



## 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.<sup>1,2</sup>

EBP could potentially be used to improve quality of healthcare.<sup>3,4</sup> In 2001, the Institute of Medicine's Quality Chasm series suggested EBP as one of the five core competencies for professional healthcare curricula.<sup>5</sup> 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.<sup>6,7</sup> 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.<sup>8</sup>

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,<sup>9,10</sup> while in the nursing realm EBP awareness, the body of knowledge and research utilization, as well as managerial support is yet burgeoning.<sup>11,12</sup> 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 McCoil) 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

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3 By means of a structured form two researchers independently extracted data on study characteristics  
4 (including country of origin, publication year, type and number of respondents and type of clinics  
5 included), questionnaires used and EBP characteristics studied, in particular EBP attitude, knowledge,  
6 skills, and awareness, and perceived barriers and facilitating factors for EBP implementation. We  
7 extracted in a qualitative manner the reported recommendations, if any, on how to overcome these  
8 barriers or how to exploit facilitators. These were grouped into solutions to be executed at various  
9 organisational levels. Extracted data were checked independently by a second investigator.  
10  
11 Meta-analysis was not planned because of the expected large range in geographical locations,  
12 caregivers investigated and questionnaires used. To summarise the results of the studies reporting  
13 on EBP-attitudes and knowledge, we calculated the medians and report the ranges of the scores  
14 given for each item, for doctors and nurses separately. A possible association between response rate,  
15 year of publication and attitude towards EBP was calculated using Spearman's correlation coefficient.  
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17 Statistical analysis was performed using PASW Statistics, version 18.0 (IBM Inc., Armonk, New York,  
18 USA).

## 37 RESULTS

### 41 Study inclusion

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43 Our search yielded 252 potentially relevant studies. We also found two recent reviews of studies on  
44 barriers towards EBP,<sup>13 14</sup> from which other relevant studies were derived. Some more recent studies  
45 not included in these reviews were also found by hand-searching the references of included studies.  
46  
47 In total, 31 studies that included 10,798 respondents from 17 countries proved eligible (Table 1).  
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49 Studies represented nearly all continents, one third (11/31) were European and a quarter (8/31)  
50 were from North America (Figure 1). In four of the studies EBP questions were administered in the  
51 context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on  
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3 nurses. Three out of the 30 studies enrolled both doctors and nurses.<sup>15-17</sup> Wherever possible, results  
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5 from doctors and nurses are presented separately.

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7 All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and  
8  
9 awareness, most questionnaires used those developed by McColl, Upton or Estabrooks.<sup>10 18 19</sup> To  
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11 assess EBP barriers and facilitators, most investigators used the Funk questionnaire.<sup>20</sup> Half of the  
12  
13 studies investigated both EBP attitude and barriers.  
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### 15 16 17 18 **Study characteristics**

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20 The studies enrolled from 19<sup>21</sup> up to 1156<sup>15</sup> respondents (median 273), consisting of doctors  
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22 (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from  
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24 various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates  
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26 varied from 9% in nationwide surveys to 100% in interviews, with a median of 72%. Twenty-four out  
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28 of the 31 studies (77%) used robust questionnaires. So, overall quality of the included studies was  
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30 good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table 1).  
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### 35 36 **EBP attitude**

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38 Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire.  
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40 Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and  
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42 is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and  
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44 appreciated the use of research evidence in daily clinical practice. However, they considered only half  
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46 of their clinical practice to be evidence-based, although what they meant by this was, in most cases,  
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48 not specified and unclear. These findings were consistent among the various countries. We did not  
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50 find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-  
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52 0.286; p=0.321) and attitude towards EBP.  
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### 57 58 **EBP knowledge and skills**

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3 The majority (median 64%) of doctors and nurses reported they considered their EBP knowledge was  
4 insufficient. Similarly, a median of 70% of the respondents regarded their skills as insufficient, even in  
5 the most recent studies, and desired (more) EBP training. The percentage of doctors who had had  
6 EBP training ranged from 13% (Indian surgical trainees) to 80% (Iranian internal medicine doctors).  
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8 The most appropriate way respondents thought to move towards EBP was through evidence-based  
9 guidelines (median 68%), evidence summaries (median 39%), or critical appraisal skills (median 36%).  
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11 PubMed accessibility was high (at least 88%, except for India, 58%, and Jordan, 70%), either at home  
12 or at work. However, clinical decision-making was based on consulting textbooks and colleagues  
13 rather than by searching electronic databases.  
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22 Figure 2 depicts the knowledge of common EBP terms among doctors. Not all studies used the same  
23 EBP terms but in general, half of the doctors had at least some knowledge about 83% (20/24) of the  
24 presented EBP-terms. Three out of the four terms they were unfamiliar with were meaningless  
25 dummy terms. Hence, the results of this part of the questionnaire seemed not biased by socially  
26 desired answering.  
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33 Only one study examined the nurses' knowledge of EBP terms (figure 3).<sup>17</sup> Half of the nurses had at  
34 least some knowledge of 4 (40%) of the 10 terms presented. The dummy terms appeared more  
35 familiar than terms like 'bias', 'power calculation' and 'number needed to treat', suggesting some  
36 socially desired answering.  
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#### 44 **Awareness of common sources of evidence**

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46 About a quarter of the responding doctors used the *Cochrane Library* (median 25%), while 39% of  
47 them were unaware of this database. The journal *Evidence-Based Medicine* was used by 14%, but  
48 unknown in 34% of the doctors. Guidelines from the *National Guideline Clearinghouse* were used by  
49 8% and unknown in 48%, the *ACP Journal Club* used by 3% but unknown in 68%, and the *TRIP*  
50 *database* was used by 15% and unknown in 71%. Two studies showed this awareness was even less  
51 among nurses.<sup>15 17</sup>  
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### 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.<sup>13</sup> 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

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

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18 Our systematic review shows that worldwide many professionals in clinical healthcare welcome EBP,  
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20 although the awareness of, education in, and actual bedside application of, EBP leaves room for  
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22 improvement. Based on the reasons found for the limited uptake of EBP, a structural implementation  
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24 of EBP in clinical healthcare organisations will require a culture change at various organisational  
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26 levels, i.e. patient care, education, and management. The evidence-based policy framework of  
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28 recommendations, as presented here, encompasses the wide range of possible entries to implement  
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30 in a multifocal manner and sustain EBP. Because recommendations were found for virtually all levels  
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32 of management, a general policy seems indicated to address and govern these EBP implementation  
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34 issues. Some recommendations might also be useful as indicators to monitor the usage of EBP in  
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36 daily clinical practice.  
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40 Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP  
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42 is progressing,<sup>22</sup> important barriers are still obstructing the full implementation of EBP in daily clinical  
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44 practice. These findings occur consistently among the various medical specialists and nurses alike,  
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46 and in many specific settings and specialties throughout the world. However, Brown et al. found in a  
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48 multiple regression analysis that perceived barriers to research use predicted only a fraction of  
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50 practice, attitude and knowledge/skills associated with EBP.<sup>23</sup> Apparently, the most frequently  
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52 encountered barriers are not necessarily the main reason for a poor implementation of EBP. Rather,  
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54 a change in mind set seems indicated among the various healthcare professionals who perceive  
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56 these barriers. Additional barriers to EBP implementation may lie at the organisational level.<sup>4</sup> Hence,  
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3 an integrative approach, involving all professionals and supported by initiatives from various  
4 organisational levels, may be a more fitting solution.

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

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

## 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.<sup>4 27 31</sup> 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.<sup>37,39</sup>

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,

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

11  
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**Table 1.** Characteristics of included studies

| Author                   | Year | Country        | Teaching hospital(s) | Respondents  | EBP aspects studied* |
|--------------------------|------|----------------|----------------------|--|----------------------|
| Ahmadi <sup>40</sup>     | 2008 | Iran           | Yes                  | Internal medicine interns, residents and fellows                           | 1,2,3                |
| Al-Almaie <sup>41</sup>  | 2004 | Saudi Arabia   | No                   | Doctors from various specialties   | 5                    |
| Al-Omari <sup>42</sup>   | 2009 | Jordan         | Both                 | Specialists, fellows, residents from various specialties                   | 1,2,4,5,6            |
| Al-Omari <sup>43</sup>   | 2006 | Saudi Arabia   | Both                 | Consultant physicians from various specialties                             | 1,2,3,5              |
| Amin <sup>21</sup>       | 2007 | Ireland        | Yes                  | Otorhinolaryngology surgical trainees                                      | 1,4                  |
| Andersson <sup>44</sup>  | 2007 | Sweden         | Yes                  | Trainee and specialist paediatric nurses                                   | 5                    |
| Brown <sup>45</sup>      | 2009 | USA            | Yes                  | Nurses from various specialties  | 5,6                  |
| Brown <sup>23</sup>      | 2010 | USA            | Both                 | Nurses from various specialties  | 5                    |
| Chiu <sup>15</sup>       | 2010 | Taiwan         | No                   | Doctors and nurses from various specialties                                | 1,2,5                |
| Gale <sup>46</sup>       | 2009 | USA            | No                   | Staff nurses and nurse managers from 8 ICUs                                | 1,5,6                |
| Gerrish <sup>47</sup>    | 2008 | UK             | Both                 | Nurses from various specialties  | 5                    |
| Hadley <sup>48</sup>     | 2007 | UK             | No                   | Junior doctors   | 1,2                  |
| Kitto <sup>31</sup>      | 2007 | Australia      | No                   | Surgeons   | 5                    |
| Koehn <sup>49</sup>      | 2008 | USA            | No                   | Staff nurses, unit managers, clinical advisors                             | 1,5                  |
| Lai <sup>16</sup>        | 2010 | Malaysia       | No                   | Doctors, nursing and allied health staff before attending EBM workshop     | 1,5                  |
| Melnyk <sup>50</sup>     | 2004 | USA            | Unknown              | Nurses before attending EBP workshops                                      | 1,5                  |
| Mehrdad <sup>51</sup>    | 2008 | Iran           | Yes                  | Clinical nurses and nurse educators  | 5,6                  |
| Mittal <sup>52</sup>     | 2010 | India          | No                   | Surgical trainees attending continuing education meeting                   | 1,2,3,4,5            |
| Nwagwu <sup>53</sup>     | 2008 | Nigeria        | Yes                  | Consultants in tertiary health care institutions                           | 2,3                  |
| Olivier <sup>54</sup>    | 2004 | Denmark        | Yes                  | Doctors from various specialties   | 2,4                  |
| Oranta <sup>55</sup>     | 2002 | Finland        | No                   | Staff and ward nurses  | 5,6                  |
| Palfreyman <sup>56</sup> | 2003 | UK             | Yes                  | Nurses and physiotherapists from various specialties                       | 2,5                  |
| Parahoo <sup>57</sup>    | 2001 | N-Ireland      | No                   | Medical and surgical nurses  | 1,5,6                |
| Poolman <sup>58</sup>    | 2007 | Netherlands    | Unknown              | Orthopaedic surgeons   | 1,2,4                |
| Roth <sup>59</sup>       | 2010 | Canada         | Unknown              | English-speaking urology residents participating in national review course | 2,3,4,5              |
| Scales <sup>60</sup>     | 2008 | USA            | Both                 | American Urology Association members                                       | 1,5                  |
| Sur <sup>61</sup>        | 2006 | USA            | Unknown              | American Urology Association members                                       | 1,3,4                |
| Ubbink <sup>17</sup>     | 2011 | Netherlands    | Yes                  | Doctors and nurses from various specialties                                | 1,2,3,4,5,6          |
| Ulvenes <sup>62</sup>    | 2009 | Norway         | Unknown              | Reference panel of Norwegian physicians                                    | 1,2                  |
| Upton <sup>63</sup>      | 2005 | UK             | Unknown              | Doctors from various specialties   | 2,5,6                |
| Veness <sup>64</sup>     | 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 <sup>40</sup>     | 1                                | 104                                     | 80                                | ±                         |
| Al-Almaie <sup>41</sup>  | 3                                | 273                                     | 67                                | -                         |
| Al-Omari <sup>42</sup>   | 5                                | 386                                     | 97                                | +                         |
| Al-Omari <sup>43</sup>   | 9                                | 178                                     | 86                                | +                         |
| Amin <sup>21</sup>       | countrywide                      | 19                                      | 95                                | +                         |
| Andersson <sup>44</sup>  | 2                                | 113                                     | 80                                | +                         |
| Brown <sup>45</sup>      | 1                                | 458                                     | 45                                | +                         |
| Brown <sup>23</sup>      | 4                                | 974                                     | 75                                | +                         |
| Chiu <sup>15</sup>       | 61                               | 1156                                    | 69                                | +                         |
| Gale <sup>46</sup>       | 1                                | 92                                      | 22                                | +                         |
| Gerrish <sup>47</sup>    | 2                                | 598                                     | 42                                | +                         |
| Hadley <sup>48</sup>     | several                          | 317                                     | 100                               | +                         |
| Kitto <sup>31</sup>      | several                          | 25                                      | 50                                | ±                         |
| Koehn <sup>49</sup>      | 1                                | 422                                     | 41                                | +                         |
| Lai <sup>16</sup>        | 2                                | 144                                     | 72                                | ±                         |
| Melnyk <sup>50</sup>     | several                          | 160                                     | 100                               | ±                         |
| Mehrdad <sup>51</sup>    | 15                               | 410                                     | 70                                | +                         |
| Mittal <sup>52</sup>     | 22                               | 93                                      | 85                                | +                         |
| Nwagwu <sup>53</sup>     | 10                               | 89                                      | 89                                | -                         |
| Olivieri <sup>54</sup>   | 1                                | 225                                     | 60                                | +                         |
| Oranta <sup>55</sup>     | 2                                | 253                                     | 80                                | +                         |
| Palfreyman <sup>56</sup> | 1                                | 106                                     | 24                                | +                         |
| Parahoo <sup>57</sup>    | 10                               | 479                                     | 53                                | +                         |
| Poolman <sup>58</sup>    | countrywide                      | 367                                     | 60                                | +                         |
| Roth <sup>59</sup>       | several                          | 29                                      | 100                               | +                         |
| Scales <sup>60</sup>     | countrywide                      | 365                                     | 72                                | +                         |
| Sur <sup>61</sup>        | countrywide                      | 714                                     | 9                                 | +                         |
| Ubbink <sup>17</sup>     | 1                                | 701                                     | 72                                | +                         |
| Ulvenes <sup>62</sup>    | countrywide                      | 976                                     | 70                                | -                         |
| Upton <sup>63</sup>      | countrywide                      | 381                                     | 76                                | +                         |
| Veness <sup>64</sup>     | countrywide                      | 191                                     | 79                                | +                         |
| <b>TOTAL</b>             | <b>24 (77%)<br/>&gt;1 centre</b> | <b>25 (81%)<br/>&gt;100 respondents</b> | <b>23 (74%)<br/>≥60% response</b> | <b>24 (77%)</b>           |

\*: 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<br>Median<br>(range) | Nurses<br>Median<br>(range) |
|--|------------------------------|-----------------------------|
| Your current attitude towards EBP<br><i>Least positive (0) to Extremely positive (100)</i>   | 72.3<br>(49-97)              | 66.7<br>(55-85)             |
| Attitude of your colleagues towards EBP<br><i>Least positive (0) to Extremely positive (100)</i>   | 61.0<br>(41-89)              | 48.0<br>(48-48)             |
| How useful are research findings in daily practice?<br><i>Useless (0) to Extremely useful (100)</i>  | 80.0<br>(46-97)              | 62.0<br>(34-82)             |
| What percentage of your clinical practice is evidence-based?<br><i>0% to 100%</i>  | 52.6<br>(40-80)              | 44.9<br>(44-46)             |
| Practicing EBP improves patient care<br><i>Completely disagree (0) to Fully agree (100)</i>  | 80.1<br>(52-97)              | 80.7<br>(74-87)             |
| EBP is of limited value in clinical practice, because a scientific basis is lacking<br><i>Completely disagree (0) to Fully agree (100)</i>                           | 36.3<br>(3-43)               | 48.3<br>(48-49)             |
| Implementing EBP, however worthwhile as an ideal, places another demand on already overloaded surgeons/nurses<br><i>Completely disagree (0) to Fully agree (100)</i> | 51.4<br>(37-56)              | 55.2<br>(17-61)             |
| The amount of evidence is overwhelming<br><i>Completely disagree (0) to Fully agree (100)</i>  | 53.5<br>(50-57)              | No data                     |
| EBP fails in practice<br><i>Completely disagree (0) to Fully agree (100)</i>   | 39.7<br>(15-84)              | 41.0<br>(39-63)             |
| EBP is important for my profession<br><i>Completely disagree (0) to Fully agree (100)</i>  | 68.3<br>(52-95)              | 61.6<br>(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   |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Lack of time to read evidence or implement new ideas</li> <li>• Lack of facilities or resources</li> <li>• Lack of staff experienced in EBP</li> <li>• Lack of training in EBP</li> <li>• EBP is insufficiently supported by staff and management</li> <li>• Evidence is not easily available</li> <li>• Unawareness of research</li> <li>• Evidence is not generalisable to own setting</li> </ul> |  |
| Doctors  | Nurses   |
| <ul style="list-style-type: none"> <li>• Lack of evidence</li> <li>• Conflicting evidence</li> <li>• Evidence is not incorporated in clinical practice</li> <li>• EBP negatively impacts medical skills and freedom</li> </ul>   | <ul style="list-style-type: none"> <li>• Evidence is written in foreign language</li> <li>• Lack of authority to change practice</li> <li>• Statistics or research is unintelligible</li> <li>• Implications for practice are unclear</li> </ul> |



**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<br>Making EBP courses available   | Olivieri<br>Sur   |
|   | Scientific journals  | Educational efforts<br>Publishing high quality research  | Poolman, Veness<br>Scales, Sur  |
| National  | Governmental enforcement   | EBP in all undergraduate and postgraduate healthcare educational institutions  | Melnyk, Ubbink  |
|   | Installing and financing regulatory professional bodies  | Quality assurance<br>Practicing EBP<br>Use of guidelines   | Al-Almaie<br>Melnyk<br>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,<br>Melnyk   |
| Board of hospital directors   | Incorporating EBP in strategic aims  | Goals tailored on systematic evaluations<br>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<br>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<br>Knowledgeable (nurse) researchers, (nurse) specialists, master' prepared professionals, faculty, research departments | Al-Almaie, Al Ohmari 2006,<br>Brown 2009, Chui, Gale,<br>Gerrish, Melnyk, Mehrdad,<br>Mittal, Oranta, Parahoo,<br>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,<br>Mehrdad, Melnyk, Lai  |
|   | Provide non-patient hours to personnel   | Time for EBP activities and implementation, changing practice, and quality care development  | Brown 2009, Gale,<br>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<br>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<br><br>Improved audit and feedback, systematic evaluation, and needs assessment<br><br>Tiered, feasible and realistic education |
| Formulating the curriculum and educating in collaboration with healthcare professionals |  | EBP integration  | Al-Almaie, Al Ohmari 2006,<br>Brown 2009, Gale, Gerrish,<br>Lai   |
| Interactive, face-to-face education in clinical practice and at the bed side            |  | EBP integration  | Ahmandi, Al-Almaie, Amin,<br>Al Ohmari 2006, Kitto,<br>Melnyk, Poolman  |
| Interactive education   |  | E-learning modules   | Kitto, Poolman, Ubbink  |
| EBP internship programme  |  | Extended EBP education   | Brown 2009  |
| In-service training   |  |  | 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   |
| <b>Faculty and researchers</b>                           | 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<br>Valorisation of results in practice                            | Brown 2009<br>Melnyk  |
|  | Close collaboration with practicing professionals   | Shared language and understanding of concepts<br>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   |
| <b>Services</b>  | Medical library facilities  | Service for searching databases<br>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<br>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<br>Provide work-based information | Al Ohmari 2009, Gerrish, Lai, Ubbink  |
|  | Computer based decision support system with priority to systematic reviews  | Computer-based guideline implementation<br>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<br>Change in practice                         | Chui, Mehrdad   |
| <b>Local workplace</b>                                   | 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                               |
| <b>Culture</b>   | 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 # |
|------------------------------------|----|---|--------------------|
| <b>TITLE</b>                       |    |   |                    |
| Title                              | 1  | Identify the report as a systematic review, meta-analysis, or both.   | 1, 2               |
| <b>ABSTRACT</b>                    |    |   |                    |
| 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                  |
| <b>INTRODUCTION</b>                |    |   |                    |
| 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                  |
| <b>METHODS</b>                     |    |   |                    |
| 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.               |

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# 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                  |
| <b>RESULTS</b>                |    |  |                    |
| 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                  |
| <b>DISCUSSION</b>             |    |  |                    |
| 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             |
| <b>FUNDING</b>                |    |  |                    |
| 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

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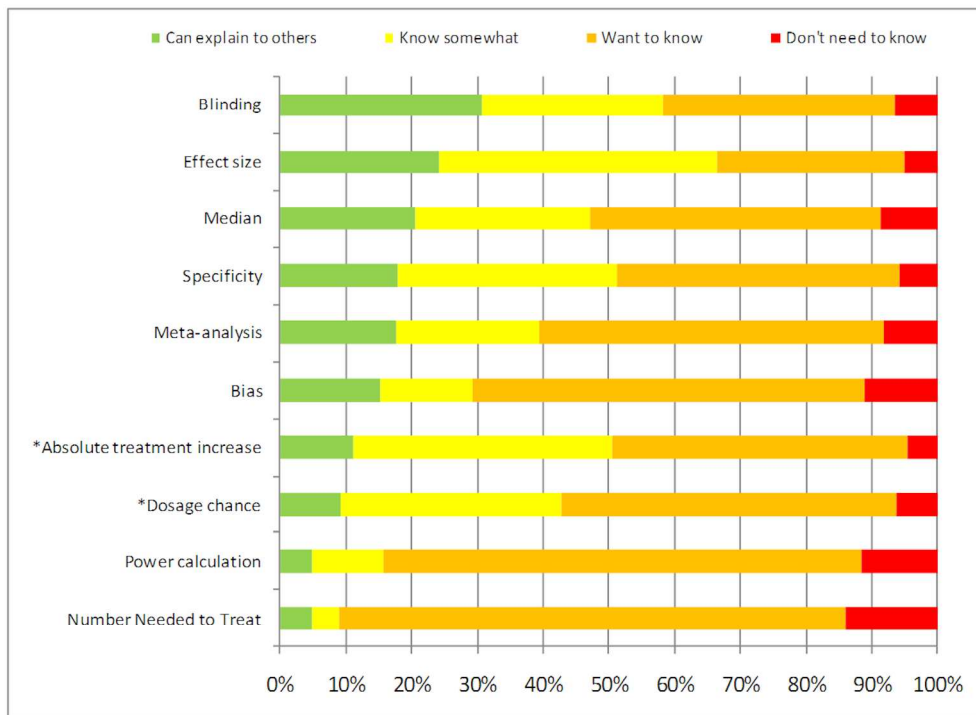
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Countries from which studies were included.  
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Doctors' knowledge of common EBP terms. The numbers between brackets indicate the number of studies that used this term. Terms with an asterisk are meaningless dummy terms.  
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Nurses' knowledge of common EBP terms. Terms with an asterisk are meaningless dummy terms.  
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## 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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**Word count:** 2865

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3 1 **ABSTRACT**  
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7 3 **Objectives:** Evidence-based practice (EBP) may help improve healthcare quality. However, not all  
8  
9 4 healthcare professionals and managers use EBP in their daily practice. We systematically reviewed  
10  
11 5 the literature to summarise self-reported appreciation of EBP and organisational infrastructure  
12  
13 6 solutions proposed to promote EBP.  
14  
15 7 **Design:** Systematic review. Two investigators independently performed the systematic reviewing  
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17 8 process.  
18  
19 9 **Information sources:** MEDLINE, EMBASE and Cochrane Library were searched for publications  
20  
21 10 between 2000 and 2011.  
22  
23 11 **Eligibility criteria for included studies:** Reviews and surveys of EBP attitude, knowledge, awareness,  
24  
25 12 skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.  
26  
27 13 **Results:** We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming.  
28  
29 14 Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions  
30  
31 15 were proposed at various organizational levels, including (inter)national associations and hospital  
32  
33 16 management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-  
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35 17 mentors on the wards to move EBP from the classroom to the bedside.  
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37 18 **Conclusions:** More than 20 years after its introduction, the EBP-paradigm has been embraced by  
38  
39 19 healthcare professionals as an important means to improve quality of patient care, but its  
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41 20 implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by  
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43 21 professional, educational and managerial role-models, may further facilitate EBP.  
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60**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.

## 1 INTRODUCTION

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

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

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

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

3

#### 4 **METHODS**

##### 5 **Literature search and study selection**

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

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

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

24

##### 25 **Quality assessment**

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

#### 4 5 **Data items and synthesis of results**

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

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

## 21 22 **RESULTS**

### 23 **Study inclusion**

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

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3 1 Four surveys among medical postgraduates were excluded because these publications were in  
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5 2 Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible  
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7 3 (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter  
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9 4 (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in  
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11 5 the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on  
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13 6 nurses. Three out of the 31 studies enrolled both doctors and nurses.<sup>17-19</sup> Wherever possible, results  
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15 7 from doctors and nurses are presented separately.  
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17 8 All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and  
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19 9 awareness, most studies used the questionnaires developed by McColl, Upton or Estabrooks.<sup>9 20 21</sup> To  
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21 10 assess EBP barriers and facilitators, most investigators used the Funk questionnaire.<sup>10</sup> Half of the  
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23 11 studies investigated both EBP attitude and barriers.  
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### 29 13 **Study characteristics**

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31 14 The studies enrolled from 19<sup>22</sup> up to 1156<sup>17</sup> respondents (median 273), consisting of doctors  
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33 15 (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from  
34  
35 16 various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates  
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37 17 varied from 9% in nationwide surveys to 100% in questionnaires during trainings, with a median of  
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39 18 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the  
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41 19 included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table  
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### 48 22 **EBP attitude**

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50 23 Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire.  
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52 24 Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and  
53  
54 25 is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and  
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56 26 appreciated the use of research evidence in daily clinical practice. However, they considered only half  
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1 of their clinical practice to be evidence-based, although what they meant by this was, in most cases,  
2 not specified and unclear. These findings were consistent among the various countries. We did not  
3 find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-  
4 0.286; p=0.321) and attitude towards EBP.

### 6 **EBP knowledge and skills**

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

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

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

### 26 **Awareness of common sources of evidence**

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3 1 Eight studies addressed this issue (table 1). About a quarter of the responding doctors used the  
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5 2 *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal  
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7 3 *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the  
8  
9 4 *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used  
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11 5 by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two  
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13 6 studies showed this awareness was even less among nurses.<sup>17 19</sup>  
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### 18 **EBP barriers and facilitators**

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20 9 Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised,  
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22 10 i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the  
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24 11 barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the  
25  
26 12 barriers found among nurses in the systematic review by Kajermo et al.<sup>15</sup> These barriers are  
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28 13 summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language  
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30 14 barrier for non-English speaking countries and the limited access to electronic databases in some  
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32 15 countries.  
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35 16 The major facilitating initiatives as desired by doctors and nurses were mostly collected through  
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37 17 open questions. These facilitators include continuing EBP-teaching efforts in pre- and postgraduate  
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39 18 curricula, constant involvement by colleagues in daily practice, staff and management support to  
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41 19 learn and apply EBP in daily clinical practice, structural promotion and facilitation of EBP activities by  
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43 20 the management and experts, and clear and easily accessible sources of evidence, protocols and  
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45 21 guidelines.  
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### 50 **Recommendations reported to implement EBP**

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52 24 All studies gave recommendations to overcome or address the identified barriers (Table 5). From  
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54 25 macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various  
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1 solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific  
2 interventions at ward level, including availability of computers and internet.  
3 A qualitative evaluation of the recommendations shows they mainly focused on education for both  
4 pre- and postgraduates. The following aspects were considered important: how and with whom to  
5 build EBP curricula, tiered education based on needs assessments, learning by interaction, and  
6 transfer of the education from the classroom to the bedside.  
7 Regarding preconditions to strategically implement EBP, authors put emphasis on the role of  
8 the management in terms of facilitating prerequisites as well as creating a positive culture  
9 towards EBP. They also suggested that solutions to the problems encountered when  
10 implementing EBP should start with an analysis of the organisation to identify problems at  
11 both local and organisational levels to tailor the interventions.

## 14 DISCUSSION

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

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3 1 Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP  
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5 2 is progressing,<sup>23</sup> important barriers are still obstructing the full implementation of EBP in daily clinical  
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7 3 practice. These findings occur consistently among the various medical specialists and nurses alike,  
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9 4 and in many specific settings and specialties throughout the world. However, Brown et al. found in a  
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11 5 multiple regression analysis that perceived barriers to research use predicted only a fraction of  
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13 6 practice, attitude and knowledge/skills associated with EBP.<sup>24</sup> Apparently, the most frequently  
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15 7 encountered barriers are not necessarily the main reason for a poor implementation of EBP. Rather,  
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17 8 a change in mind set seems indicated among the various healthcare professionals who perceive  
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19 9 these barriers. Additional barriers to EBP implementation may lie at the organisational level.<sup>4</sup> Hence,  
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21 10 an integrative approach, involving all professionals and supported by initiatives from various  
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23 11 organisational levels, may be a more fitting solution.

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27 12 An integrative approach to overcome perceived barriers to EBP has also been suggested by other  
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29 13 authors,<sup>25</sup> who reasoned that the best implementation strategy should be a multifocal,  
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31 14 comprehensive programme involving all professionals and should be tailored to their desires and  
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33 15 perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation  
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35 16 strategies presented imperfect evidence to support decisions about which guideline dissemination  
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37 17 and implementation strategies are likely to be efficient under different circumstances.<sup>26</sup> Opinion  
38  
39 18 leaders and role models appear to have a key function.<sup>27</sup> A recent systematic review, comprising  
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41 19 seven observational studies, described the relation between EBP implementation and leadership  
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43 20 among nurses.<sup>28</sup> The evidence suggested that initiatives on the level of leadership, organisation and  
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45 21 culture are pivotal for the process of implementing EBP in nursing. However, available evidence for  
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47 22 the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.<sup>4</sup> In  
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49 23 the medical realm such evidence is also limited.<sup>29-32</sup>

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53 24 Other frameworks or multi-dimensional programs have been proposed to improve research  
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55 25 utilisation,<sup>13</sup> or to stimulate the use of EBP by nurses,<sup>33</sup> or on specific wards.<sup>34</sup> Others have promoted  
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57 26 a dedicated research agenda,<sup>35</sup> integrated EBP education,<sup>31 36</sup> or the implementation of EBP in

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

9

### 10 **Limitations**

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

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

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

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3 1 Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if  
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5 2 clinicians are aware of available evidence, the right thing to do does not always happen. Continuous  
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7 3 quality improvement strategies also involve active implementation of available evidence and existing  
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9 4 guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the  
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11 5 first step towards quality improvement.  
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## 7 **Conclusion**

8 Our review of all available surveys on the barriers for, and promotion of, EBP-activities as perceived  
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10 9 by clinical doctors and nurses suggests that EBP-implementation needs a multilevel approach,  
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12 10 involving interventions in the policy-making, managerial, educational, and practical areas. We offer a  
13  
14 11 summary of the suggested interventions at these different levels. These may be used not only to  
15  
16 12 implement, but also to monitor the usage of EBP in daily clinical practice. This requires a joint effort  
17  
18 13 and cultural change within the whole healthcare organisation, but is likely to result in a better quality  
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20 14 of care.  
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1 **Table 1.** Characteristics of included studies

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

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

3

1 **Table 2.** Quality characteristics of included studies

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

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

3

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

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

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

| Doctors and nurses alike   |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Lack of time to read evidence or implement new ideas</li> <li>• Lack of facilities or resources</li> <li>• Lack of staff experienced in EBP</li> <li>• Lack of training in EBP</li> <li>• EBP is insufficiently supported by staff and management</li> <li>• Evidence is not easily available</li> <li>• Unawareness of research</li> <li>• Evidence is not generalisable to own setting</li> </ul> |  |
| Doctors  | Nurses   |
| <ul style="list-style-type: none"> <li>• Lack of evidence</li> <li>• Conflicting evidence</li> <li>• Evidence is not incorporated in clinical practice</li> <li>• EBP negatively impacts medical skills and freedom</li> </ul>   | <ul style="list-style-type: none"> <li>• Evidence is written in foreign language</li> <li>• Lack of authority to change practice</li> <li>• Statistics or research is unintelligible</li> <li>• Implications for practice are unclear</li> </ul> |

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1 **Table 5.** Structural incorporation of EBP at various levels as stated by the authors of  
 2 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<br>Making EBP courses available  | Olivieri<br>Sur   |
|                             | Scientific journals  | Educational efforts<br>Publishing high quality research   | Poolman, Veness<br>Scales, Sur  |
| National                    | Governmental enforcement   | EBP in all undergraduate and postgraduate healthcare educational institutions   | Melnyk, Ubbink  |
|                             | Installing and financing regulatory professional bodies  | Quality assurance<br>Practicing EBP<br>Use of guidelines  | Al-Almaie<br>Melnyk<br>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,<br>Melnyk   |
| Board of hospital directors | Incorporating EBP in strategic aims  | Goals tailored on systematic evaluations<br>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<br>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<br>Knowledgeable (nurse) researchers, (nurse) specialists, master' prepared professionals, faculty, research departments                      | Al-Almaie, Al Ohmari 2006,<br>Brown 2009, Chui, Gale,<br>Gerrish, Melnyk, Mehrdad,<br>Mittal, Oranta, Parahoo,<br>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,<br>Mehrdad, Melnyk, Lai  |
|                             | Provide non-patient hours to personnel   | Time for EBP activities and implementation, changing practice, and quality care development   | Brown 2009, Gale,<br>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<br>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<br><br>Improved audit and feedback, systematic evaluation, and needs assessment<br><br>Tiered, feasible and realistic education | Ahmandi, Al-Almaie, Al-<br>Ohmari 2006, Amin,<br>Andersson, Brown 2009,<br>Gale, Gerrish, Hadley,<br>Kitto, Koehn, Lai, Mehrdad,<br>Melnyk, Mittal, Nwagwu,<br>Oliveri, Parahoo, Poolman,<br>Scales, Sur, Ubbink, Upton |
|                             | Formulating the curriculum and educating in collaboration with healthcare professionals  | EBP integration   | Al-Almaie, Al Ohmari 2006,<br>Brown 2009, Gale, Gerrish,<br>Lai   |
|                             | Interactive, face-to-face education in clinical practice and at the bed side   | EBP integration   | Ahmandi, Al-Almaie, Amin,<br>Al Ohmari 2006, Kitto,<br>Melnyk, Poolman  |
|                             | Interactive education  | E-learning modules  | Kitto, Poolman, Ubbink  |
|                             | EBP internship programme   | Extended EBP education  | Brown 2009  |
|                             | In-service training  |   | 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   |
| <b>Faculty and researchers</b>                           | 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<br>Valorisation of results in practice                            | Brown 2009<br>Melnyk  |
|  | Close collaboration with practicing professionals   | Shared language and understanding of concepts<br>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   |
| <b>Services</b>  | Medical library facilities  | Service for searching databases<br>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<br>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<br>Provide work-based information | Al Ohmari 2009, Gerrish, Lai, Ubbink  |
|  | Computer based decision support system with priority to systematic reviews  | Computer-based guideline implementation<br>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<br>Change in practice                         | Chui, Mehrdad   |
| <b>Local workplace</b>                                   | 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                               |
| <b>Culture</b>   | 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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1 ~~Policy framework to implement evidence-~~  
2 ~~based practice~~ Framework of policy  
3 recommendations for implementation of  
4 EBP: a systematic scoping review

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3 1 **ABSTRACT**  
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5 2  
6  
7 3 **Objectives:** Evidence-based practice (EBP) may help improve healthcare quality. However, not all  
8  
9 4 healthcare professionals and managers use EBP in their daily practice. We systematically reviewed  
10  
11 5 the literature to summarise self-reported appreciation of EBP and organisational infrastructure  
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13 6 solutions proposed to promote EBP.  
14  
15 7 **Design:** Systematic review. Two investigators independently performed the systematic reviewing  
16  
17 8 process.  
18  
19 9 **Information sources:** MEDLINE, EMBASE and Cochrane Library were searched for publications  
20  
21 10 between 2000 and 2011.  
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23  
24 11 **Eligibility criteria for included studies:** Reviews and surveys of EBP attitude, knowledge, awareness,  
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26 12 skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.  
27  
28 13 **Results:** We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming.  
29  
30 14 Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions  
31  
32 15 were proposed at various organizational levels, including (inter)national associations and hospital  
33  
34 16 management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-  
35  
36 17 mentors on the wards to move EBP from the classroom to the bedside.  
37  
38 18 **Conclusions:** More than 20 years after its introduction, the EBP-paradigm has been embraced by  
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40 19 healthcare professionals as an important means to improve quality of patient care, but its  
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42 20 implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by  
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44 21 professional, educational and managerial role-models, may further facilitate EBP.  
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1 **Article focus:**

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

4  
5 **Key messages:**

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

11  
12 **Strength and limitations of this study:**

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

## 1 INTRODUCTION

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

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

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

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

## 4 5 **METHODS**

### 6 **Literature search and study selection**

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

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

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



## 1 Quality assessment

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

## 6 Data items and synthesis of results

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

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

## 23 RESULTS

### 24 Study inclusion

25 Our search yielded ~~28652~~ potentially relevant studies. We also found two recent reviews of studies  
26 on barriers towards EBP,<sup>153 146</sup> from which other relevant studies were derived. Some more recent

1 studies not included in these reviews were also found by hand-searching the references of included  
2 studies. Four surveys among medical postgraduates were excluded because these publications were  
3 in Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible  
4 (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter  
5 (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in  
6 the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on  
7 nurses. Three out of the 30<sup>1</sup> studies enrolled both doctors and nurses.<sup>175-179</sup> Wherever possible,  
8 results from doctors and nurses are presented separately.

9 All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and  
10 awareness, most studiesquestionnaires used these questionnaires developed by McColl, Upton or  
11 Estabrooks.<sup>109 1820 1921</sup> To assess EBP barriers and facilitators, most investigators used the Funk  
12 questionnaire.<sup>120</sup> Half of the studies investigated both EBP attitude and barriers.

### 14 **Study characteristics**

15 The studies enrolled from 19<sup>242</sup> up to 1156<sup>157</sup> respondents (median 273), consisting of doctors  
16 (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from  
17 various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates  
18 varied from 9% in nationwide surveys to 100% in interviewsquestionnaires during trainings, with a  
19 median of 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall  
20 quality of the included studies was good (Table 2). Most studies addressed EBP attitude, skills, and  
21 barriers (Table 1).

### 23 **EBP attitude**

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

1 appreciated the use of research evidence in daily clinical practice. However, they considered only half  
2 of their clinical practice to be evidence-based, although what they meant by this was, in most cases,  
3 not specified and unclear. These findings were consistent among the various countries. We did not  
4 find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-  
5 0.286; p=0.321) and attitude towards EBP.

### 6 7 **EBP knowledge and skills**

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

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

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

## 1 Awareness of common sources of evidence

2 [Eight studies addressed this issue \(table 1\)](#). About a quarter of the responding doctors used the  
3 *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal  
4 *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the  
5 *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used  
6 by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two  
7 studies showed this awareness was even less among nurses.<sup>157 179</sup>

## 9 EBP barriers and facilitators

10 Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised,  
11 i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the  
12 barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the  
13 barriers found among nurses in the systematic review by Kajermo et al.<sup>135</sup> These barriers are  
14 summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language  
15 barrier for non-English speaking countries and the limited access to electronic databases in some  
16 countries.

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

## 24 Recommendations reported to implement EBP

25 All studies gave recommendations to overcome or address the identified barriers (Table [56](#)). From  
26 macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various

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

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

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

## 14 DISCUSSION

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

1 Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP  
2 is progressing,<sup>233</sup> important barriers are still obstructing the full implementation of EBP in daily  
3 clinical practice. These findings occur consistently among the various medical specialists and nurses  
4 alike, and in many specific settings and specialties throughout the world. However, Brown et al.  
5 found in a multiple regression analysis that perceived barriers to research use predicted only a  
6 fraction of practice, attitude and knowledge/skills associated with EBP.<sup>234</sup> Apparently, the most  
7 frequently encountered barriers are not necessarily the main reason for a poor implementation of  
8 EBP. Rather, a change in mind set seems indicated among the various healthcare professionals who  
9 perceive these barriers. Additional barriers to EBP implementation may lie at the organisational  
10 level.<sup>4</sup> Hence, an integrative approach, involving all professionals and supported by initiatives from  
11 various organisational levels, may be a more fitting solution.

12 An integrative approach to overcome perceived barriers to EBP has also been suggested by other  
13 authors,<sup>245</sup> who reasoned that the best implementation strategy should be a multifocal,  
14 comprehensive programme involving all professionals and should be tailored to their desires and  
15 perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation  
16 strategies presented imperfect evidence to support decisions about which guideline dissemination  
17 and implementation strategies are likely to be efficient under different circumstances.<sup>256</sup> Opinion  
18 leaders and role models appear to have a key function.<sup>267</sup> A recent systematic review, comprising  
19 seven observational studies, described the relation between EBP implementation and leadership  
20 among nurses.<sup>278</sup> The evidence suggested that initiatives on the level of leadership, organisation and  
21 culture are pivotal for the process of implementing EBP in nursing. However, available evidence for  
22 the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.<sup>4</sup> In  
23 the medical realm such evidence is also limited.<sup>289-342</sup>

24 Other frameworks or multi-dimensional programs have been proposed to improve research  
25 utilisation,<sup>123</sup> or to stimulate the use of EBP by nurses,<sup>323</sup> or on specific wards.<sup>334</sup> Others have  
26 promoted a dedicated research agenda,<sup>345</sup> integrated EBP education,<sup>301 365</sup> or the implementation of

1 EBP in specific medical specialties.<sup>146 367</sup> Clinically integrated rather than stand-alone EBP teaching  
2 initiatives have shown to improve EBP behaviour and may therefore help implement EBP in clinical  
3 practice.<sup>387</sup> These initiatives per se seem defective because none of these aspects can be omitted to  
4 arrive at a truly evidence-based healthcare: If EBP-education falls short, managers do not facilitate  
5 EBP activities, doctors do not apply EBP in their daily practice, or nurses are lagging behind in EBP  
6 knowledge, optimum evidence-based healthcare eventually will not (fully) reach the patients who  
7 deserve it. This has been one of the reasons why a European teaching project has started to  
8 incorporate evidence-based medicine in clinical practice.<sup>398</sup>

### 10 Limitations

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

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

21 Third, in our review we searched for surveys of EBP attitude, knowledge, awareness, barriers and  
22 facilitators rather than studies specifically focusing on testing alternatives to improve  
23 implementation of EBP. Such studies, however, are rare.<sup>4 278 342</sup> The implementation factors these  
24 studies mentioned also became clear from our review, while the success of these implementation  
25 strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing  
26 actual EBP behaviour during daily practice.<sup>38 7,3940 41</sup>

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3 1 Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if  
4  
5 2 clinicians are aware of available evidence, the right thing to do does not always happen. Continuous  
6  
7 3 quality improvement strategies also involve active implementation of available evidence and existing  
8  
9 4 guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the  
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11 5 first step towards quality improvement.  
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## 7 **Conclusion**

8 | Our review of all available surveys on the barriers for, and promotion of, EBP-activities as perceived  
9 | by clinical doctors and nurses suggest~~s~~ing that EBP-implementation needs a multilevel approach,  
10 | involving interventions in the policy-making, managerial, educational, and practical areas. We offer a  
11 | summary of the possible-suggested interventions at these different levels. These may be used not  
12 | only to implement, but also to monitor the usage of EBP in daily clinical practice. This requires a joint  
13 | effort and cultural change within the whole healthcare organisation, but is likely to result in a better  
14 | quality of care.  
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1 **Table 1.** Characteristics of included studies

| Author                    | Year | Country        | Teaching hospital(s) | Respondents  | EBP aspects studied* |
|---------------------------|------|----------------|----------------------|--|----------------------|
| Alhadi <sup>402</sup>     | 2008 | Iran           | Yes                  | Internal medicine interns, residents and fellows                           | 1,2,3                |
| AlAlmaie <sup>413</sup>   | 2004 | Saudi Arabia   | No                   | Doctors from various specialties   | 5                    |
| AlOmari <sup>412</sup>    | 2009 | Jordan         | Both                 | Specialists, fellows, residents from various specialties                   | 1,2,4,5,6            |
| AlOmari <sup>435</sup>    | 2006 | Saudi Arabia   | Both                 | Consultant physicians from various specialties                             | 1,2,3,5              |
| Arhin <sup>224</sup>      | 2007 | Ireland        | Yes                  | Otorhinolaryngology surgical trainees                                      | 1,4                  |
| Andersson <sup>464</sup>  | 2007 | Sweden         | Yes                  | Trainee and specialist paediatric nurses                                   | 5                    |
| Brøwn <sup>475</sup>      | 2009 | USA            | Yes                  | Nurses from various specialties  | 5,6                  |
| Brøwn <sup>243</sup>      | 2010 | USA            | Both                 | Nurses from various specialties  | 5                    |
| Chiu <sup>175</sup>       | 2010 | Taiwan         | No                   | Doctors and nurses from various specialties                                | 1,2,5                |
| Gale <sup>468</sup>       | 2009 | USA            | No                   | Staff nurses and nurse managers from 8 ICUs                                | 1,5,6                |
| Gerrish <sup>492</sup>    | 2008 | UK             | Both                 | Nurses from various specialties  | 5                    |
| Hadley <sup>4850</sup>    | 2007 | UK             | No                   | Junior doctors   | 1,2                  |
| Kitto <sup>324</sup>      | 2007 | Australia      | No                   | Surgeons   | 5                    |
| Kdehn <sup>4951</sup>     | 2008 | USA            | No                   | Staff nurses, unit managers, clinical advisors                             | 1,5                  |
| Lai <sup>168</sup>        | 2010 | Malaysia       | No                   | Doctors, nursing and allied health staff before attending EBM workshop     | 1,5                  |
| Melnyk <sup>529</sup>     | 2004 | USA            | Unknown              | Nurses before attending EBP workshops                                      | 1,5                  |
| Mehrdad <sup>534</sup>    | 2008 | Iran           | Yes                  | Clinical nurses and nurse educators  | 5,6                  |
| Mittal <sup>524</sup>     | 2010 | India          | No                   | Surgical trainees attending continuing education meeting                   | 1,2,3,4,5            |
| Nwagwu <sup>535</sup>     | 2008 | Nigeria        | Yes                  | Consultants in tertiary health care institutions                           | 2,3                  |
| Olivier <sup>546</sup>    | 2004 | Denmark        | Yes                  | Doctors from various specialties   | 2,4                  |
| Ojanta <sup>557</sup>     | 2002 | Finland        | No                   | Staff and ward nurses  | 5,6                  |
| Palfreyman <sup>568</sup> | 2003 | UK             | Yes                  | Nurses and physiotherapists from various specialties                       | 2,5                  |
| Pahoo <sup>579</sup>      | 2001 | N-Ireland      | No                   | Medical and surgical nurses  | 1,5,6                |
| Pdolan <sup>5860</sup>    | 2007 | Netherlands    | Unknown              | Orthopaedic surgeons   | 1,2,4                |
| Rdth <sup>5961</sup>      | 2010 | Canada         | Unknown              | English-speaking urology residents participating in national review course | 2,3,4,5              |
| Scales <sup>620</sup>     | 2008 | USA            | Both                 | American Urology Association members                                       | 1,5                  |
| Sul <sup>634</sup>        | 2006 | USA            | Unknown              | American Urology Association members                                       | 1,3,4                |
| Ubbink <sup>192</sup>     | 2011 | Netherlands    | Yes                  | Doctors and nurses from various specialties                                | 1,2,3,4,5,6          |
| Uvenes <sup>643</sup>     | 2009 | Norway         | Unknown              | Reference panel of Norwegian physicians                                    | 1,2                  |
| Upton <sup>653</sup>      | 2005 | UK             | Unknown              | Doctors from various specialties   | 2,5,6                |
| Vtness <sup>664</sup>     | 2003 | Australia & NZ | Unknown              | Radiation oncologists and registrars                                       | 1,2,3,4,6            |

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

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1 **Table 2.** Quality characteristics of included studies

| Author                    | Centres (N)                            | Respondents (N)                               | Response rate (%)                       | Questionnaire robustness* |
|---------------------------|--|---|---|---------------------------|
| Ahmadi <sup>420</sup>     | 1                                      | 104   | 80                                      | ±±                        |
| Al-Almaie <sup>433</sup>  | 3                                      | 273   | 67                                      | -                         |
| Al-Omari <sup>424</sup>   | 5                                      | 386   | 97                                      | ++                        |
| Al-Omari <sup>435</sup>   | 9                                      | 178   | 86                                      | ++                        |
| Amin <sup>221</sup>       | countrywide                            | 19  | 95                                      | ++                        |
| Andersson <sup>464</sup>  | 2                                      | 113   | 80                                      | ++                        |
| Brown <sup>457</sup>      | 1                                      | 458   | 45                                      | ++                        |
| Brown <sup>243</sup>      | 4                                      | 974   | 75                                      | ++                        |
| Chiu <sup>175</sup>       | 61                                     | 1156  | 69                                      | ++                        |
| Gale <sup>468</sup>       | 1                                      | 92  | 22                                      | ++                        |
| Gerrish <sup>497</sup>    | 2                                      | 598   | 42                                      | ++                        |
| Hadley <sup>4850</sup>    | several                                | 317   | 100                                     | ++                        |
| Kitto <sup>321</sup>      | several                                | 25  | 50                                      | ±±                        |
| Koehn <sup>4951</sup>     | 1                                      | 422   | 41                                      | ++                        |
| Lai <sup>186</sup>        | 2                                      | 144   | 72                                      | ±±                        |
| Melnyk <sup>502</sup>     | several                                | 160   | 100                                     | ±±                        |
| Mehrdad <sup>531</sup>    | 15                                     | 410   | 70                                      | ++                        |
| Mittal <sup>521</sup>     | 22                                     | 93  | 85                                      | ++                        |
| Nwagwu <sup>552</sup>     | 10                                     | 89  | 89                                      | -                         |
| Olivieri <sup>546</sup>   | 1                                      | 225   | 60                                      | ++                        |
| Oranta <sup>575</sup>     | 2                                      | 253   | 80                                      | ++                        |
| Palfreyman <sup>586</sup> | 1                                      | 106   | 24                                      | ++                        |
| Parahoo <sup>597</sup>    | 10                                     | 479   | 53                                      | ++                        |
| Poolman <sup>5860</sup>   | countrywide                            | 367   | 60                                      | ++                        |
| Roth <sup>5961</sup>      | several                                | 29  | 100                                     | ++                        |
| Scales <sup>620</sup>     | countrywide                            | 365   | 72                                      | ++                        |
| Sur <sup>631</sup>        | countrywide                            | 714   | 9                                       | ++                        |
| Ubbink <sup>197</sup>     | 1                                      | 701   | 72                                      | ++                        |
| Ulvenes <sup>621</sup>    | countrywide                            | 976   | 70                                      | -                         |
| Upton <sup>652</sup>      | countrywide                            | 381   | 76                                      | ++                        |
| Veness <sup>664</sup>     | countrywide                            | 191   | 79                                      | ++                        |
| <b>TOTAL</b>              | <b>24 (77%)</b><br><b>&gt;1 centre</b> | <b>25 (81%)</b><br><b>&gt;100 respondents</b> | <b>23 (74%)</b><br><b>≥60% response</b> | <b>24 (77%)</b>           |

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

3



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

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

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

| Doctors and nurses alike   |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Lack of time to read evidence or implement new ideas</li> <li>• Lack of facilities or resources</li> <li>• Lack of staff experienced in EBP</li> <li>• Lack of training in EBP</li> <li>• EBP is insufficiently supported by staff and management</li> <li>• Evidence is not easily available</li> <li>• Unawareness of research</li> <li>• Evidence is not generalisable to own setting</li> </ul> |  |
| Doctors  | Nurses   |
| <ul style="list-style-type: none"> <li>• Lack of evidence</li> <li>• Conflicting evidence</li> <li>• Evidence is not incorporated in clinical practice</li> <li>• EBP negatively impacts medical skills and freedom</li> </ul>   | <ul style="list-style-type: none"> <li>• Evidence is written in foreign language</li> <li>• Lack of authority to change practice</li> <li>• Statistics or research is unintelligible</li> <li>• Implications for practice are unclear</li> </ul> |

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3 1 **Table 5. Major facilitating factors to apply EBP as stated by both doctors and nurses**  
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8 3 ● Workshops and courses on EBP and research  
9 4 ● Culture change to apply EBP in daily clinical practice  
10 5 ● EBP mentor or expert available  
11 6 ● Easy access to research papers  
12 7 ● Protocols and guidelines in own / English language  
13 8 ● Evidence on clinically relevant topics  
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1 **Table 56.** Structural incorporation of EBP at various levels as stated by the authors of  
 2 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<br>Making EBP courses available  | Olivieri<br>Sur   |
|                             | Scientific journals  | Educational efforts<br>Publishing high quality research   | Poolman, Veness<br>Scales, Sur  |
| National                    | Governmental enforcement   | EBP in all undergraduate and postgraduate healthcare educational institutions   | Melnyk, Ubbink  |
|                             | Installing and financing regulatory professional bodies  | Quality assurance<br>Practicing EBP<br>Use of guidelines  | Al-Almaie<br>Melnyk<br>Ubbink   |
|                             | Installing and financing a national institute  | Development of evidence based guidelines  | Al-Almaie   |
|                             | Arranging and financing  | Free use of the Cochrane Library  | Oliveri   |
| Board of hospital directors | Policy makers, professional associations, health insurance companies, and regulatory bodies  | Promotion of EBP  | Scales, Oliveri, Poolman, Melnyk  |
|                             | Incorporating EBP in strategic aims  | Goals tailored on systematic evaluations<br>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  |
| Managers                    | Providing management, administrators, and directors with tools and means   | Effective learning and practising EBP   | Al Ohmari 2006, Lai   |
|                             | Integrating EBP and policy setting   | Evidence-based management   | Al Ohmari 2009  |
|                             | Recruitment, selection, employment of new personnel<br>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<br>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, Mehrdad, 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<br><br>Improved audit and feedback, systematic evaluation, and needs assessment<br><br>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   | Extended EBP education  | Brown 2009  |
|                             | In-service training  |   | 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   |
| <b>Faculty and researchers</b>                           | 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<br>Valorisation of results in practice                            | Brown 2009<br>Melnyk  |
|  | Close collaboration with practicing professionals   | Shared language and understanding of concepts<br>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   |
| <b>Services</b>  | Medical library facilities  | Service for searching databases<br>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<br>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<br>Provide work-based information | Al Ohmari 2009, Gerrish, Lai, Ubbink  |
|  | Computer based decision support system with priority to systematic reviews  | Computer-based guideline implementation<br>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<br>Change in practice                         | Chui, Mehrdad   |
| <b>Local workplace</b>                                   | 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                               |
| <b>Culture</b>   | 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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# PRISMA 2009 Checklist

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| Section/topic                      | #  | Checklist item  | Reported on page # |
|------------------------------------|----|---|--------------------|
| <b>TITLE</b>                       |    |   |                    |
| Title                              | 1  | Identify the report as a systematic review, meta-analysis, or both.   | 1, 2               |
| <b>ABSTRACT</b>                    |    |   |                    |
| 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                  |
| <b>INTRODUCTION</b>                |    |   |                    |
| 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                  |
| <b>METHODS</b>                     |    |   |                    |
| 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 <sup>2</sup> ) for each meta-analysis.  | n.a.               |

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# 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                  |
| <b>RESULTS</b>                |    |  |                    |
| 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                  |
| <b>DISCUSSION</b>             |    |  |                    |
| 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             |
| <b>FUNDING</b>                |    |  |                    |
| 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

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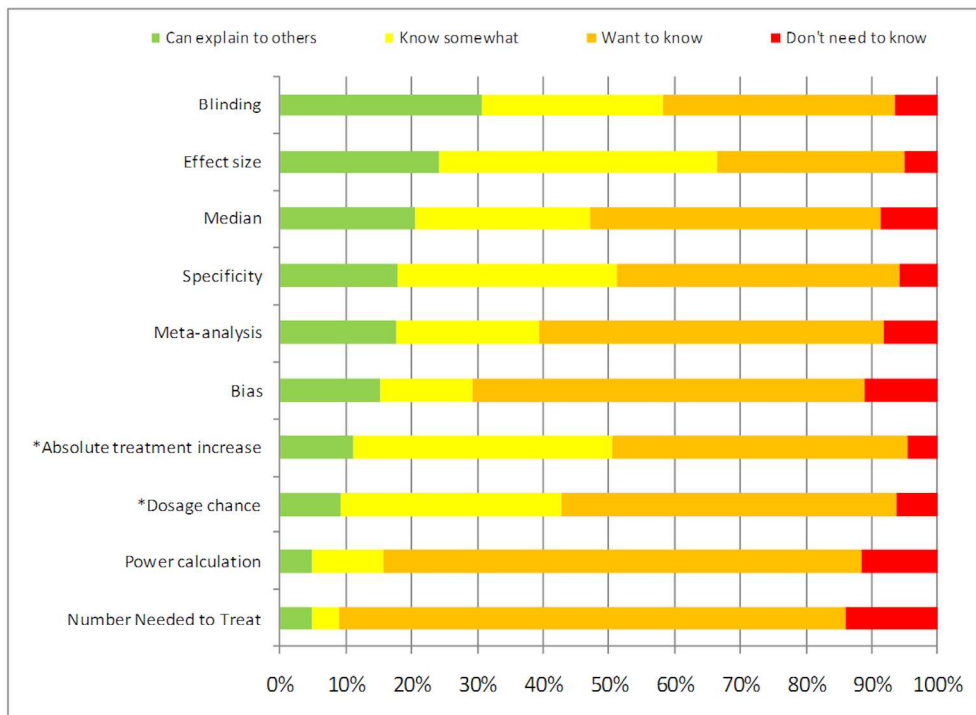
Countries from which studies were included.  
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Doctors' knowledge of common EBP terms. The numbers between brackets indicate the number of studies that used this term. Terms with an asterisk are meaningless dummy terms.  
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Nurses' knowledge of common EBP terms. Terms with an asterisk are meaningless dummy terms.  
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**Framework of policy recommendations for implementation  
of evidence-based practice: a systematic scoping review**

|                                 |   |
|---------------------------------|---|
| Journal:                        | <i>BMJ Open</i>   |
| Manuscript ID:                  | bmjopen-2012-001881.R2  |
| Article Type:                   | Research  |
| Date Submitted by the Author:   | 21-Dec-2012   |
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| <b>Primary Subject Heading</b>: | Evidence based practice   |
| Secondary Subject Heading:      | Medical management, Medical education and training, Patient-centred medicine, Evidence based practice   |
| Keywords:                       | Change management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Quality in health care < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, MEDICAL EDUCATION & TRAINING   |
|                                 |   |

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

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**Word count:** 2865

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3 1 **ABSTRACT**  
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7 3 **Objectives:** Evidence-based practice (EBP) may help improve healthcare quality. However, not all  
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9 4 healthcare professionals and managers use EBP in their daily practice. We systematically reviewed  
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11 5 the literature to summarise self-reported appreciation of EBP and organisational infrastructure  
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13 6 solutions proposed to promote EBP.  
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15 7 **Design:** Systematic review. Two investigators independently performed the systematic reviewing  
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17 8 process.  
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19 9 **Information sources:** MEDLINE, EMBASE and Cochrane Library were searched for publications  
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21 10 between 2000 and 2011.  
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23 11 **Eligibility criteria for included studies:** Reviews and surveys of EBP attitude, knowledge, awareness,  
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25 12 skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.  
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27 13 **Results:** We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming.  
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29 14 Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions  
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31 15 were proposed at various organizational levels, including (inter)national associations and hospital  
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33 16 management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-  
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35 17 mentors on the wards to move EBP from the classroom to the bedside.  
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37 18 **Conclusions:** More than 20 years after its introduction, the EBP-paradigm has been embraced by  
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39 19 healthcare professionals as an important means to improve quality of patient care, but its  
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41 20 implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by  
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43 21 professional, educational and managerial role-models, may further facilitate EBP.  
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3 1 **Article summary**

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5 2 **Article focus:**

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7 3 • Systematic review of the literature to summarise self-reported appreciation of evidence-based  
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9 4 practice (EBP) and organisational infrastructure solutions proposed to promote EBP.  
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13 6 **Key messages:**

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15 7 • More than 20 years after its introduction, the EBP-paradigm has been embraced by healthcare  
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17 8 professionals as an important means to improve quality of patient care, but its implementation is  
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19 9 still deficient.  
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21 10 • Policy exerted at micro, middle and macro levels, and supported by professional, educational and  
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23 11 managerial role-models, may further facilitate EBP.  
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29 13 **Strength and limitations of this study:**

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31 14 • Worldwide overview of EBP appreciation and implementation strategies useful for all centres  
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33 15 striving at a better EBP implementation.  
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35 16 • Self-reporting may have led to an overestimation of the results.  
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37 17 • The success of implementation strategies is still unclear.  
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## 1 INTRODUCTION

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

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

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

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

3

#### 4 **METHODS**

##### 5 **Literature search and study selection**

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

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

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

24

##### 25 **Quality assessment**



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

#### 4 5 **Data items and synthesis of results**

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

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

## 21 22 **RESULTS**

### 23 **Study inclusion**

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

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3 1 Four surveys among medical postgraduates were excluded because these publications were in  
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5 2 Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible  
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7 3 (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter  
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9 4 (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in  
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11 5 the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on  
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13 6 nurses. Three out of the 31 studies enrolled both doctors and nurses.<sup>17-19</sup> Wherever possible, results  
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15 7 from doctors and nurses are presented separately.  
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17 8 All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and  
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19 9 awareness, most studies used the questionnaires developed by McColl, Upton or Estabrooks.<sup>9 20 21</sup> To  
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21 10 assess EBP barriers and facilitators, most investigators used the Funk questionnaire.<sup>10</sup> Half of the  
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23 11 studies investigated both EBP attitude and barriers.  
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### 29 13 **Study characteristics**

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31 14 The studies enrolled from 19<sup>22</sup> up to 1156<sup>17</sup> respondents (median 273), consisting of doctors  
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33 15 (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from  
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35 16 various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates  
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37 17 varied from 9% in nationwide surveys to 100% in questionnaires during trainings, with a median of  
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39 18 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the  
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41 19 included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table  
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### 48 22 **EBP attitude**

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50 23 Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire.  
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52 24 Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and  
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54 25 is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and  
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56 26 appreciated the use of research evidence in daily clinical practice. However, they considered only half  
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1 of their clinical practice to be evidence-based, although what they meant by this was, in most cases,  
2 not specified and unclear. These findings were consistent among the various countries. We did not  
3 find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-  
4 0.286; p=0.321) and attitude towards EBP.

### 6 **EBP knowledge and skills**

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

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

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

### 26 **Awareness of common sources of evidence**

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3 1 Eight studies addressed this issue (table 1). About a quarter of the responding doctors used the  
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5 2 *Cochrane Library* (median 25%), while 39% of them were unaware of this database. The journal  
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7 3 *Evidence-Based Medicine* was used by 14%, but unknown in 34% of the doctors. Guidelines from the  
8  
9 4 *National Guideline Clearinghouse* were used by 8% and unknown in 48%, the *ACP Journal Club* used  
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11 5 by 3% but unknown in 68%, and the *TRIP database* was used by 15% and unknown in 71%. Two  
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13 6 studies showed this awareness was even less among nurses.<sup>17 19</sup>  
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### 18 **EBP barriers and facilitators**

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20 9 Responses regarding the 29 barriers presented in Funk's questionnaire were usually dichotomised,  
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22 10 i.e. items scored as "barrier" or "large barrier" were counted as barriers. To give an overview of the  
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24 11 barriers to EBP most frequently mentioned by doctors and nurses, we merged our data with the  
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26 12 barriers found among nurses in the systematic review by Kajermo et al.<sup>15</sup> These barriers are  
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28 13 summarised in Table 4. Worldwide, EBP barriers were strikingly convergent, except the language  
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30 14 barrier for non-English speaking countries and the limited access to electronic databases in some  
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32 15 countries.  
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35 16 The major facilitating initiatives as desired by doctors and nurses were mostly collected through  
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37 17 open questions. These facilitators include continuing EBP-teaching efforts in pre- and postgraduate  
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39 18 curricula, constant involvement by colleagues in daily practice, staff and management support to  
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41 19 learn and apply EBP in daily clinical practice, structural promotion and facilitation of EBP activities by  
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43 20 the management and experts, and clear and easily accessible sources of evidence, protocols and  
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45 21 guidelines.  
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### 50 **Recommendations reported to implement EBP**

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52 24 All studies gave recommendations to overcome or address the identified barriers (Table 5). From  
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54 25 macro, middle, and micro level perspectives, i.e. at (inter)national, hospital and ward levels, various  
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1 solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific  
2 interventions at ward level, including availability of computers and internet.  
3 A qualitative evaluation of the recommendations shows they mainly focused on education for both  
4 pre- and postgraduates. The following aspects were considered important: how and with whom to  
5 build EBP curricula, tiered education based on needs assessments, learning by interaction, and  
6 transfer of the education from the classroom to the bedside.  
7 Regarding preconditions to strategically implement EBP, authors put emphasis on the role of  
8 the management in terms of facilitating prerequisites as well as creating a positive culture  
9 towards EBP. They also suggested that solutions to the problems encountered when  
10 implementing EBP should start with an analysis of the organisation to identify problems at  
11 both local and organisational levels to tailor the interventions.

## 14 DISCUSSION

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

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3 1 daily clinical practice. Furthermore, this review could stimulate the testing of some of our  
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5 2 recommendations through appropriately designed studies.  
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7 3 Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP  
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9 4 is progressing,<sup>23</sup> important barriers are still obstructing the full implementation of EBP in daily clinical  
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11 5 practice. These findings occur consistently among the various medical specialists and nurses alike,  
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13 6 and in many specific settings and specialties throughout the world. However, Brown et al. found in a  
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15 7 multiple regression analysis that perceived barriers to research use predicted only a fraction of  
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17 8 practice, attitude and knowledge/skills associated with EBP.<sup>24</sup> Apparently, the most frequently  
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19 9 reported barriers are not necessarily the main reason for a poor implementation of EBP. Rather, a  
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21 10 change in mind set seems indicated among the various healthcare professionals who perceive these  
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23 11 barriers. Additional barriers to EBP implementation may lie at the organisational level.<sup>4</sup> Hence, an  
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25 12 integrative approach, involving all professionals and supported by initiatives from various  
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27 13 organisational levels, may be a more fitting solution.  
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29 14 An integrative approach to overcome perceived barriers to EBP has also been suggested by other  
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31 15 authors,<sup>25</sup> who reasoned that the best implementation strategy should be a multifocal,  
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33 16 comprehensive programme involving all professionals and should be tailored to their desires and  
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35 17 perceived barriers. A systematic review of 235 studies on (multifaceted) guideline implementation  
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37 18 strategies presented imperfect evidence to support decisions about which guideline dissemination  
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39 19 and implementation strategies are likely to be efficient under different circumstances.<sup>26</sup> Opinion  
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41 20 leaders and role models appear to have a key function.<sup>27</sup> A recent systematic review, comprising  
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43 21 seven observational studies, described the relation between EBP implementation and leadership  
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45 22 among nurses.<sup>28</sup> The evidence suggested that initiatives on the level of leadership, organisation and  
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47 23 culture are pivotal for the process of implementing EBP in nursing. However, available evidence for  
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49 24 the effectiveness of organisational infrastructures in promoting evidence-based nursing is scarce.<sup>4</sup> In  
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51 25 the medical realm such evidence is also limited.<sup>29-32</sup>  
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1 Other frameworks or multi-dimensional programs have been proposed to improve research  
2 utilisation,<sup>13</sup> or to stimulate the use of EBP by nurses,<sup>33</sup> or on specific wards.<sup>34</sup> Others have promoted  
3 a dedicated research agenda,<sup>35</sup> integrated EBP education,<sup>31 36</sup> or the implementation of EBP in  
4 specific medical specialties.<sup>16 37</sup> Clinically integrated rather than stand-alone EBP teaching initiatives  
5 have been shown to improve EBP behaviour and may therefore help implement EBP in clinical  
6 practice.<sup>38</sup> These initiatives per se seem defective because none of these aspects can be omitted to  
7 arrive at a truly evidence-based healthcare: If EBP-education falls short, managers do not facilitate  
8 EBP activities, doctors do not apply EBP in their daily practice, or nurses are lagging behind in EBP  
9 knowledge, optimum evidence-based healthcare eventually will not (fully) reach the patients who  
10 deserve it. This has been one of the reasons why a European teaching project has started to  
11 incorporate evidence-based medicine in clinical practice.<sup>39</sup>

### 13 **Limitations**

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

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

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

1 studies mentioned also became clear from our review, while the success of these implementation  
2 strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing  
3 actual EBP behaviour during daily practice.<sup>38 40 41</sup>  
4 Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if  
5 clinicians are aware of available evidence, the right thing to do does not always happen. Continuous  
6 quality improvement strategies also involve active implementation of available evidence and existing  
7 guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the  
8 first step towards quality improvement.

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## 10 **Conclusion**

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

18

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20 **Competing Interests:** All authors declare: no support from any organisation for the submitted work;  
21 no financial relationships with any organisations that might have an interest in the submitted work in  
22 the previous three years, no other relationships or activities that could appear to have influenced the  
23 submitted work.

24 **Data Sharing:** No additional files available.



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1 **Table 1.** Characteristics of included studies

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

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

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1 **Table 2.** Quality characteristics of included studies

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

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

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

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

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

| Doctors and nurses alike   |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Lack of time to read evidence or implement new ideas</li> <li>• Lack of facilities or resources</li> <li>• Lack of staff experienced in EBP</li> <li>• Lack of training in EBP</li> <li>• EBP is insufficiently supported by staff and management</li> <li>• Evidence is not easily available</li> <li>• Unawareness of research</li> <li>• Evidence is not generalisable to own setting</li> </ul> |  |
| Doctors  | Nurses   |
| <ul style="list-style-type: none"> <li>• Lack of evidence</li> <li>• Conflicting evidence</li> <li>• Evidence is not incorporated in clinical practice</li> <li>• EBP negatively impacts medical skills and freedom</li> </ul>   | <ul style="list-style-type: none"> <li>• Evidence is written in foreign language</li> <li>• Lack of authority to change practice</li> <li>• Statistics or research is unintelligible</li> <li>• Implications for practice are unclear</li> </ul> |

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For peer review only

1 **Table 5.** Structural incorporation of EBP at various levels as stated by the authors of  
 2 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<br>Making EBP courses available  | Olivieri<br>Sur   |
|                             | Scientific journals  | Educational efforts<br>Publishing high quality research   | Poolman, Veness<br>Scales, Sur  |
| National                    | Governmental enforcement   | EBP in all undergraduate and postgraduate healthcare educational institutions   | Melnyk, Ubbink  |
|                             | Installing and financing regulatory professional bodies  | Quality assurance<br>Practicing EBP<br>Use of guidelines  | Al-Almaie<br>Melnyk<br>Ubbink   |
|                             | Installing and financing a national institute  | Development of evidence based guidelines  | Al-Almaie   |
|                             | Arranging and financing  | Free use of the Cochrane Library  | Oliveri   |
| Board of hospital directors | Policy makers, professional associations, health insurance companies, and regulatory bodies  | Promotion of EBP  | Scales, Oliveri, Poolman, Melnyk  |
|                             | Incorporating EBP in strategic aims  | Goals tailored on systematic evaluations<br>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  |
| Managers                    | Providing management, administrators, and directors with tools and means   | Effective learning and practising EBP   | Al Ohmari 2006, Lai   |
|                             | Integrating EBP and policy setting   | Evidence-based management   | Al Ohmari 2009  |
|                             | Recruitment, selection, employment of new personnel<br>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<br>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, Mehrdad, 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<br><br>Improved audit and feedback, systematic evaluation, and needs assessment<br><br>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   | Extended EBP education  | Brown 2009  |
|                             | In-service training  |   | Gerrish   |

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|--|---|--|---|
|  | 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   |
| <b>Faculty and researchers</b>                           | 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<br>Valorisation of results in practice                            | Brown 2009<br>Melnyk  |
|  | Close collaboration with practicing professionals   | Shared language and understanding of concepts<br>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   |
| <b>Services</b>  | Medical library facilities  | Service for searching databases<br>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<br>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<br>Provide work-based information | Al Ohmari 2009, Gerrish, Lai, Ubbink  |
|  | Computer based decision support system with priority to systematic reviews  | Computer-based guideline implementation<br>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<br>Change in practice                         | Chui, Mehrdad   |
| <b>Local workplace</b>                                   | 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                               |
| <b>Culture</b>   | 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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# 1 Framework of policy recommendations for 2 implementation of evidence-based 3 practiceEBP: a systematic scoping review 4

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3 1 **ABSTRACT**  
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7 3 **Objectives:** Evidence-based practice (EBP) may help improve healthcare quality. However, not all  
8  
9 4 healthcare professionals and managers use EBP in their daily practice. We systematically reviewed  
10  
11 5 the literature to summarise self-reported appreciation of EBP and organisational infrastructure  
12  
13 6 solutions proposed to promote EBP.  
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15 7 **Design:** Systematic review. Two investigators independently performed the systematic reviewing  
16  
17 8 process.  
18  
19 9 **Information sources:** MEDLINE, EMBASE and Cochrane Library were searched for publications  
20  
21 10 between 2000 and 2011.  
22  
23 11 **Eligibility criteria for included studies:** Reviews and surveys of EBP attitude, knowledge, awareness,  
24  
25 12 skills, barriers, and facilitators among managers, doctors, and nurses in clinical settings.  
26  
27 13 **Results:** We found 31 surveys of fairly good quality. General attitude towards EBP was welcoming.  
28  
29 14 Respondents perceived several barriers, but also many facilitators for EBP-implementation. Solutions  
30  
31 15 were proposed at various organizational levels, including (inter)national associations and hospital  
32  
33 16 management promoting EBP, pre- and postgraduate education, as well as individual support by EBP-  
34  
35 17 mentors on the wards to move EBP from the classroom to the bedside.  
36  
37 18 **Conclusions:** More than 20 years after its introduction, the EBP-paradigm has been embraced by  
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39 19 healthcare professionals as an important means to improve quality of patient care, but its  
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41 20 implementation is still deficient. Policy exerted at micro, middle and macro levels, and supported by  
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43 21 professional, educational and managerial role-models, may further facilitate EBP.  
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1 **Article focus:**

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

4  
5 **Key messages:**

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

11  
12 **Strength and limitations of this study:**

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



## 1 INTRODUCTION

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

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

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

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

3

#### 4 **METHODS**

##### 5 **Literature search and study selection**

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

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

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

24

##### 25 **Quality assessment**

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

#### 4 5 **Data items and synthesis of results**

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

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

## 21 22 **RESULTS**

### 23 **Study inclusion**

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

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3 1 Four surveys among medical postgraduates were excluded because these publications were in  
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5 2 Chinese. In total, 31 studies that included 10,798 respondents from 17 countries proved eligible  
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7 3 (Table 1). Studies represented nearly all continents, one third (11/31) were European and a quarter  
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9 4 (8/31) were from North America (Figure 1). In four of the studies EBP questions were administered in  
10  
11 5 the context of an educational meeting. Seventeen studies focused specifically on doctors, eleven on  
12  
13 6 nurses. Three out of the 31 studies enrolled both doctors and nurses.<sup>17-19</sup> Wherever possible, results  
14  
15 7 from doctors and nurses are presented separately.  
16  
17 8 All studies applied postal or electronic questionnaires. To assess EBP attitude, knowledge, skills, and  
18  
19 9 awareness, most studies used the questionnaires developed by McColl, Upton or Estabrooks.<sup>9 20 21</sup> To  
20  
21 10 assess EBP barriers and facilitators, most investigators used the Funk questionnaire.<sup>10</sup> Half of the  
22  
23 11 studies investigated both EBP attitude and barriers.  
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### 29 13 **Study characteristics**

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31 14 The studies enrolled from 19<sup>22</sup> up to 1156<sup>17</sup> respondents (median 273), consisting of doctors  
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33 15 (residents, specialists) and nurses (ward and staff nurses, nurse managers and educators) from  
34  
35 16 various clinical specialties. Seven of the 31 studies were conducted in a single centre. Response rates  
36  
37 17 varied from 9% in nationwide surveys to 100% in questionnaires during trainings, with a median of  
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39 18 72%. Twenty-four out of the 31 studies (77%) used robust questionnaires. So, overall quality of the  
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41 19 included studies was good (Table 2). Most studies addressed EBP attitude, skills, and barriers (Table  
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### 49 22 **EBP attitude**

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51 23 Fifteen of the 18 studies addressing EBP attitude used a (sometimes modified) McColl questionnaire.  
52  
53 24 Based on these 15 studies, both doctors and nurses strongly felt that EBP improves patient care and  
54  
55 25 is important for their profession (Table 3). Their overall attitude towards EBP was welcoming and  
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57 26 appreciated the use of research evidence in daily clinical practice. However, they considered only half  
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1 of their clinical practice to be evidence-based, although what they meant by this was, in most cases,  
2 not specified and unclear. These findings were consistent among the various countries. We did not  
3 find significant correlations between either response rate (-0.112; p=0.703) or year of publication (-  
4 0.286; p=0.321) and attitude towards EBP.

### 6 **EBP knowledge and skills**

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

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

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

### 26 **Awareness of common sources of evidence**

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

### 8 **EBP barriers and facilitators**

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

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

### 23 **Recommendations reported to implement EBP**

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

1 solutions were proposed, ranging from advocating EBP by national regulatory bodies to specific  
2 interventions at ward level, including availability of computers and internet.  
3 A qualitative evaluation of the recommendations shows they mainly focused on education for both  
4 pre- and postgraduates. The following aspects were considered important: how and with whom to  
5 build EBP curricula, tiered education based on needs assessments, learning by interaction, and  
6 transfer of the education from the classroom to the bedside.  
7 Regarding preconditions to strategically implement EBP, authors put emphasis on the role of  
8 the management in terms of facilitating prerequisites as well as creating a positive culture  
9 towards EBP. They also suggested that solutions to the problems encountered when  
10 implementing EBP should start with an analysis of the organisation to identify problems at  
11 both local and organisational levels to tailor the interventions.

## 14 DISCUSSION

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

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

3 Although the majority of health care professionals appear quite EBP-minded, and the uptake of EBP  
4 is progressing,<sup>23</sup> important barriers are still obstructing the full implementation of EBP in daily clinical  
5 practice. These findings occur consistently among the various medical specialists and nurses alike,  
6 and in many specific settings and specialties throughout the world. However, Brown et al. found in a  
7 multiple regression analysis that perceived barriers to research use predicted only a fraction of  
8 practice, attitude and knowledge/skills associated with EBP.<sup>24</sup> Apparently, the most frequently  
9 reported encountered barriers are not necessarily the main reason for a poor implementation of EBP.

10 Rather, a change in mind set seems indicated among the various healthcare professionals who  
11 perceive these barriers. Additional barriers to EBP implementation may lie at the organisational  
12 level.<sup>4</sup> Hence, an integrative approach, involving all professionals and supported by initiatives from  
13 various organisational levels, may be a more fitting solution.

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



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

### 13 Limitations

14 Although not all studies found were performed in teaching hospitals, the majority may have been  
15 performed in centres that already had the aim, or were in the process of implementing EBP. Many  
16 other centres are likely to be lagging further behind. However, higher response rates were not  
17 associated with more positive attitudes towards EBP. Given the settings and types of respondents in  
18 the studies included here, the inferences of our review appear primarily valid for clinical doctors and  
19 nurses from various specialties in centres that aim at implementing EBM.  
20 Second, the questionnaires used were self-reported and response rates varied considerably. For both  
21 reasons, our results may overestimate enthusiasm, knowledge, and uptake of EBP. On the other  
22 hand, the framework of implementation recommendations we derived from these studies may be  
23 useful for all centres striving at a better EBP implementation.  
24 Third, in our review we searched for surveys of EBP attitude, knowledge, awareness, barriers and  
25 facilitators rather than studies specifically focusing on testing alternatives to improve  
26 implementation of EBP. Such studies, however, are rare.<sup>4 28 32</sup> The implementation factors these

1 studies mentioned also became clear from our review, while the success of these implementation  
2 strategies is still unclear. One of the reasons for this is the absence of a valid means of assessing  
3 actual EBP behaviour during daily practice.<sup>38 40 41</sup>  
4 Finally, we realise EBP is an essential but not the sole factor to improve quality of care. Even if  
5 clinicians are aware of available evidence, the right thing to do does not always happen. Continuous  
6 quality improvement strategies also involve active implementation of available evidence and existing  
7 guidelines. Nevertheless, a critical evidence-based attitude towards current practice remains the  
8 first step towards quality improvement.

9

## 10 **Conclusion**

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

18

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1 **Table 1.** Characteristics of included studies

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

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

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1 **Table 2.** Quality characteristics of included studies

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

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

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

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

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

| Doctors and nurses alike   |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Lack of time to read evidence or implement new ideas</li> <li>• Lack of facilities or resources</li> <li>• Lack of staff experienced in EBP</li> <li>• Lack of training in EBP</li> <li>• EBP is insufficiently supported by staff and management</li> <li>• Evidence is not easily available</li> <li>• Unawareness of research</li> <li>• Evidence is not generalisable to own setting</li> </ul> |  |
| Doctors  | Nurses   |
| <ul style="list-style-type: none"> <li>• Lack of evidence</li> <li>• Conflicting evidence</li> <li>• Evidence is not incorporated in clinical practice</li> <li>• EBP negatively impacts medical skills and freedom</li> </ul>   | <ul style="list-style-type: none"> <li>• Evidence is written in foreign language</li> <li>• Lack of authority to change practice</li> <li>• Statistics or research is unintelligible</li> <li>• Implications for practice are unclear</li> </ul> |

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For peer review only

1 **Table 5.** Structural incorporation of EBP at various levels as stated by the authors of  
 2 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<br>Making EBP courses available  | Olivieri<br>Sur   |
|                             | Scientific journals  | Educational efforts<br>Publishing high quality research   | Poolman, Veness<br>Scales, Sur  |
| National                    | Governmental enforcement   | EBP in all undergraduate and postgraduate healthcare educational institutions   | Melnyk, Ubbink  |
|                             | Installing and financing regulatory professional bodies  | Quality assurance<br>Practicing EBP<br>Use of guidelines  | Al-Almaie<br>Melnyk<br>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<br>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<br>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<br>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, Mehrdad, 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<br><br>Improved audit and feedback, systematic evaluation, and needs assessment<br><br>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   | Extended EBP education  | Brown 2009  |
|                             | In-service training  |   | Gerrish   |

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|--|---|--|---|
|  | 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   |
| <b>Faculty and researchers</b>                           | 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<br>Valorisation of results in practice                            | Brown 2009<br>Melnyk  |
|  | Close collaboration with practicing professionals   | Shared language and understanding of concepts<br>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   |
| <b>Services</b>  | Medical library facilities  | Service for searching databases<br>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<br>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<br>Provide work-based information | Al Ohmari 2009, Gerrish, Lai, Ubbink  |
|  | Computer based decision support system with priority to systematic reviews  | Computer-based guideline implementation<br>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<br>Change in practice                         | Chui, Mehrdad   |
| <b>Local workplace</b>                                   | 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                               |
| <b>Culture</b>   | 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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# PRISMA 2009 Checklist

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| Section/topic                      | #  | Checklist item  | Reported on page # |
|------------------------------------|----|---|--------------------|
| <b>TITLE</b>                       |    |   |                    |
| Title                              | 1  | Identify the report as a systematic review, meta-analysis, or both.   | 1, 2               |
| <b>ABSTRACT</b>                    |    |   |                    |
| 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                  |
| <b>INTRODUCTION</b>                |    |   |                    |
| 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                  |
| <b>METHODS</b>                     |    |   |                    |
| 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 <sup>2</sup> ) for each meta-analysis.  | n.a.               |

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# 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                  |
| <b>RESULTS</b>                |    |  |                    |
| 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                  |
| <b>DISCUSSION</b>             |    |  |                    |
| 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             |
| <b>FUNDING</b>                |    |  |                    |
| 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                 |

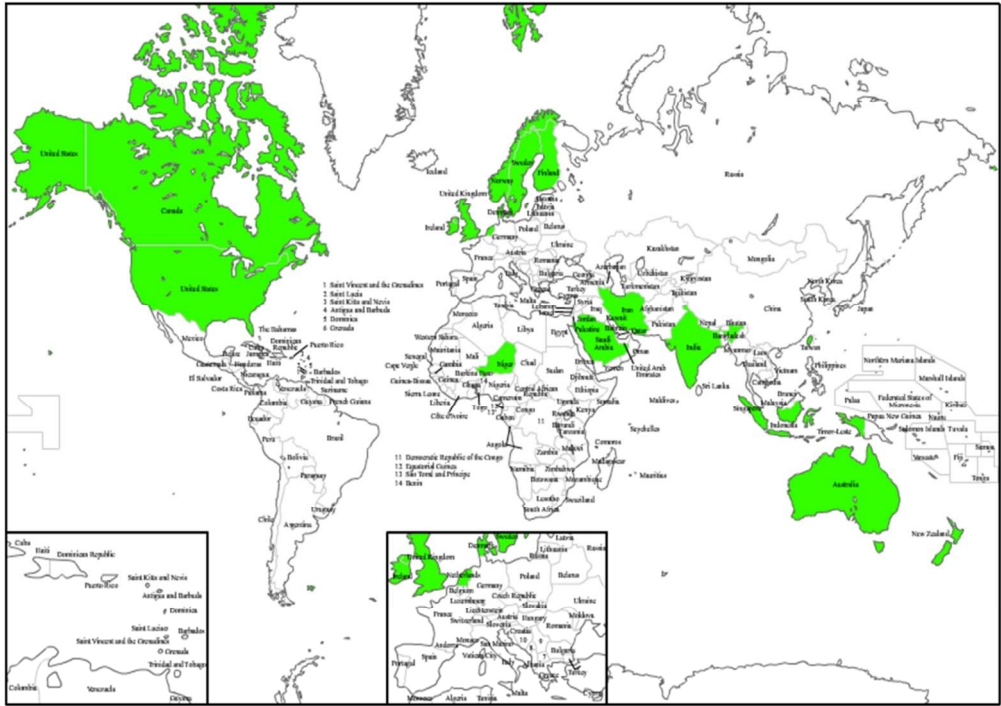
From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: [www.prisma-statement.org](http://www.prisma-statement.org).

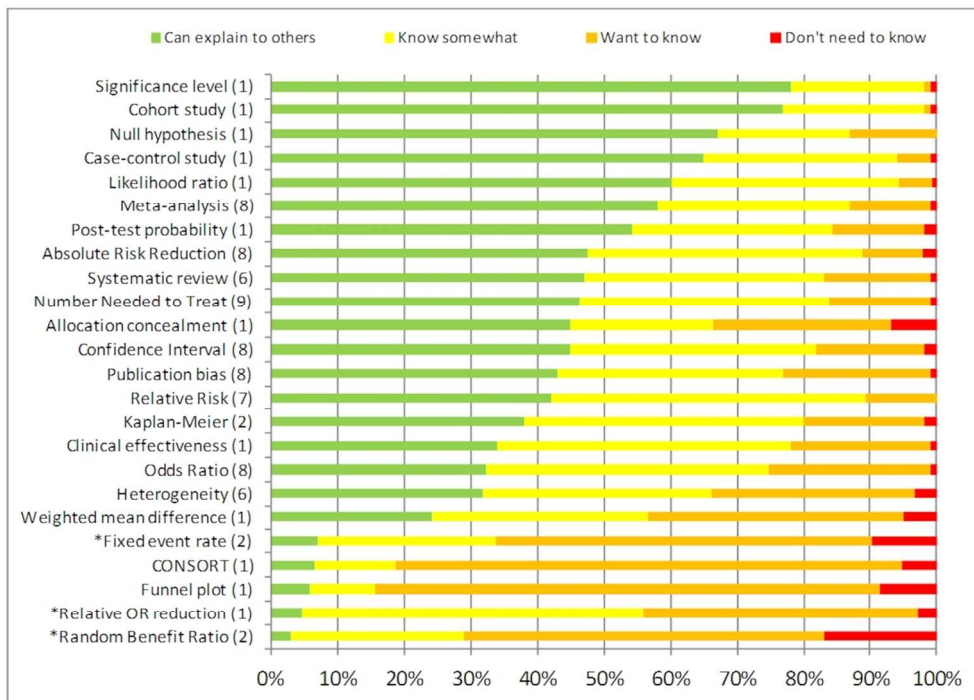
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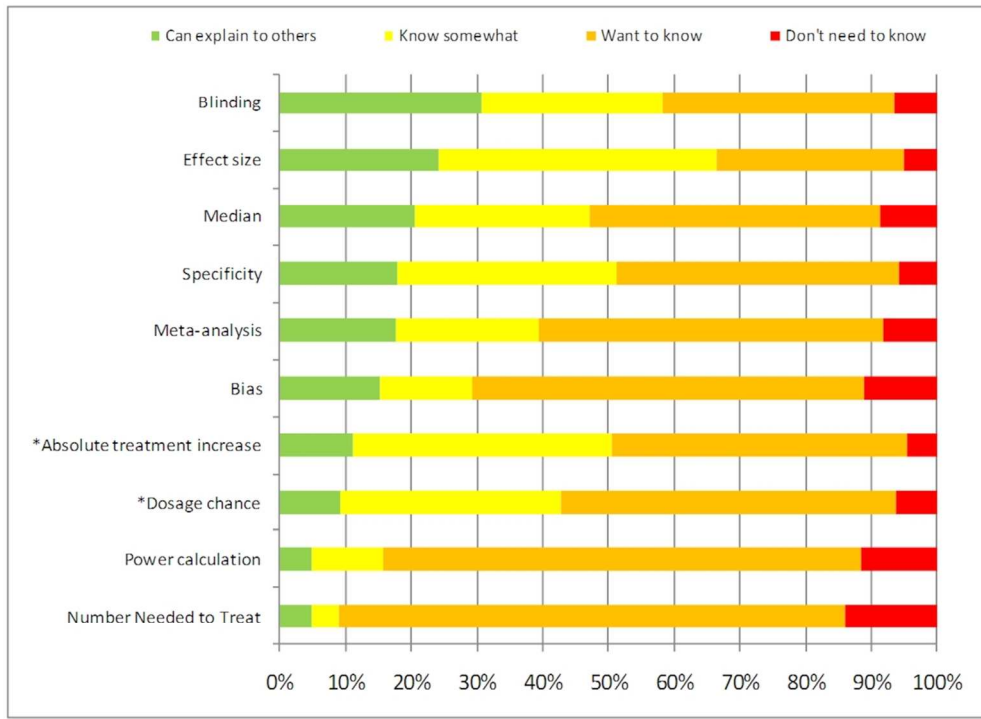
Countries from which studies were included.  
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Doctors' knowledge of common EBP terms. The numbers between brackets indicate the number of studies that used this term. Terms with an asterisk are meaningless dummy terms.  
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Nurses'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