2,3] important barriers are still obstructing the full implementation of EBP in daily clinical practice. These findings occur consistently among the various medical specialists and nurses alike, and in many specific settings and specialties throughout the world. However, Brown et al. found in a multiple regression analysis that perceived barriers to research use predicted only a fraction of practice, attitude and knowledge/skills associated with EBP.[2,3,4] Apparently, the most frequently encountered barriers are not necessarily the main reason for a poor implementation of EBP. Rather, a change in mind set seems indicated among the various healthcare professionals who perceive these barriers. Additional barriers to EBP implementation may lie at the organisational level.[4] Hence, an integrative approach, involving all professionals and supported by initiatives from various organisational levels, may be a more fitting solution.

An integrative approach to overcome perceived barriers to EBP has also been suggested by other authors,[2,4,5] who reasoned that the best implementation strategy should be a multifocal, comprehensive programme involving all professionals and should be tailored to their desires and perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation strategies presented imperfect evidence to support decisions about which guideline dissemination and implementation strategies are likely to be efficient under different circumstances.[2,5,6] Opinion leaders and role models appear to have a key function.[2,6,7] A recent systematic review, comprising seven observational studies, described the relation between EBP implementation and leadership among nurses.[2,7,8] The evidence suggested that initiatives on the level of leadership, organisation and culture are pivotal for the process of implementing EBP in nursing. However, available evidence for the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.[4] In the medical realm such evidence is also limited.[2,8,9,3,1,2]

Other frameworks or multi-dimensional programs have been proposed to improve research utillisation,[1,2,3] or to stimulate the use of EBP by nurses,[3,2,3] or on specific wards.[3,3,4] Others have promoted a dedicated research agenda,[3,4,5] integrated EBP education,[3,0,1 3,6,5] or the implementation of

EBP in specific medical specialties.[1,4,6,36,7] Clinically integrated rather than stand-alone EBP teaching initiatives have shown to improve EBP behaviour and may therefore help implement EBP in clinical practice.[3,8,7] These initiatives per se seem defective because none of these aspects can be omitted to arrive at a truly evidence-based healthcare: If EBP-education falls short, managers do not facilitate EBP activities, doctors do not apply EBP in their daily practice, or nurses are lagging behind in EBP knowledge, optimum evidence-based healthcare eventually will not (fully) reach the patients who deserve it. This has been one of the reasons why a European teaching project has started to incorporate evidence-based medicine in clinical practice.[3,9,8]

Limitations

Although not all studies found were performed in teaching hospitals, the majority may have been performed in centres that already had the aim, or were in the process of implementing EBP. Many other centres are likely to be lagging further behind. However, higher response rates were not associated with more positive attitudes towards EBP. Given the settings and types of respondents in the studies included here, the inferences of our review appear primarily valid for clinical doctors and nurses from various specialties in centres that aim at implementing EBM.

Second, the questionnaires used were self-reported and response rates varied considerably. For both reasons, our results may overestimate enthusiasm, knowledge, and uptake of EBP. On the other hand, the framework of implementation recommendations we derived from these studies ~~will~~ may be useful for all centres striving at a better EBP implementation.

Third, in our review we searched for surveys of EBP attitude, knowledge, awareness, barriers and facilitators rather than studies specifically focusing on testing alternatives to improve implementation of EBP. Such studies, however, are rare.[4,2,7,8,3,12] The implementation factors these studies mentioned also became clear from our review, while the success of these implementation strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing actual EBP behaviour during daily practice.[3,8,7,39,40,41]

Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if clinicians are aware of available evidence, the right thing to do does not always happen. Continuous quality improvement strategies also involve active implementation of available evidence and existing guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the first step towards quality improvement.

Conclusion

Our review of all available surveys on the barriers for, and promotion of, EBP-activities as perceived by clinical doctors and nurses suggest~~sing~~ that EBP-implementation needs a multilevel approach, involving interventions in the policy-making, managerial, educational, and practical areas. We offer a summary of the ~~possible~~ suggested interventions at these different levels. These may be used not only to implement, but also to monitor the usage of EBP in daily clinical practice. This requires a joint effort and cultural change within the whole healthcare organisation, but is likely to result in a better quality of care.

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Table 1. Characteristics of included studies

Author	Year	Country	Teaching hospital(s)	Respondents	EBP aspects studied*
Ahmadi[40,52]	2008	Iran	Yes	Internal medicine interns, residents and fellows	1,2,3
Al-Almaie[41,53]	2004	Saudi Arabia	No	Doctors from various specialties	5
Al-Omari[41,42]	2009	Jordan	Both	Specialists, fellows, residents from various specialties	1,2,4,5,6
Al-Omari[43,55]	2006	Saudi Arabia	Both	Consultant physicians from various specialties	1,2,3,5
Amin[22,51]	2007	Ireland	Yes	Otorhinolaryngology surgical trainees	1,4
Andersson[46,54]	2007	Sweden	Yes	Trainee and specialist paediatric nurses	5
Brown[47,55]	2009	USA	Yes	Nurses from various specialties	5,6
Brown[24,53]	2010	USA	Both	Nurses from various specialties	5
Chiu[17,55]	2010	Taiwan	No	Doctors and nurses from various specialties	1,2,5
Gale[46,58]	2009	USA	No	Staff nurses and nurse managers from 8 ICUs	1,5,6
Gerrish[49,57]	2008	UK	Both	Nurses from various specialties	5
Hadley[48,50]	2007	UK	No	Junior doctors	1,2
Kitto[32,51]	2007	Australia	No	Surgeons	5
Koehn[49,51]	2008	USA	No	Staff nurses, unit managers, clinical advisors	1,5
Lai[16,58]	2010	Malaysia	No	Doctors, nursing and allied health staff before attending EBM workshop	1,5
Melnyk[52,60]	2004	USA	Unknown	Nurses before attending EBP workshops	1,5
Mehrdad[53,54]	2008	Iran	Yes	Clinical nurses and nurse educators	5,6
Mittal[52,54]	2010	India	No	Surgical trainees attending continuing education meeting	1,2,3,4,5
Nwagwu[53,55]	2008	Nigeria	Yes	Consultants in tertiary health care institutions	2,3
Olivieri[54,56]	2004	Denmark	Yes	Doctors from various specialties	2,4
Oranta[55,57]	2002	Finland	No	Staff and ward nurses	5,6
Palfreyman[56,58]	2003	UK	Yes	Nurses and physiotherapists from various specialties	2,5
Parahoo[57,59]	2001	N-Ireland	No	Medical and surgical nurses	1,5,6
Poolman[58,60]	2007	Netherlands	Unknown	Orthopaedic surgeons	1,2,4
Roth[59,61]	2010	Canada	Unknown	English-speaking urology residents participating in national review course	2,3,4,5
Scales[62,0]	2008	USA	Both	American Urology Association members	1,5
Sur[63,1]	2006	USA	Unknown	American Urology Association members	1,3,4
Ubbink[19,37]	2011	Netherlands	Yes	Doctors and nurses from various specialties	1,2,3,4,5,6
Ulvenes[64,2]	2009	Norway	Unknown	Reference panel of Norwegian physicians	1,2
Upton[65,3]	2005	UK	Unknown	Doctors from various specialties	2,5,6
Veness[66,4]	2003	Australia & NZ	Unknown	Radiation oncologists and registrars	1,2,3,4,6

*: 1= attitude; 2= skills; 3=awareness; 4=knowledge; 5=barriers; 6=facilitators

Table 2. Quality characteristics of included studies

Author	Centres (N)	Respondents (N)	Response rate (%)	Questionnaire robustness*
Ahmadi[42]	1	104	80	+
Al-Almaie[43]	3	273	67	-
Al-Omari[44]	5	386	97	+
Al-Omari[43]	9	178	86	+
Amin[22]	countrywide	19	95	+
Andersson[46]	2	113	80	+
Brown[45]	1	458	45	+
Brown[24]	4	974	75	+
Chiu[17]	61	1156	69	+
Gale[46]	1	92	22	+
Gerrish[49]	2	598	42	+
Hadley[48]	several	317	100	+
Kitto[32]	several	25	50	+
Koehn[49]	1	422	41	+
Lai[18]	2	144	72	+
Melnyk[50]	several	160	100	+
Mehrdad[53]	15	410	70	+
Mittal[52]	22	93	85	+
Nwagwu[55]	10	89	89	-
Olivieri[54]	1	225	60	+
Oranta[57]	2	253	80	+
Palfreyman[58]	1	106	24	+
Parahoo[59]	10	479	53	+
Poolman[58]	countrywide	367	60	+
Roth[59]	several	29	100	+
Scales[62]	countrywide	365	72	+
Sur[63]	countrywide	714	9	+
Ubbink[19]	1	701	72	+
Ulvenes[62]	countrywide	976	70	-
Upton[65]	countrywide	381	76	+
Veness[66]	countrywide	191	79	+
TOTAL	**24 (77%) >1 centre**	**25 (81%) >100 respondents**	**23 (74%) ≥60% response**	**24 (77%)**

*: Robustness based on pilot testing, previous validation, or Cronbach's alpha.

Table 3. Attitudes of doctors and nurses towards EBP. Scores can range from 0 to 100.

	Doctors Median (range)	**Nurses** Median (range)
Your current attitude towards EBP *Least positive (0) to Extremely positive (100)*	72.3 (49-97)	66.7 (55-85)
Attitude of your colleagues towards EBP *Least positive (0) to Extremely positive (100)*	61.0 (41-89)	48.0 (48-48)
How useful are research findings in daily practice? *Useless (0) to Extremely useful (100)*	80.0 (46-97)	62.0 (34-82)
What percentage of your clinical practice is evidence-based? *0% to 100%*	52.6 (40-80)	44.9 (44-46)
Practicing EBP improves patient care *Completely disagree (0) to Fully agree (100)*	80.1 (52-97)	80.7 (74-87)
EBP is of limited value in clinical practice, because a scientific basis is lacking *Completely disagree (0) to Fully agree (100)*	36.3 (3-43)	48.3 (48-49)
Implementing EBP, however worthwhile as an ideal, places another demand on already overloaded surgeons/nurses *Completely disagree (0) to Fully agree (100)*	51.4 (37-56)	55.2 (17-61)
The amount of evidence is overwhelming *Completely disagree (0) to Fully agree (100)*	53.5 (50-57)	No data
EBP fails in practice *Completely disagree (0) to Fully agree (100)*	39.7 (15-84)	41.0 (39-63)
EBP is important for my profession *Completely disagree (0) to Fully agree (100)*	68.3 (52-95)	61.6 (30-93)

Table 4. Barriers to apply EBP as mentioned by doctors and nurses. Stated are those ranked among the top ten in most studies.

Doctors and nurses alike	
• Lack of time to read evidence or implement new ideas • Lack of facilities or resources • Lack of staff experienced in EBP • Lack of training in EBP • EBP is insufficiently supported by staff and management • Evidence is not easily available • Unawareness of research • Evidence is not generalisable to own setting	
Doctors	**Nurses**
• Lack of evidence • Conflicting evidence • Evidence is not incorporated in clinical practice • EBP negatively impacts medical skills and freedom	• Evidence is written in foreign language • Lack of authority to change practice • Statistics or research is unintelligible • Implications for practice are unclear

Table 5. Major facilitating factors to apply EBP as stated by both doctors and nurses

- Workshops and courses on EBP and research
- Culture change to apply EBP in daily clinical practice
- EBP mentor or expert available
- Easy access to research papers
- Protocols and guidelines in own / English language
- Evidence on clinically relevant topics

Table 5~~6~~. Structural incorporation of EBP at various levels as stated by the authors of the individual studies

LEVEL	INTERVENTION by	EFFECT	AUTHOR
Worldwide	International collaboration	Expansion and acceleration of the production and maintenance of Cochrane Systematic Reviews	Oliveri
	Global and international associations	Promotion of EBP Making EBP courses available	Olivieri Sur
	Scientific journals	Educational efforts Publishing high quality research	Poolman, Veness Scales, Sur
National	Governmental enforcement	EBP in all undergraduate and postgraduate healthcare educational institutions	Melnyk, Ubbink
	Installing and financing regulatory professional bodies	Quality assurance Practicing EBP Use of guidelines	Al-Almaie Melnyk Ubbink
	Installing and financing a national institute	Development of evidence based guidelines	Al-Almaie
	Arranging and financing	Free use of the Cochrane Library	Oliveri
	Policy makers, professional associations, health insurance companies, and regulatory bodies	Promotion of EBP	Scales, Oliveri, Poolman, Melnyk
Board of hospital directors	Incorporating EBP in strategic aims	Goals tailored on systematic evaluations Implementation of EBP and research utilization	Brown 2009, Ubbink
	Installing research councils	High-quality research	Brown 2009, Melnyk
	Allocating budget	High-quality research	Mehrdad
	Performing systematic evaluations during working visits, quarterly meetings with managers	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Incorporating performance of EBP activities by directors, managers and administrators in annual interviews	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Providing management, administrators, and directors with tools and means	Effective learning and practising EBP	Al Ohmari 2006, Lai
Managers	Integrating EBP and policy setting	Evidence-based management	Al Ohmari 2009
	Recruitment, selection, employment of new personnel Identifying EBP role-models among current personnel	EBP-minded working force	Ubbink, Brown 2010
	Building an infrastructure and environment with an atmosphere that supports, promotes and embraces EBP (i.e. incentives, prizes or rewards, positive attitude)	Effective tools for implementing, learning and practising EBP Knowledgeable (nurse) researchers, (nurse) specialists, master' prepared professionals, faculty, research departments	Al-Almaie, Al Ohmari 2006, Brown 2009, Chui, Gale, Gerrish, Melnyk, Mehrdad, Mittal, Oranta, Parahoo, Ubbink
	Collaborating with educators	Organizational barriers and education addressed	Brown 2009
	Allocating budget	(More) dedicated EBP personnel, education, activities, computers and facilities at each point of care. Attending continuous education, (inter)national conferences	Brown 2009, Gale, Gerrish, Mehrdad, Melnyk, Lai
	Provide non-patient hours to personnel	Time for EBP activities and implementation, changing practice, and quality care development	Brown 2009, Gale, Mehrad, Palfeyman
	Regular evaluation (audit and feedback) of ward-level EBP activities, knowledge, skills, behaviour and research utilization during annual interviews	Annual evaluation of implementing EBP-activities	Ahmandi, Al-Almaie, Al Ohmari 2009, Ubbink
Educators	Incorporating and inflating time spent on EBP by refining and modifying curriculum and education style in postgraduate and undergraduate medical and nursing curricula	Each non-academic degree professional produces a Cochrane Systematic review Improved audit and feedback, systematic evaluation, and needs assessment Tiered, feasible and realistic education	Ahmandi, Al-Almaie, Al-Ohmari 2006, Amin, Andersson, Brown 2009, Gale, Gerrish, Hadley, Kitto, Koehn, Lai, Mehrdad, Melnyk, Mittal, Nwagwu, Oliveri, Parahoo, Poolman, Scales, Sur, Ubbink, Upton
	Formulating the curriculum and educating in collaboration with healthcare professionals	EBP integration	Al-Almaie, Al Ohmari 2006, Brown 2009, Gale, Gerrish, Lai
	Interactive, face-to-face education in clinical practice and at the bed side	EBP integration	Ahmandi, Al-Almaie, Amin, Al Ohmari 2006, Kitto, Melnyk, Poolman
	Interactive education	E-learning modules	Kitto, Poolman, Ubbink
	EBP internship programme In-service training	Extended EBP education	Brown 2009 Gerrish

	Accessing, appraising and interpreting guidelines, research and protocols, basic statistical analysis, research training, IT-technology, quality development, change management, being a role model, English language	Optimum content of education	Al Ohmari 2006, Andersson, Gerrish, Lai, Mehrdad, Mittal, Nwagwu, Oranta, Parahoo
	Educating all educators in EBP	Well-equipped educators	Oranta
	Emphasizing professionals' own responsibility	Professional skills and competencies maintained	Oranta
	Evaluating effectiveness of EBP teaching	Optimum EBP education	Ulvenes, Veness
Faculty and researchers	Documenting, analysing and interpreting the effectiveness of actions undertaken	EBP implementation	Brown 2009
	Support professionals in clinical setting by simple and clear (written) communication	EBP implementation	Mehrdad, Brown 2009
	Using a variety of strategies	Dissemination of research findings Valorisation of results in practice	Brown 2009 Melnyk
	Close collaboration with practicing professionals	Shared language and understanding of concepts Actual relevant clinical questions are addressed	Oranta
	Being a role model	Real-life discussions about patients	Poolman
	Performing and promoting research	Well-designed high quality research	Scales, Sur
Services	Medical library facilities	Service for searching databases Clinical letters, journals and guidelines	Al Ohmari 2006, Melnyk, Mittal, Parahoo, Ubbink, Al Ohmari 2006,
	Computer and internet facilities at point of care, ward, or in EBP suites	Liberal access to databases Tailored to EBP level of professionals	Al Ohmari 2006, Gale, Lai, Mehrdad, Nwagwu, Chui, Melnyk, Ubbink
	Content management system allowing access to guidelines, protocols, critically appraised topics and condensed recommendations	User-friendly and reliable, readable and pre-appraised information Provide work-based information	Al Ohmari 2009, Gerrish, Lai, Ubbink
	Computer based decision support system with priority to systematic reviews	Computer-based guideline implementation Alerts and reminders	Al-Almaie, Al Ohmari 2009
	Accessible critical appraisal committee	Easy assessment of relevant literature	Mehrdad
	Implementation guidance	Overcomes obstacles to implement EBP or recommendation Change in practice	Chui, Mehrdad
Local workplace	Journal clubs, grand rounds, handovers, regular (research) meetings	EBP implementation	Oranta, Poolman, Ubbink
	Dedicated time and personnel for EBP activities	Individual support at the units	Andersson, Ubbink
	Easy access to EBP mentors, change mentors, innovators and educators, computers, databases, and relevant EBP websites or links	EBP implementation	Al-Almaie, Chui, Gale, Lai, Mehrdad, Ubbink, Veness
Culture	Emphasis on EBP in day-to-day practice		Amin
	Emphasis on patient benefit of EBP		Gale, Melnyk
	Sharing experience, knowledge and support		Andersson
	Activating autonomy and empower nurses to influence change		Brown 2009, Gerrish
	Shared governance structures		Brown 2009
	Engaging in research		Gerrish
	Willingness to facilitate the process of implementing		Koehn
	Innovative strategies including a culture of research implementation		Mehrdad
	Displaying interest and belief in value of research utilization		Mittal
	Enlightening professionals to use EBP in decision making		Nwagwu
	Supportive culture to research		Parahoo

1

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1, 2
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	n.a.
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	n.a.

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6, 20, 21
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	7, 21
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	22-25
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n.a.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	7
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	7
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	10, 11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	12, 13
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	13

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

Countries from which studies were included.
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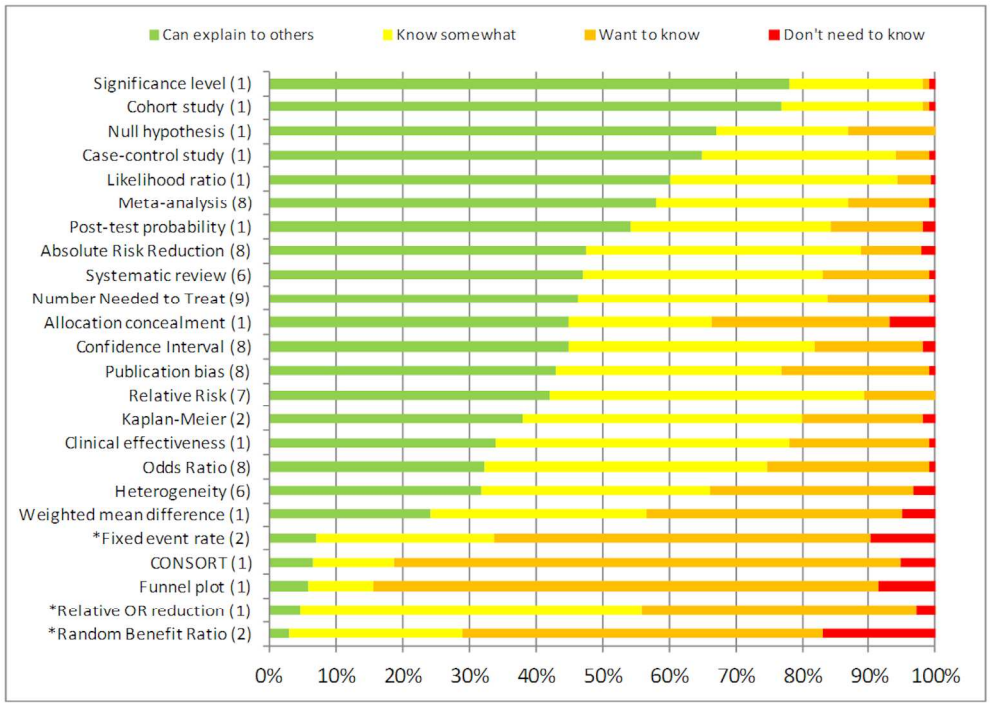
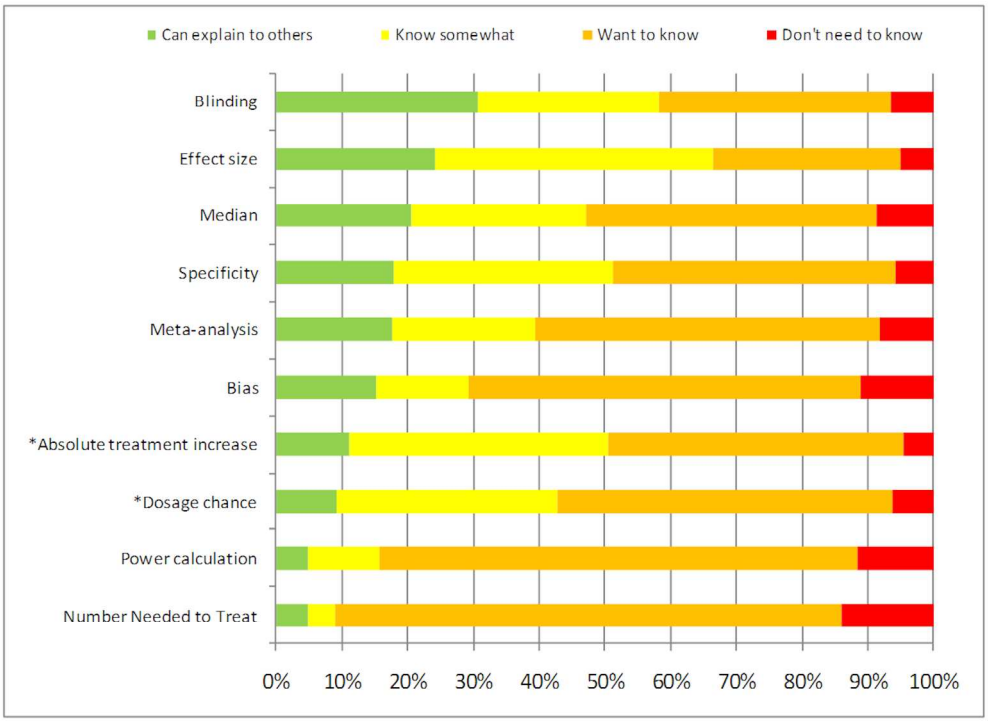


Doctors' knowledge of common EBP terms. The numbers between brackets indicate the number of studies that used this term. Terms with an asterisk are meaningless dummy terms.
291x208mm (300 x 300 DPI)



Nurses' knowledge of common EBP terms. Terms with an asterisk are meaningless dummy terms.
291x211mm (300 x 300 DPI)

Framework of policy recommendations for implementation of evidence-based practice: a systematic scoping review

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Framework of policy recommendations for implementation of evidence-based practice: a systematic scoping review

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ABSTRACT

Objectives: Evidence-based practice (EBP) may help improve healthcare quality. However, not all healthcare professionals and managers use EBP in their daily practice. We systematically reviewed the literature to summarise self-reported appreciation of EBP and organisational infrastructure solutions proposed to promote EBP.

Design: Systematic review. Two investigators independently performed the systematic reviewing process.

Information sources: MEDLINE, EMBASE and Cochrane Library were searched for publications between 2000 and 2011.

Eligibility criteria for included studies: Reviews and surveys of EBP attitude, knowledge, awareness, skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.

Results: We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming. Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions were proposed at various organizational levels, including (inter)national associations and hospital management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-mentors on the wards to move EBP from the classroom to the bedside.

Conclusions: More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Article summary

Article focus:

- Systematic review of the literature to summarise self-reported appreciation of evidence-based practice (EBP) and organisational infrastructure solutions proposed to promote EBP.

Key messages:

- More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient.
- Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Strength and limitations of this study:

- Worldwide overview of EBP appreciation and implementation strategies useful for all centres striving at a better EBP implementation.
- Self-reporting may have led to an overestimation of the results.
- The success of implementation strategies is still unclear.

INTRODUCTION

Evidence-Based Practice (EBP) provides a structure for the bedside use of research and consideration of patient values and preferences to optimize clinical decision-making and to improve patient care.[1 2] EBP could potentially be used to improve quality of healthcare.[3 4] In 2001, the Institute of Medicine's Quality Chasm series suggested EBP as one of the five core competencies for professional healthcare curricula.[5] More recently, the growing societal demand for quality, safety, equality and accountability of healthcare, and credentialing programs as exerted by the Joint Commission International and Magnet hospitals have further promoted EBP.[6 7] To date, hospital executive boards, insurance companies and consumers recognize EBP may help prevent unsafe or inefficient practices, as part of a strategy to achieve quality improvement in healthcare.[8]

Thus far, however, educational efforts have failed to achieve EBP at the bedside or in daily clinical problem-solving. While there is an ongoing debate on how to measure quality of care in general, attitude, awareness, knowledge or behaviour are relevant to understand application of EBP. Various questionnaires have been developed and used to appreciate these aspects (e.g. McColl, Funk).[9,10] This information suggested the implementation of EBP by doctors is hampered by a perceived lack of time, knowledge or EBP resources,[9 11] while in the nursing realm EBP awareness, the body of knowledge and research utilization, as well as managerial support are still developing.[12 13] Based on these findings, many different recommendations for improvement have been proposed. Hence, it is timely to synthesise these recommendations for more structural organisational initiatives that may help overcome barriers and facilitate the uptake of EBP.

Therefore, the purpose of this study was to collect surveys of healthcare professionals' views on EBP in terms of self-reported attitude, knowledge, awareness, skills, barriers and behaviour regarding EBP among clinical doctors, nurses and managers, and to summarise proposed recommendations as derived from these views to improve the use of EBP. We subsequently used the findings of this review to propose a framework for implementation of EBP, tailor-made for different managerial

levels and suitable to structurally facilitate and sustain evidence-based behaviour in clinical healthcare organisations.

METHODS

Literature search and study selection

Two of the authors (DTU, HV) searched the MEDLINE (using PubMed), EMBASE (using Ovid) and Cochrane databases from 2000 through 2011 for surveys or reviews of EBP attitude, knowledge, awareness, barriers and facilitators among nurses, physicians and managers in any clinical setting, i.e. hospitals or other healthcare institutions, rather than general practice settings, on which a review has recently been published.[14] Reference lists of the included studies and reviews were checked for additional eligible papers.

In brief, our search strategy was: (evidence-based[ti] practice OR evidence-based medicine OR EBM OR EBP) AND (questionnaire* OR survey OR inventory) AND ((barriers OR McColl) AND (knowledge OR attitude* OR aware* OR behavio*) AND (hospital* OR clinic* OR medical cent*)). No language restrictions were applied. Papers in foreign languages, if any, would be translated if possible.

We excluded studies in an undergraduate educational setting, studies with a purely qualitative design, studies not including clinical doctors or nurses, and those focusing on a specific disorder, guideline, model or technique. We focused on surveys rather than the latter studies, because merely following (particularly expert-based) guidelines or focusing on a specific disorder or technique does not necessarily indicate the general application of the five steps of EBP. Studies before 2000 were also excluded because in these years the EBP paradigm was in an early phase with a limited dispersion among healthcare professionals. Study selection and quality assessment was performed by two investigators independently.

Quality assessment

Judgment of the quality of the surveys was based on the number of centres and respondents involved, response rates, and robustness of the questionnaires used (through pilot testing, prior validation or internal consistency based on a Cronbach's alpha).

Data items and synthesis of results

By means of a structured form two researchers independently extracted data on study characteristics (including country of origin, publication year, type and number of respondents and type of clinics included), questionnaires used and EBP characteristics studied, in particular EBP attitude, knowledge, skills, and awareness, and perceived barriers and facilitating factors for EBP implementation. We extracted in a qualitative manner the reported recommendations, if any, on how to overcome these barriers or how to exploit facilitators. These were grouped into solutions to be executed at various organisational levels. After one investigator had entered the data in the database, these data were checked for accuracy by a second.

Meta-analysis was not planned because of the expected large range in geographical locations, caregivers investigated and questionnaires used. To summarise the results of the studies reporting on EBP-attitudes and knowledge, we calculated the medians and report the ranges of the scores given for each item, for doctors and nurses separately. A possible association between response rate, year of publication and attitude towards EBP was calculated using Spearman's correlation coefficient. Statistical analysis was performed using PASW Statistics, version 18.0 (IBM Inc., Armonk, New York, USA).

RESULTS

Study inclusion

Our search yielded 286 potentially relevant studies. We also found two recent reviews of studies on barriers towards EBP,[15 16] from which other relevant studies were derived. Some more recent studies not included in these reviews were also found by hand-searching the references of included studies.

Four surveys among medical postgraduates were excluded because these publications were in Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on nurses. Three out of the 31 studies enrolled both doctors and nurses.[17-19] Wherever possible, results from doctors and nurses are presented separately.

All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and awareness, most studies used the questionnaires developed by McColl, Upton or Estabrooks.[9 20 21] To assess EBP barriers and facilitators, most investigators used the Funk questionnaire.[10] Half of the studies investigated both EBP attitude and barriers.

Study characteristics

The studies enrolled from 19[22] up to 1156[17] respondents (median 273), consisting of doctors (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates varied from 9% in nationwide surveys to 100% in questionnaires during trainings, with a median of 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table 1).

EBP attitude

Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire. Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and appreciated the use of research evidence in daily clinical practice. However, they considered only half

of their clinical practice to be evidence-based, although what they meant by this was, in most cases, not specified and unclear. These findings were consistent among the various countries. We did not find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-0.286; p=0.321) and attitude towards EBP.

EBP knowledge and skills

The majority (median 64%) of doctors and nurses reported they considered their EBP knowledge was insufficient. Similarly, a median of 70% of the respondents regarded their skills as insufficient, even in the most recent studies, and desired (more) EBP training. The percentage of doctors who had had EBP training ranged from 13% (Indian surgical trainees) to 80% (Iranian internal medicine doctors). The most appropriate way respondents thought to move towards EBP was through evidence-based guidelines (median 68%), evidence summaries (median 39%), or critical appraisal skills (median 36%). PubMed accessibility was high (at least 88%, except for India, 58%, and Jordan, 70%), either at home or at work. However, clinical decision-making was based on consulting textbooks and colleagues rather than by searching electronic databases.

Figure 2 depicts the knowledge of common EBP terms among doctors. Not all studies used the same EBP terms but in general, half of the doctors had at least some knowledge about 83% (20/24) of the presented EBP-terms. Three out of the four terms they were unfamiliar with were meaningless dummy terms. Hence, the results of this part of the questionnaire seemed not biased by socially desired answering.

Only one study examined the nurses' knowledge of EBP terms (figure 3).[19] Half of the nurses had at least some knowledge of 4 (40%) of the 10 terms presented. The dummy terms appeared more familiar than terms like 'bias', 'power calculation' and 'number needed to treat', suggesting some socially desired answering.

Awareness of common sources of evidence

Eight studies addressed this issue (table 1). About a quarter of the responding doctors used the *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two studies showed this awareness was even less among nurses.[17 19]

EBP barriers and facilitators

Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised, i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the barriers found among nurses in the systematic review by Kajermo et al.[15] These barriers are summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language barrier for non-English speaking countries and the limited access to electronic databases in some countries.

The major facilitating initiatives as desired by doctors and nurses were mostly collected through open questions. These facilitators include continuing EBP-teaching efforts in pre- and postgraduate curricula, constant involvement by colleagues in daily practice, staff and management support to learn and apply EBP in daily clinical practice, structural promotion and facilitation of EBP activities by the management and experts, and clear and easily accessible sources of evidence, protocols and guidelines.

Recommendations reported to implement EBP

All studies gave recommendations to overcome or address the identified barriers (Table 5). From macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various

solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific interventions at ward level, including availability of computers and internet.

A qualitative evaluation of the recommendations shows they mainly focused on education for both pre- and postgraduates. The following aspects were considered important: how and with whom to build EBP curricula, tiered education based on needs assessments, learning by interaction, and transfer of the education from the classroom to the bedside.

Regarding preconditions to strategically implement EBP, authors put emphasis on the role of the management in terms of facilitating prerequisites as well as creating a positive culture towards EBP. They also suggested that solutions to the problems encountered when implementing EBP should start with an analysis of the organisation to identify problems at both local and organisational levels to tailor the interventions.

DISCUSSION

Our systematic review shows that worldwide many professionals in clinical healthcare welcome EBP, although the awareness of, education in, and actual bedside application of, EBP leaves room for improvement. Based on the reasons given for the limited uptake of EBP, a structural implementation of EBP in clinical healthcare organisations will require a culture change at various organisational levels, i.e. patient care, education, and management. The framework of policy recommendations, as presented here, encompasses the wide range of possible entries to implement in a multifocal manner and sustain EBP. Because recommendations were found for virtually all levels of management, a general policy seems indicated to address and govern these EBP implementation issues. Some recommendations might also be useful as indicators to monitor the usage of EBP in

daily clinical practice. Furthermore, this review could stimulate the testing of some of our recommendations through appropriately designed studies.

Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP is progressing,[23] important barriers are still obstructing the full implementation of EBP in daily clinical practice. These findings occur consistently among the various medical specialists and nurses alike, and in many specific settings and specialties throughout the world. However, Brown et al. found in a multiple regression analysis that perceived barriers to research use predicted only a fraction of practice, attitude and knowledge/skills associated with EBP.[24] Apparently, the most frequently reported barriers are not necessarily the main reason for a poor implementation of EBP. Rather, a change in mind set seems indicated among the various healthcare professionals who perceive these barriers. Additional barriers to EBP implementation may lie at the organisational level.[4] Hence, an integrative approach, involving all professionals and supported by initiatives from various organisational levels, may be a more fitting solution.

An integrative approach to overcome perceived barriers to EBP has also been suggested by other authors,[25] who reasoned that the best implementation strategy should be a multifocal, comprehensive programme involving all professionals and should be tailored to their desires and perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation strategies presented imperfect evidence to support decisions about which guideline dissemination and implementation strategies are likely to be efficient under different circumstances.[26] Opinion leaders and role models appear to have a key function.[27] A recent systematic review, comprising seven observational studies, described the relation between EBP implementation and leadership among nurses.[28] The evidence suggested that initiatives on the level of leadership, organisation and culture are pivotal for the process of implementing EBP in nursing. However, available evidence for the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.[4] In the medical realm such evidence is also limited.[29-32]

Other frameworks or multi-dimensional programs have been proposed to improve research utillisation,[13] or to stimulate the use of EBP by nurses,[33] or on specific wards.[34] Others have promoted a dedicated research agenda,[35] integrated EBP education,[31 36] or the implementation of EBP in specific medical specialties.[16 37] Clinically integrated rather than stand-alone EBP teaching initiatives have been shown to improve EBP behaviour and may therefore help implement EBP in clinical practice.[38] These initiatives per se seem defective because none of these aspects can be omitted to arrive at a truly evidence-based healthcare: If EBP-education falls short, managers do not facilitate EBP activities, doctors do not apply EBP in their daily practice, or nurses are lagging behind in EBP knowledge, optimum evidence-based healthcare eventually will not (fully) reach the patients who deserve it. This has been one of the reasons why a European teaching project has started to incorporate evidence-based medicine in clinical practice.[39]

Limitations

Although not all studies found were performed in teaching hospitals, the majority may have been performed in centres that already had the aim, or were in the process of implementing EBP. Many other centres are likely to be lagging further behind. However, higher response rates were not associated with more positive attitudes towards EBP. Given the settings and types of respondents in the studies included here, the inferences of our review appear primarily valid for clinical doctors and nurses from various specialties in centres that aim at implementing EBM.

Second, the questionnaires used were self-reported and response rates varied considerably. For both reasons, our results may overestimate enthusiasm, knowledge, and uptake of EBP. On the other hand, the framework of implementation recommendations we derived from these studies may be useful for all centres striving at a better EBP implementation.

Third, in our review we searched for surveys of EBP attitude, knowledge, awareness, barriers and facilitators rather than studies specifically focusing on testing alternatives to improve implementation of EBP. Such studies, however, are rare.[4 28 32] The implementation factors these

studies mentioned also became clear from our review, while the success of these implementation strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing actual EBP behaviour during daily practice.[38 40 41]

Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if clinicians are aware of available evidence, the right thing to do does not always happen. Continuous quality improvement strategies also involve active implementation of available evidence and existing guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the first step towards quality improvement.

Conclusion

Our review of all available surveys on the barriers for, and promotion of, EBP-activities as perceived by clinical doctors and nurses suggests that EBP-implementation needs a multilevel approach, involving interventions in the policy-making, managerial, educational, and practical areas. We offer a summary of the suggested interventions at these different levels. These may be used not only to implement, but also to monitor the usage of EBP in daily clinical practice. This requires a joint effort and cultural change within the whole healthcare organisation, but is likely to result in a better quality of care.

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Table 1. Characteristics of included studies

Author	Year	Country	Teaching hospital(s)	Respondents	EBP aspects studied*
Ahmadi[42]	2008	Iran	Yes	Internal medicine interns, residents and fellows	1,2,3
Al-Almaie[43]	2004	Saudi Arabia	No	Doctors from various specialties	5
Al-Omari[44]	2009	Jordan	Both	Specialists, fellows, residents from various specialties	1,2,4,5,6
Al-Omari[45]	2006	Saudi Arabia	Both	Consultant physicians from various specialties	1,2,3,5
Amin[22]	2007	Ireland	Yes	Otorhinolaryngology surgical trainees	1,4
Andersson[46]	2007	Sweden	Yes	Trainee and specialist paediatric nurses	5
Brown[47]	2009	USA	Yes	Nurses from various specialties	5,6
Brown[24]	2010	USA	Both	Nurses from various specialties	5
Chiu[17]	2010	Taiwan	No	Doctors and nurses from various specialties	1,2,5
Gale[48]	2009	USA	No	Staff nurses and nurse managers from 8 ICUs	1,5,6
Gerrish[49]	2008	UK	Both	Nurses from various specialties	5
Hadley[50]	2007	UK	No	Junior doctors	1,2
Kitto[32]	2007	Australia	No	Surgeons	5
Koehn[51]	2008	USA	No	Staff nurses, unit managers, clinical advisors	1,5
Lai[18]	2010	Malaysia	No	Doctors, nursing and allied health staff before attending EBM workshop	1,5
Melnyk[52]	2004	USA	Unknown	Nurses before attending EBP workshops	1,5
Mehrdad[53]	2008	Iran	Yes	Clinical nurses and nurse educators	5,6
Mittal[54]	2010	India	No	Surgical trainees attending continuing education meeting	1,2,3,4,5
Nwagwu[55]	2008	Nigeria	Yes	Consultants in tertiary health care institutions	2,3
Olivieri[56]	2004	Denmark	Yes	Doctors from various specialties	2,4
Oranta[57]	2002	Finland	No	Staff and ward nurses	5,6
Palfreyman[58]	2003	UK	Yes	Nurses and physiotherapists from various specialties	2,5
Parahoo[59]	2001	N-Ireland	No	Medical and surgical nurses	1,5,6
Poolman[60]	2007	Netherlands	Unknown	Orthopaedic surgeons	1,2,4
Roth[61]	2010	Canada	Unknown	English-speaking urology residents participating in national review course	2,3,4,5
Scales[62]	2008	USA	Both	American Urology Association members	1,5
Sur[63]	2006	USA	Unknown	American Urology Association members	1,3,4
Ubbink[19]	2011	Netherlands	Yes	Doctors and nurses from various specialties	1,2,3,4,5,6
Ulvenes[64]	2009	Norway	Unknown	Reference panel of Norwegian physicians	1,2
Upton[65]	2005	UK	Unknown	Doctors from various specialties	2,5,6
Veness[66]	2003	Australia & NZ	Unknown	Radiation oncologists and registrars	1,2,3,4,6

*: 1= attitude; 2= skills; 3=awareness; 4=knowledge; 5=barriers; 6=facilitators

Table 2. Quality characteristics of included studies

Author	Centres (N)	Respondents (N)	Response rate (%)	Questionnaire robustness*
Ahmadi[42]	1	104	80	+
Al-Almaie[43]	3	273	67	-
Al-Omari[44]	5	386	97	++
Al-Omari[45]	9	178	86	++
Amin[22]	countrywide	19	95	++
Andersson[46]	2	113	80	++
Brown[47]	1	458	45	++
Brown[24]	4	974	75	++
Chiu[17]	61	1156	69	++
Gale[48]	1	92	22	++
Gerrish[49]	2	598	42	++
Hadley[50]	several	317	100	++
Kitto[32]	several	25	50	+
Koehn[51]	1	422	41	++
Lai[18]	2	144	72	+
Melnyk[52]	several	160	100	+
Mehrdad[53]	15	410	70	++
Mittal[54]	22	93	85	++
Nwagwu[55]	10	89	89	-
Olivieri[56]	1	225	60	++
Oranta[57]	2	253	80	++
Palfreyman[58]	1	106	24	++
Parahoo[59]	10	479	53	++
Poolman[60]	countrywide	367	60	++
Roth[61]	several	29	100	++
Scales[62]	countrywide	365	72	++
Sur[63]	countrywide	714	9	++
Ubbink[19]	1	701	72	++
Ulvenes[64]	countrywide	976	70	-
Upton[65]	countrywide	381	76	++
Veness[66]	countrywide	191	79	++
TOTAL	**24 (77%) >1 centre**	**25 (81%) >100 respondents**	**23 (74%) ≥60% response**	**24 (77%)**

***:** Robustness based on pilot testing, previous validation, or Cronbach's alpha.

Table 3. Attitudes of doctors and nurses towards EBP. Scores can range from 0 to 100.

	Doctors Median (range)	**Nurses** Median (range)
Your current attitude towards EBP *Least positive (0) to Extremely positive (100)*	72.3 (49-97)	66.7 (55-85)
Attitude of your colleagues towards EBP *Least positive (0) to Extremely positive (100)*	61.0 (41-89)	48.0 (48-48)
How useful are research findings in daily practice? *Useless (0) to Extremely useful (100)*	80.0 (46-97)	62.0 (34-82)
What percentage of your clinical practice is evidence-based? *0% to 100%*	52.6 (40-80)	44.9 (44-46)
Practicing EBP improves patient care *Completely disagree (0) to Fully agree (100)*	80.1 (52-97)	80.7 (74-87)
EBP is of limited value in clinical practice, because a scientific basis is lacking *Completely disagree (0) to Fully agree (100)*	36.3 (3-43)	48.3 (48-49)
Implementing EBP, however worthwhile as an ideal, places another demand on already overloaded surgeons/nurses *Completely disagree (0) to Fully agree (100)*	51.4 (37-56)	55.2 (17-61)
The amount of evidence is overwhelming *Completely disagree (0) to Fully agree (100)*	53.5 (50-57)	No data
EBP fails in practice *Completely disagree (0) to Fully agree (100)*	39.7 (15-84)	41.0 (39-63)
EBP is important for my profession *Completely disagree (0) to Fully agree (100)*	68.3 (52-95)	61.6 (30-93)

Table 4. Barriers to apply EBP as mentioned by doctors and nurses. Stated are those ranked among the top ten in most studies.

Doctors and nurses alike	
• Lack of time to read evidence or implement new ideas • Lack of facilities or resources • Lack of staff experienced in EBP • Lack of training in EBP • EBP is insufficiently supported by staff and management • Evidence is not easily available • Unawareness of research • Evidence is not generalisable to own setting	
Doctors	**Nurses**
• Lack of evidence • Conflicting evidence • Evidence is not incorporated in clinical practice • EBP negatively impacts medical skills and freedom	• Evidence is written in foreign language • Lack of authority to change practice • Statistics or research is unintelligible • Implications for practice are unclear

1

2

3

4

Table 5. Structural incorporation of EBP at various levels as stated by the authors of the individual studies

LEVEL	INTERVENTION by	EFFECT	AUTHOR
Worldwide	International collaboration	Expansion and acceleration of the production and maintenance of Cochrane Systematic Reviews	Oliveri
	Global and international associations	Promotion of EBP Making EBP courses available	Olivieri Sur
	Scientific journals	Educational efforts Publishing high quality research	Poolman, Veness Scales, Sur
National	Governmental enforcement	EBP in all undergraduate and postgraduate healthcare educational institutions	Melnyk, Ubbink
	Installing and financing regulatory professional bodies	Quality assurance Practicing EBP Use of guidelines	Al-Almaie Melnyk Ubbink
	Installing and financing a national institute	Development of evidence based guidelines	Al-Almaie
	Arranging and financing	Free use of the Cochrane Library	Oliveri
	Policy makers, professional associations, health insurance companies, and regulatory bodies	Promotion of EBP	Scales, Oliveri, Poolman, Melnyk
Board of hospital directors	Incorporating EBP in strategic aims	Goals tailored on systematic evaluations Implementation of EBP and research utilization	Brown 2009, Ubbink
	Installing research councils	High-quality research	Brown 2009, Melnyk
	Allocating budget	High-quality research	Mehrdad
	Performing systematic evaluations during working visits, quarterly meetings with managers	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Incorporating performance of EBP activities by directors, managers and administrators in annual interviews	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Providing management, administrators, and directors with tools and means	Effective learning and practising EBP	Al Ohmari 2006, Lai
Managers	Integrating EBP and policy setting	Evidence-based management	Al Ohmari 2009
	Recruitment, selection, employment of new personnel Identifying EBP role-models among current personnel	EBP-minded working force	Ubbink, Brown 2010
	Building an infrastructure and environment with an atmosphere that supports, promotes and embraces EBP (i.e. incentives, prizes or rewards, positive attitude)	Effective tools for implementing, learning and practising EBP Knowledgeable (nurse) researchers, (nurse) specialists, master' prepared professionals, faculty, research departments	Al-Almaie, Al Ohmari 2006, Brown 2009, Chui, Gale, Gerrish, Melnyk, Mehrdad, Mittal, Oranta, Parahoo, Ubbink
	Collaborating with educators	Organizational barriers and education addressed	Brown 2009
	Allocating budget	(More) dedicated EBP personnel, education, activities, computers and facilities at each point of care. Attending continuous education, (inter)national conferences	Brown 2009, Gale, Gerrish, Mehrdad, Melnyk, Lai
	Provide non-patient hours to personnel	Time for EBP activities and implementation, changing practice, and quality care development	Brown 2009, Gale, Mehrad, Palfeyman
	Regular evaluation (audit and feedback) of ward-level EBP activities, knowledge, skills, behaviour and research utilization during annual interviews	Annual evaluation of implementing EBP-activities	Ahmandi, Al-Almaie, Al Ohmari 2009, Ubbink
Educators	Incorporating and inflating time spent on EBP by refining and modifying curriculum and education style in postgraduate and undergraduate medical and nursing curricula	Each non-academic degree professional produces a Cochrane Systematic review Improved audit and feedback, systematic evaluation, and needs assessment Tiered, feasible and realistic education	Ahmandi, Al-Almaie, Al-Ohmari 2006, Amin, Andersson, Brown 2009, Gale, Gerrish, Hadley, Kitto, Koehn, Lai, Mehrdad, Melnyk, Mittal, Nwagwu, Oliveri, Parahoo, Poolman, Scales, Sur, Ubbink, Upton
	Formulating the curriculum and educating in collaboration with healthcare professionals	EBP integration	Al-Almaie, Al Ohmari 2006, Brown 2009, Gale, Gerrish, Lai
	Interactive, face-to-face education in clinical practice and at the bed side	EBP integration	Ahmandi, Al-Almaie, Amin, Al Ohmari 2006, Kitto, Melnyk, Poolman
	Interactive education	E-learning modules	Kitto, Poolman, Ubbink
	EBP internship programme In-service training	Extended EBP education	Brown 2009 Gerrish

	Accessing, appraising and interpreting guidelines, research and protocols, basic statistical analysis, research training, IT-technology, quality development, change management, being a role model, English language	Optimum content of education	Al Ohmari 2006, Andersson, Gerrish, Lai, Mehrdad, Mittal, Nwagwu, Oranta, Parahoo
	Educating all educators in EBP	Well-equipped educators	Oranta
	Emphasizing professionals' own responsibility	Professional skills and competencies maintained	Oranta
	Evaluating effectiveness of EBP teaching	Optimum EBP education	Ulvenes, Veness
Faculty and researchers	Documenting, analysing and interpreting the effectiveness of actions undertaken	EBP implementation	Brown 2009
	Support professionals in clinical setting by simple and clear (written) communication	EBP implementation	Mehrdad, Brown 2009
	Using a variety of strategies	Dissemination of research findings Valorisation of results in practice	Brown 2009 Melnyk
	Close collaboration with practicing professionals	Shared language and understanding of concepts Actual relevant clinical questions are addressed	Oranta
	Being a role model	Real-life discussions about patients	Poolman
	Performing and promoting research	Well-designed high quality research	Scales, Sur
Services	Medical library facilities	Service for searching databases Clinical letters, journals and guidelines	Al Ohmari 2006, Melnyk, Mittal, Parahoo, Ubbink, Al Ohmari 2006,
	Computer and internet facilities at point of care, ward, or in EBP suites	Liberal access to databases Tailored to EBP level of professionals	Al Ohmari 2006, Gale, Lai, Mehrdad, Nwagwu, Chui, Melnyk, Ubbink
	Content management system allowing access to guidelines, protocols, critically appraised topics and condensed recommendations	User-friendly and reliable, readable and pre-appraised information Provide work-based information	Al Ohmari 2009, Gerrish, Lai, Ubbink
	Computer based decision support system with priority to systematic reviews	Computer-based guideline implementation Alerts and reminders	Al-Almaie, Al Ohmari 2009
	Accessible critical appraisal committee	Easy assessment of relevant literature	Mehrdad
	Implementation guidance	Overcomes obstacles to implement EBP or recommendation Change in practice	Chui, Mehrdad
Local workplace	Journal clubs, grand rounds, handovers, regular (research) meetings	EBP implementation	Oranta, Poolman, Ubbink
	Dedicated time and personnel for EBP activities	Individual support at the units	Andersson, Ubbink
	Easy access to EBP mentors, change mentors, innovators and educators, computers, databases, and relevant EBP websites or links	EBP implementation	Al-Almaie, Chui, Gale, Lai, Mehrdad, Ubbink, Veness
Culture	Emphasis on EBP in day-to-day practice		Amin
	Emphasis on patient benefit of EBP		Gale, Melnyk
	Sharing experience, knowledge and support		Andersson
	Activating autonomy and empower nurses to influence change		Brown 2009, Gerrish
	Shared governance structures		Brown 2009
	Engaging in research		Gerrish
	Willingness to facilitate the process of implementing		Koehn
	Innovative strategies including a culture of research implementation		Mehrdad
	Displaying interest and belief in value of research utilization		Mittal
	Enlightening professionals to use EBP in decision making		Nwagwu
	Supportive culture to research		Parahoo

1

Framework of policy recommendations for implementation of evidence-based practice ~~EBP~~: a systematic scoping review

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ABSTRACT

Objectives: Evidence-based practice (EBP) may help improve healthcare quality. However, not all healthcare professionals and managers use EBP in their daily practice. We systematically reviewed the literature to summarise self-reported appreciation of EBP and organisational infrastructure solutions proposed to promote EBP.

Design: Systematic review. Two investigators independently performed the systematic reviewing process.

Information sources: MEDLINE, EMBASE and Cochrane Library were searched for publications between 2000 and 2011.

Eligibility criteria for included studies: Reviews and surveys of EBP attitude, knowledge, awareness, skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.

Results: We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming. Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions were proposed at various organizational levels, including (inter)national associations and hospital management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-mentors on the wards to move EBP from the classroom to the bedside.

Conclusions: More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Article focus:

- Systematic review of the literature to summarise self-reported appreciation of evidence-based practice (EBP) and organisational infrastructure solutions proposed to promote EBP.

Key messages:

- More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare professionals as an important means to improve quality of patient care, but its implementation is still deficient.
- Policy exerted at micro, middle and macro levels, and supported by professional, educational and managerial role-models, may further facilitate EBP.

Strength and limitations of this study:

- Worldwide overview of EBP appreciation and implementation strategies useful for all centres striving at a better EBP implementation.
- Self-reporting may have led to an overestimation of the results.
- The success of implementation strategies is still unclear.

INTRODUCTION

Evidence-Based Practice (EBP) provides a structure for the bedside use of research and consideration of patient values and preferences to optimize clinical decision-making and to improve patient care.[1 2] EBP could potentially be used to improve quality of healthcare.[3 4] In 2001, the Institute of Medicine's Quality Chasm series suggested EBP as one of the five core competencies for professional healthcare curricula.[5] More recently, the growing societal demand for quality, safety, equality and accountability of healthcare, and credentialing programs as exerted by the Joint Commission International and Magnet hospitals have further promoted EBP.[6 7] To date, hospital executive boards, insurance companies and consumers recognize EBP may help prevent unsafe or inefficient practices, as part of a strategy to achieve quality improvement in healthcare.[8]

Thus far, however, educational efforts have failed to achieve EBP at the bedside or in daily clinical problem-solving. While there is an ongoing debate on how to measure quality of care in general, attitude, awareness, knowledge or behaviour are relevant to understand application of EBP. Various questionnaires have been developed and used to appreciate these aspects (e.g. McColl, Funk).[9,10] This information suggested the implementation of EBP by doctors is hampered by a perceived lack of time, knowledge or EBP resources,[9 11] while in the nursing realm EBP awareness, the body of knowledge and research utilization, as well as managerial support are still developing.[12 13] Based on these findings, many different recommendations for improvement have been proposed. Hence, it is timely to synthesise these recommendations for more structural organisational initiatives that may help overcome barriers and facilitate the uptake of EBP.

Therefore, the purpose of this study was to collect surveys of healthcare professionals' views on EBP in terms of self-reported attitude, knowledge, awareness, skills, barriers and behaviour regarding EBP among clinical doctors, nurses and managers, and to summarise proposed recommendations as derived from these views to improve the use of EBP. We subsequently used the findings of this review to propose a framework for implementation of EBP, tailor-made for different managerial

levels and suitable to structurally facilitate and sustain evidence-based behaviour in clinical healthcare organisations.

METHODS

Literature search and study selection

Two of the authors (DTU, HV) searched the MEDLINE (using PubMed), EMBASE (using Ovid) and Cochrane databases from 2000 through 2011 for surveys or reviews of EBP attitude, knowledge, awareness, barriers and facilitators among nurses, physicians and managers in any clinical setting, i.e. hospitals or other healthcare institutions, rather than general practice settings, on which a review has recently been published.[14] Reference lists of the included studies and reviews were checked for additional eligible papers.

In brief, our search strategy was: (evidence-based[ti] practice OR evidence-based medicine OR EBM OR EBP) AND (questionnaire* OR survey OR inventory) AND ((barriers OR McColl) AND (knowledge OR attitude* OR aware* OR behavio*) AND (hospital* OR clinic* OR medical cent*)). No language restrictions were applied. Papers in foreign languages, if any, would be translated if possible.

We excluded studies in an undergraduate educational setting, studies with a purely qualitative design, studies not including clinical doctors or nurses, and those focusing on a specific disorder, guideline, model or technique. We focused on surveys rather than the latter studies, because merely following (particularly expert-based) guidelines or focusing on a specific disorder or technique does not necessarily indicate the general application of the five steps of EBP. Studies before 2000 were also excluded because in these years the EBP paradigm was in an early phase with a limited dispersion among healthcare professionals. Study selection and quality assessment was performed by two investigators independently.

Quality assessment

Judgment of the quality of the surveys was based on the number of centres and respondents involved, response rates, and robustness of the questionnaires used (through pilot testing, prior validation or internal consistency based on a Cronbach's alpha).

Data items and synthesis of results

By means of a structured form two researchers independently extracted data on study characteristics (including country of origin, publication year, type and number of respondents and type of clinics included), questionnaires used and EBP characteristics studied, in particular EBP attitude, knowledge, skills, and awareness, and perceived barriers and facilitating factors for EBP implementation. We extracted in a qualitative manner the reported recommendations, if any, on how to overcome these barriers or how to exploit facilitators. These were grouped into solutions to be executed at various organisational levels. After one investigator had entered the data in the database, these data were checked for accuracy by a second.

Meta-analysis was not planned because of the expected large range in geographical locations, caregivers investigated and questionnaires used. To summarise the results of the studies reporting on EBP-attitudes and knowledge, we calculated the medians and report the ranges of the scores given for each item, for doctors and nurses separately. A possible association between response rate, year of publication and attitude towards EBP was calculated using Spearman's correlation coefficient. Statistical analysis was performed using PASW Statistics, version 18.0 (IBM Inc., Armonk, New York, USA).

RESULTS

Study inclusion

Our search yielded 286 potentially relevant studies. We also found two recent reviews of studies on barriers towards EBP,[15 16] from which other relevant studies were derived. Some more recent studies not included in these reviews were also found by hand-searching the references of included studies.

Four surveys among medical postgraduates were excluded because these publications were in Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on nurses. Three out of the 31 studies enrolled both doctors and nurses.[17-19] Wherever possible, results from doctors and nurses are presented separately.

All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and awareness, most studies used the questionnaires developed by McColl, Upton or Estabrooks.[9 20 21] To assess EBP barriers and facilitators, most investigators used the Funk questionnaire.[10] Half of the studies investigated both EBP attitude and barriers.

Study characteristics

The studies enrolled from 19[22] up to 1156[17] respondents (median 273), consisting of doctors (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates varied from 9% in nationwide surveys to 100% in questionnaires during trainings, with a median of 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table 1).

EBP attitude

Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire. Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and appreciated the use of research evidence in daily clinical practice. However, they considered only half

of their clinical practice to be evidence-based, although what they meant by this was, in most cases, not specified and unclear. These findings were consistent among the various countries. We did not find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-0.286; p=0.321) and attitude towards EBP.

EBP knowledge and skills

The majority (median 64%) of doctors and nurses reported they considered their EBP knowledge was insufficient. Similarly, a median of 70% of the respondents regarded their skills as insufficient, even in the most recent studies, and desired (more) EBP training. The percentage of doctors who had had EBP training ranged from 13% (Indian surgical trainees) to 80% (Iranian internal medicine doctors). The most appropriate way respondents thought to move towards EBP was through evidence-based guidelines (median 68%), evidence summaries (median 39%), or critical appraisal skills (median 36%). PubMed accessibility was high (at least 88%, except for India, 58%, and Jordan, 70%), either at home or at work. However, clinical decision-making was based on consulting textbooks and colleagues rather than by searching electronic databases.

Figure 2 depicts the knowledge of common EBP terms among doctors. Not all studies used the same EBP terms but in general, half of the doctors had at least some knowledge about 83% (20/24) of the presented EBP-terms. Three out of the four terms they were unfamiliar with were meaningless dummy terms. Hence, the results of this part of the questionnaire seemed not biased by socially desired answering.

Only one study examined the nurses' knowledge of EBP terms (figure 3).[19] Half of the nurses had at least some knowledge of 4 (40%) of the 10 terms presented. The dummy terms appeared more familiar than terms like 'bias', 'power calculation' and 'number needed to treat', suggesting some socially desired answering.

Awareness of common sources of evidence

Eight studies addressed this issue (table 1). About a quarter of the responding doctors used the *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two studies showed this awareness was even less among nurses.[17 19]

EBP barriers and facilitators

Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised, i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the barriers found among nurses in the systematic review by Kajermo et al.[15] These barriers are summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language barrier for non-English speaking countries and the limited access to electronic databases in some countries.

The major facilitating initiatives as desired by doctors and nurses were mostly collected through open questions. These facilitators include continuing EBP-teaching efforts in pre- and postgraduate curricula, constant involvement by colleagues in daily practice, staff and management support to learn and apply EBP in daily clinical practice, structural promotion and facilitation of EBP activities by the management and experts, and clear and easily accessible sources of evidence, protocols and guidelines.

Recommendations reported to implement EBP

All studies gave recommendations to overcome or address the identified barriers (Table 5). From macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various

solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific interventions at ward level, including availability of computers and internet.

A qualitative evaluation of the recommendations shows they mainly focused on education for both pre- and postgraduates. The following aspects were considered important: how and with whom to build EBP curricula, tiered education based on needs assessments, learning by interaction, and transfer of the education from the classroom to the bedside.

Regarding preconditions to strategically implement EBP, authors put emphasis on the role of the management in terms of facilitating prerequisites as well as creating a positive culture towards EBP. They also suggested that solutions to the problems encountered when implementing EBP should start with an analysis of the organisation to identify problems at both local and organisational levels to tailor the interventions.

DISCUSSION

Our systematic review shows that worldwide many professionals in clinical healthcare welcome EBP, although the awareness of, education in, and actual bedside application of, EBP leaves room for improvement. Based on the reasons given for the limited uptake of EBP, a structural implementation of EBP in clinical healthcare organisations will require a culture change at various organisational levels, i.e. patient care, education, and management. The framework of policy recommendations, as presented here, encompasses the wide range of possible entries to implement in a multifocal manner and sustain EBP. Because recommendations were found for virtually all levels of management, a general policy seems indicated to address and govern these EBP implementation issues. Some recommendations might also be useful as indicators to monitor the usage of EBP in

daily clinical practice. Furthermore, this review could stimulate the testing of some of our recommendations through appropriately designed studies.

Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP is progressing,[23] important barriers are still obstructing the full implementation of EBP in daily clinical practice. These findings occur consistently among the various medical specialists and nurses alike, and in many specific settings and specialties throughout the world. However, Brown et al. found in a multiple regression analysis that perceived barriers to research use predicted only a fraction of practice, attitude and knowledge/skills associated with EBP.[24] Apparently, the most frequently reported~~encountered~~ barriers are not necessarily the main reason for a poor implementation of EBP. Rather, a change in mind set seems indicated among the various healthcare professionals who perceive these barriers. Additional barriers to EBP implementation may lie at the organisational level.[4] Hence, an integrative approach, involving all professionals and supported by initiatives from various organisational levels, may be a more fitting solution.

An integrative approach to overcome perceived barriers to EBP has also been suggested by other authors,[25] who reasoned that the best implementation strategy should be a multifocal, comprehensive programme involving all professionals and should be tailored to their desires and perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation strategies presented imperfect evidence to support decisions about which guideline dissemination and implementation strategies are likely to be efficient under different circumstances.[26] Opinion leaders and role models appear to have a key function.[27] A recent systematic review, comprising seven observational studies, described the relation between EBP implementation and leadership among nurses.[28] The evidence suggested that initiatives on the level of leadership, organisation and culture are pivotal for the process of implementing EBP in nursing. However, available evidence for the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.[4] In the medical realm such evidence is also limited.[29-32]

Other frameworks or multi-dimensional programs have been proposed to improve research utillisation,[13] or to stimulate the use of EBP by nurses,[33] or on specific wards.[34] Others have promoted a dedicated research agenda,[35] integrated EBP education,[31 36] or the implementation of EBP in specific medical specialties.[16 37] Clinically integrated rather than stand-alone EBP teaching initiatives have been shown to improve EBP behaviour and may therefore help implement EBP in clinical practice.[38] These initiatives per se seem defective because none of these aspects can be omitted to arrive at a truly evidence-based healthcare: If EBP-education falls short, managers do not facilitate EBP activities, doctors do not apply EBP in their daily practice, or nurses are lagging behind in EBP knowledge, optimum evidence-based healthcare eventually will not (fully) reach the patients who deserve it. This has been one of the reasons why a European teaching project has started to incorporate evidence-based medicine in clinical practice.[39]

Limitations

Although not all studies found were performed in teaching hospitals, the majority may have been performed in centres that already had the aim, or were in the process of implementing EBP. Many other centres are likely to be lagging further behind. However, higher response rates were not associated with more positive attitudes towards EBP. Given the settings and types of respondents in the studies included here, the inferences of our review appear primarily valid for clinical doctors and nurses from various specialties in centres that aim at implementing EBM.

Second, the questionnaires used were self-reported and response rates varied considerably. For both reasons, our results may overestimate enthusiasm, knowledge, and uptake of EBP. On the other hand, the framework of implementation recommendations we derived from these studies may be useful for all centres striving at a better EBP implementation.

Third, in our review we searched for surveys of EBP attitude, knowledge, awareness, barriers and facilitators rather than studies specifically focusing on testing alternatives to improve implementation of EBP. Such studies, however, are rare.[4 28 32] The implementation factors these

studies mentioned also became clear from our review, while the success of these implementation strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing actual EBP behaviour during daily practice.[38 40 41]

Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if clinicians are aware of available evidence, the right thing to do does not always happen. Continuous quality improvement strategies also involve active implementation of available evidence and existing guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the first step towards quality improvement.

Conclusion

Our review of all available surveys on the barriers for, and promotion of, EBP-activities as perceived by clinical doctors and nurses suggests that EBP-implementation needs a multilevel approach, involving interventions in the policy-making, managerial, educational, and practical areas. We offer a summary of the suggested interventions at these different levels. These may be used not only to implement, but also to monitor the usage of EBP in daily clinical practice. This requires a joint effort and cultural change within the whole healthcare organisation, but is likely to result in a better quality of care.

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Table 1. Characteristics of included studies

Author	Year	Country	Teaching hospital(s)	Respondents	EBP aspects studied*
Ahmadi[42]	2008	Iran	Yes	Internal medicine interns, residents and fellows	1,2,3
Al-Almaie[43]	2004	Saudi Arabia	No	Doctors from various specialties	5
Al-Omari[44]	2009	Jordan	Both	Specialists, fellows, residents from various specialties	1,2,4,5,6
Al-Omari[45]	2006	Saudi Arabia	Both	Consultant physicians from various specialties	1,2,3,5
Amin[22]	2007	Ireland	Yes	Otorhinolaryngology surgical trainees	1,4
Andersson[46]	2007	Sweden	Yes	Trainee and specialist paediatric nurses	5
Brown[47]	2009	USA	Yes	Nurses from various specialties	5,6
Brown[24]	2010	USA	Both	Nurses from various specialties	5
Chiu[17]	2010	Taiwan	No	Doctors and nurses from various specialties	1,2,5
Gale[48]	2009	USA	No	Staff nurses and nurse managers from 8 ICUs	1,5,6
Gerrish[49]	2008	UK	Both	Nurses from various specialties	5
Hadley[50]	2007	UK	No	Junior doctors	1,2
Kitto[32]	2007	Australia	No	Surgeons	5
Koehn[51]	2008	USA	No	Staff nurses, unit managers, clinical advisors	1,5
Lai[18]	2010	Malaysia	No	Doctors, nursing and allied health staff before attending EBM workshop	1,5
Melnyk[52]	2004	USA	Unknown	Nurses before attending EBP workshops	1,5
Mehrdad[53]	2008	Iran	Yes	Clinical nurses and nurse educators	5,6
Mittal[54]	2010	India	No	Surgical trainees attending continuing education meeting	1,2,3,4,5
Nwagwu[55]	2008	Nigeria	Yes	Consultants in tertiary health care institutions	2,3
Olivieri[56]	2004	Denmark	Yes	Doctors from various specialties	2,4
Oranta[57]	2002	Finland	No	Staff and ward nurses	5,6
Palfreyman[58]	2003	UK	Yes	Nurses and physiotherapists from various specialties	2,5
Parahoo[59]	2001	N-Ireland	No	Medical and surgical nurses	1,5,6
Poolman[60]	2007	Netherlands	Unknown	Orthopaedic surgeons	1,2,4
Roth[61]	2010	Canada	Unknown	English-speaking urology residents participating in national review course	2,3,4,5
Scales[62]	2008	USA	Both	American Urology Association members	1,5
Sur[63]	2006	USA	Unknown	American Urology Association members	1,3,4
Ubbink[19]	2011	Netherlands	Yes	Doctors and nurses from various specialties	1,2,3,4,5,6
Ulvenes[64]	2009	Norway	Unknown	Reference panel of Norwegian physicians	1,2
Upton[65]	2005	UK	Unknown	Doctors from various specialties	2,5,6
Veness[66]	2003	Australia & NZ	Unknown	Radiation oncologists and registrars	1,2,3,4,6

*: 1= attitude; 2= skills; 3=awareness; 4=knowledge; 5=barriers; 6=facilitators

Table 2. Quality characteristics of included studies

Author	Centres (N)	Respondents (N)	Response rate (%)	Questionnaire robustness*
Ahmadi[42]	1	104	80	+
Al-Almaie[43]	3	273	67	-
Al-Omari[44]	5	386	97	++
Al-Omari[45]	9	178	86	++
Amin[22]	countrywide	19	95	++
Andersson[46]	2	113	80	++
Brown[47]	1	458	45	++
Brown[24]	4	974	75	++
Chiu[17]	61	1156	69	++
Gale[48]	1	92	22	++
Gerrish[49]	2	598	42	++
Hadley[50]	several	317	100	++
Kitto[32]	several	25	50	+
Koehn[51]	1	422	41	++
Lai[18]	2	144	72	+
Melnyk[52]	several	160	100	+
Mehrdad[53]	15	410	70	++
Mittal[54]	22	93	85	++
Nwagwu[55]	10	89	89	-
Olivieri[56]	1	225	60	++
Oranta[57]	2	253	80	++
Palfreyman[58]	1	106	24	++
Parahoo[59]	10	479	53	++
Poolman[60]	countrywide	367	60	++
Roth[61]	several	29	100	++
Scales[62]	countrywide	365	72	++
Sur[63]	countrywide	714	9	++
Ubbink[19]	1	701	72	++
Ulvenes[64]	countrywide	976	70	-
Upton[65]	countrywide	381	76	++
Veness[66]	countrywide	191	79	++
TOTAL	**24 (77%) >1 centre**	**25 (81%) >100 respondents**	**23 (74%) ≥60% response**	**24 (77%)**

***:** Robustness based on pilot testing, previous validation, or Cronbach's alpha.

Table 3. Attitudes of doctors and nurses towards EBP. Scores can range from 0 to 100.

	Doctors Median (range)	**Nurses** Median (range)
Your current attitude towards EBP *Least positive (0) to Extremely positive (100)*	72.3 (49-97)	66.7 (55-85)
Attitude of your colleagues towards EBP *Least positive (0) to Extremely positive (100)*	61.0 (41-89)	48.0 (48-48)
How useful are research findings in daily practice? *Useless (0) to Extremely useful (100)*	80.0 (46-97)	62.0 (34-82)
What percentage of your clinical practice is evidence-based? *0% to 100%*	52.6 (40-80)	44.9 (44-46)
Practicing EBP improves patient care *Completely disagree (0) to Fully agree (100)*	80.1 (52-97)	80.7 (74-87)
EBP is of limited value in clinical practice, because a scientific basis is lacking *Completely disagree (0) to Fully agree (100)*	36.3 (3-43)	48.3 (48-49)
Implementing EBP, however worthwhile as an ideal, places another demand on already overloaded surgeons/nurses *Completely disagree (0) to Fully agree (100)*	51.4 (37-56)	55.2 (17-61)
The amount of evidence is overwhelming *Completely disagree (0) to Fully agree (100)*	53.5 (50-57)	No data
EBP fails in practice *Completely disagree (0) to Fully agree (100)*	39.7 (15-84)	41.0 (39-63)
EBP is important for my profession *Completely disagree (0) to Fully agree (100)*	68.3 (52-95)	61.6 (30-93)

Table 4. Barriers to apply EBP as mentioned by doctors and nurses. Stated are those ranked among the top ten in most studies.

Doctors and nurses alike	
• Lack of time to read evidence or implement new ideas • Lack of facilities or resources • Lack of staff experienced in EBP • Lack of training in EBP • EBP is insufficiently supported by staff and management • Evidence is not easily available • Unawareness of research • Evidence is not generalisable to own setting	
Doctors	**Nurses**
• Lack of evidence • Conflicting evidence • Evidence is not incorporated in clinical practice • EBP negatively impacts medical skills and freedom	• Evidence is written in foreign language • Lack of authority to change practice • Statistics or research is unintelligible • Implications for practice are unclear

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Table 5. Structural incorporation of EBP at various levels as stated by the authors of the individual studies

LEVEL	INTERVENTION by	EFFECT	AUTHOR
Worldwide	International collaboration	Expansion and acceleration of the production and maintenance of Cochrane Systematic Reviews	Oliveri
	Global and international associations	Promotion of EBP Making EBP courses available	Olivieri Sur
	Scientific journals	Educational efforts Publishing high quality research	Poolman, Veness Scales, Sur
National	Governmental enforcement	EBP in all undergraduate and postgraduate healthcare educational institutions	Melnyk, Ubbink
	Installing and financing regulatory professional bodies	Quality assurance Practicing EBP Use of guidelines	Al-Almaie Melnyk Ubbink
	Installing and financing a national institute	Development of evidence based guidelines	Al-Almaie
	Arranging and financing	Free use of the Cochrane Library	Oliveri
	Policy makers, professional associations, health insurance companies, and regulatory bodies	Promotion of EBP	Scales, Oliveri, Poolman, Melnyk
Board of hospital directors	Incorporating EBP in strategic aims	Goals tailored on systematic evaluations Implementation of EBP and research utilization	Brown 2009, Ubbink
	Installing research councils	High-quality research	Brown 2009, Melnyk
	Allocating budget	High-quality research	Mehrdad
	Performing systematic evaluations during working visits, quarterly meetings with managers	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Incorporating performance of EBP activities by directors, managers and administrators in annual interviews	Increased hospital's level of EBP implementation and quality of care	Ubbink
	Providing management, administrators, and directors with tools and means	Effective learning and practising EBP	Al Ohmari 2006, Lai
Managers	Integrating EBP and policy setting	Evidence-based management	Al Ohmari 2009
	Recruitment, selection, employment of new personnel Identifying EBP role-models among current personnel	EBP-minded working force	Ubbink, Brown 2010
	Building an infrastructure and environment with an atmosphere that supports, promotes and embraces EBP (i.e. incentives, prizes or rewards, positive attitude)	Effective tools for implementing, learning and practising EBP Knowledgeable (nurse) researchers, (nurse) specialists, master' prepared professionals, faculty, research departments	Al-Almaie, Al Ohmari 2006, Brown 2009, Chui, Gale, Gerrish, Melnyk, Mehrdad, Mittal, Oranta, Parahoo, Ubbink
	Collaborating with educators	Organizational barriers and education addressed	Brown 2009
	Allocating budget	(More) dedicated EBP personnel, education, activities, computers and facilities at each point of care. Attending continuous education, (inter)national conferences	Brown 2009, Gale, Gerrish, Mehrdad, Melnyk, Lai
	Provide non-patient hours to personnel	Time for EBP activities and implementation, changing practice, and quality care development	Brown 2009, Gale, Mehrad, Palfeyman
	Regular evaluation (audit and feedback) of ward-level EBP activities, knowledge, skills, behaviour and research utilization during annual interviews	Annual evaluation of implementing EBP-activities	Ahmandi, Al-Almaie, Al Ohmari 2009, Ubbink
Educators	Incorporating and inflating time spent on EBP by refining and modifying curriculum and education style in postgraduate and undergraduate medical and nursing curricula	Each non-academic degree professional produces a Cochrane Systematic review Improved audit and feedback, systematic evaluation, and needs assessment Tiered, feasible and realistic education	Ahmandi, Al-Almaie, Al-Ohmari 2006, Amin, Andersson, Brown 2009, Gale, Gerrish, Hadley, Kitto, Koehn, Lai, Mehrdad, Melnyk, Mittal, Nwagwu, Oliveri, Parahoo, Poolman, Scales, Sur, Ubbink, Upton
	Formulating the curriculum and educating in collaboration with healthcare professionals	EBP integration	Al-Almaie, Al Ohmari 2006, Brown 2009, Gale, Gerrish, Lai
	Interactive, face-to-face education in clinical practice and at the bed side	EBP integration	Ahmandi, Al-Almaie, Amin, Al Ohmari 2006, Kitto, Melnyk, Poolman
	Interactive education	E-learning modules	Kitto, Poolman, Ubbink
	EBP internship programme In-service training	Extended EBP education	Brown 2009 Gerrish

	Accessing, appraising and interpreting guidelines, research and protocols, basic statistical analysis, research training, IT-technology, quality development, change management, being a role model, English language	Optimum content of education	Al Ohmari 2006, Andersson, Gerrish, Lai, Mehrdad, Mittal, Nwagwu, Oranta, Parahoo
	Educating all educators in EBP	Well-equipped educators	Oranta
	Emphasizing professionals' own responsibility	Professional skills and competencies maintained	Oranta
	Evaluating effectiveness of EBP teaching	Optimum EBP education	Ulvenes, Veness
Faculty and researchers	Documenting, analysing and interpreting the effectiveness of actions undertaken	EBP implementation	Brown 2009
	Support professionals in clinical setting by simple and clear (written) communication	EBP implementation	Mehrdad, Brown 2009
	Using a variety of strategies	Dissemination of research findings Valorisation of results in practice	Brown 2009 Melnyk
	Close collaboration with practicing professionals	Shared language and understanding of concepts Actual relevant clinical questions are addressed	Oranta
	Being a role model	Real-life discussions about patients	Poolman
	Performing and promoting research	Well-designed high quality research	Scales, Sur
Services	Medical library facilities	Service for searching databases Clinical letters, journals and guidelines	Al Ohmari 2006, Melnyk, Mittal, Parahoo, Ubbink, Al Ohmari 2006,
	Computer and internet facilities at point of care, ward, or in EBP suites	Liberal access to databases Tailored to EBP level of professionals	Al Ohmari 2006, Gale, Lai, Mehrdad, Nwagwu, Chui, Melnyk, Ubbink
	Content management system allowing access to guidelines, protocols, critically appraised topics and condensed recommendations	User-friendly and reliable, readable and pre-appraised information Provide work-based information	Al Ohmari 2009, Gerrish, Lai, Ubbink
	Computer based decision support system with priority to systematic reviews	Computer-based guideline implementation Alerts and reminders	Al-Almaie, Al Ohmari 2009
	Accessible critical appraisal committee	Easy assessment of relevant literature	Mehrdad
	Implementation guidance	Overcomes obstacles to implement EBP or recommendation Change in practice	Chui, Mehrdad
Local workplace	Journal clubs, grand rounds, handovers, regular (research) meetings	EBP implementation	Oranta, Poolman, Ubbink
	Dedicated time and personnel for EBP activities	Individual support at the units	Andersson, Ubbink
	Easy access to EBP mentors, change mentors, innovators and educators, computers, databases, and relevant EBP websites or links	EBP implementation	Al-Almaie, Chui, Gale, Lai, Mehrdad, Ubbink, Veness
Culture	Emphasis on EBP in day-to-day practice		Amin
	Emphasis on patient benefit of EBP		Gale, Melnyk
	Sharing experience, knowledge and support		Andersson
	Activating autonomy and empower nurses to influence change		Brown 2009, Gerrish
	Shared governance structures		Brown 2009
	Engaging in research		Gerrish
	Willingness to facilitate the process of implementing		Koehn
	Innovative strategies including a culture of research implementation		Mehrdad
	Displaying interest and belief in value of research utilization		Mittal
	Enlightening professionals to use EBP in decision making		Nwagwu
	Supportive culture to research		Parahoo

1

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1, 2
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	n.a.
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	n.a.

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	6
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	6, 20, 21
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	7, 21
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	22-25
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	n.a.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	7
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	7
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	10, 11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	12
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	12, 13
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	13

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

Countries from which studies were included.
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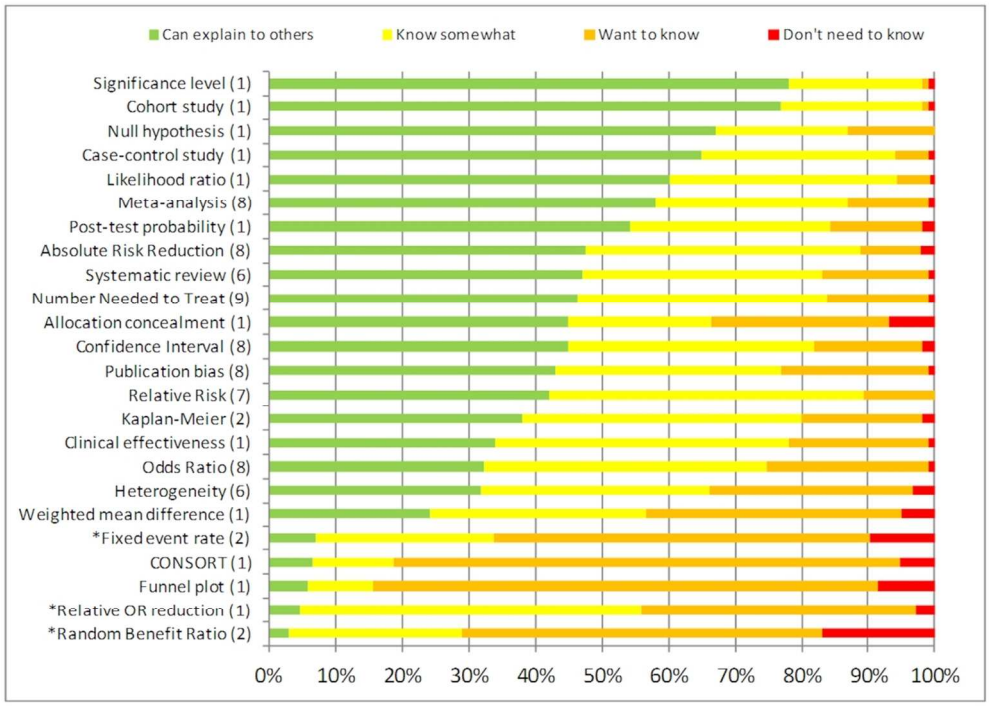

Doctors' knowledge of common EBP terms. The numbers between brackets indicate the number of studies that used this term. Terms with an asterisk are meaningless dummy terms.
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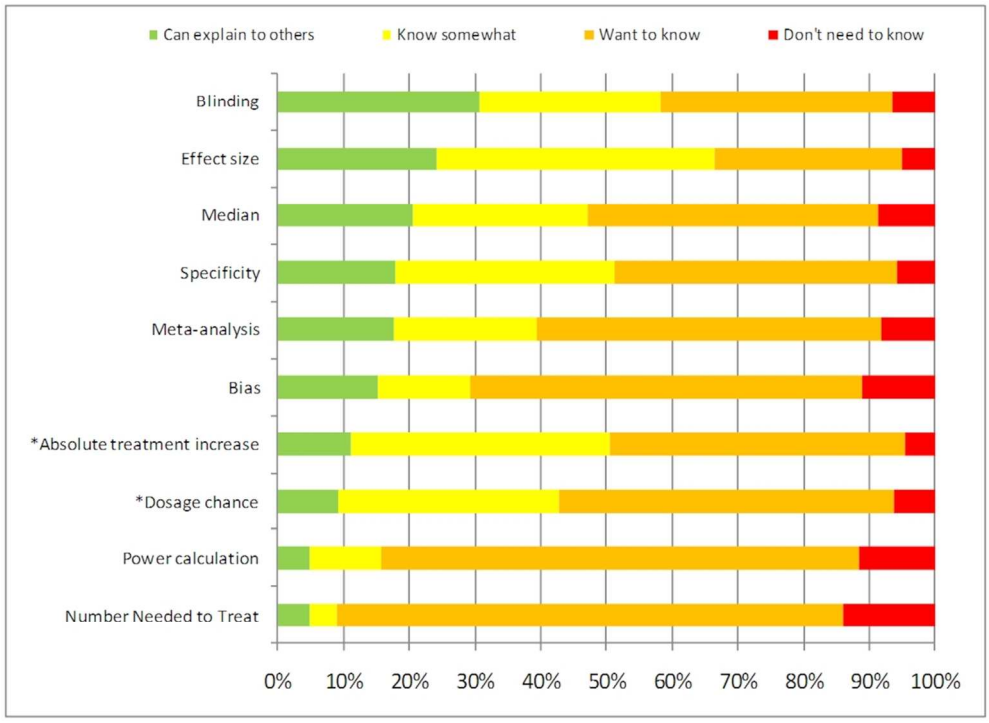

Nurses' knowledge of common EBP terms. Terms with an asterisk are meaningless dummy terms.
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