The Neglected Contexts and Outcomes of Evidence-based Management: A Systematic Scoping Review in Hospital Settings

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Abstract

Purpose: The COVID-19 pandemic highlighted the necessity of practicing Evidence-based Management (EBMgt) as an approach to decision-making in hospital settings. The literature, however, provides limited insight into the process of evidence-based management and its contextual nuances. Such insight is critical for better leveraging evidence-based management in practice. Therefore, our aim was to integrate the literature on the process of evidence-based management in hospital settings, identify the gaps in knowledge, and delineate areas for future research.

Design/methodology/approach: We conducted a systematic scoping review using an innovative methodology that involved two systematic searches. First using evidence-based management terminology and second using terminology associated with the evidence-based management concept, which we derived from the first search.

Findings: We identified 218 relevant articles, which using content analysis, we mapped onto the Grounded Model of the Evidence-based Management Process; a novel model of the EBMgt process developed by Sahakian and colleagues. We found that the English language literature provides limited insight into the role of managers’ perceptions and motives in EBMgt, the practice of EBMgt in Global South countries, and the outcomes of EBMgt. Overall, our findings indicated that aspects of the decision-maker, context, and outcomes have been neglected in EBMgt.

Originality:
We contributed to the EBMgt literature by identifying these gaps and proposing future research areas and to the systematic review literature by developing a novel scoping review method.

**Keywords:** Systematic Scoping Review, Evidence-based Management (EBMgt), Healthcare Management, Management Decision-making, Healthcare Managers, Hospitals

**Article Classification:** Original Article, Literature review
Introduction

The COVID-19 pandemic highlighted the necessity of using data to inform healthcare decision-making. To face the extraordinary patient care challenges COVID-19 caused, medical professionals are relying not only on the existing scientific literature and their clinical judgment, but also on emergent data about the virus (del Rio and Malani, 2020). In parallel, to face the extraordinary operational challenges, hospital managers must combine their experience with existing research, as well as, emergent data about managing the virus (Adams and Walls, 2020). Additionally, since the organization of healthcare delivery differs across and within countries and healthcare organizations (Anell and Willis, 2000), managers must consider data in concert with contextual factors, like resources, culture, and laws, and must tailor solutions accordingly (Tanne et al., 2020). Ultimately, since this pandemic highlighted the necessity of using data and contextualizing it to inform decision-making, it put Evidence-based Management (EBMgt) at the forefront of hospital management.

EBMgt involves gathering evidence from different sources, appraising its quality, and using it to inform decisions (Barends et al., 2014). By encouraging the use of critically appraised evidence, EBMgt aims to improve decisions, and consequently organizational outcomes (Barends et al., 2014). This is an opportune time to integrate current knowledge about EBMgt in hospital settings into a unifying framework and identify the gaps in it. Doing so will allow us to better understand EBMgt and leverage it in practice. Accordingly, our aim is to integrate the literature on the EBMgt process in hospital settings, identify the gaps, and outline areas for future research. We conducted a systematic scoping review of the EBMgt literature in hospital settings, and analyzed the results using a novel framework of the EBMgt process. Unlike systematic reviews, systematic scoping reviews are more comprehensive and their aim is to map the existing literature on a topic rather than synthesize it to answer a specific question (Levac et al., 2020).
Systematic reviews of EBMgt in healthcare

Systematic reviews of the EBMgt literature have concluded that the literature offers limited empirical insight into how EBMgt is implemented in different contexts (Currie, 2013, Reay et al., 2009, Rynes and Bartunek, 2017). Within healthcare, systematic reviews of EBMgt have examined its components in isolation rather than exploring the process through which it is implemented. For example, Jaana et al. (2014) examined the availability and accessibility of systematic reviews and meta-analyses for healthcare managers. They found that reviews addressing purely management-related topics (e.g., pay-for-performance) were rare and challenging to retrieve. Roshanghalb et al. (2018) identified the decision-makers the EBMgt literature has focused on, the decisions they make, and evidence they use. They found that the literature has focused on hospital managers and medical professionals, who rely on expert opinion, organizational evidence, and research to make different decisions, including performance assessment and strategic planning. Sarkies et al. (2017) examined the effectiveness of implementation strategies meant to improve research evidence uptake in decision-making. They found various strategies and identified factors that contributed to their effectiveness. These systematic reviews provide insight into some aspects of EBMgt, but not into the process of EBMgt practice and the contextual factors that influence it. Such insight is necessary since evidence availability alone does not guarantee its use, rather evidence use is influenced by contextual factors (Baba and HakemZadeh, 2012). Additionally, while these reviews make recommendations for future research, they do not identify the gaps in our knowledge of the EBMgt process in hospital settings.

As such, our aim in this study is to integrate the literature on EBMgt process in hospital settings into a unifying framework, identify the gaps, and outline core areas for future research. We explored the following research questions: 1) What aspects of the EBMgt process in hospital settings have been studied? 2) What are the main gaps in our knowledge
of the EBMgt process in hospital settings? and 3) How generalizable is the literature to different contexts? Answering these questions will deepen our understanding of how managers can use evidence for decision-making, both in daily practice and to face global healthcare challenges.

To answer our questions, we conducted a systematic scoping review of the EBMgt literature in hospital settings. We decided to analyze the results from a process perspective (Pettigrew, 1992). This is suitable since EBMgt is an approach to decision-making: the deliberation process before, during, and after choosing a course of action (Elwyn and Miron-Shatz, 2009) and since existing systematic reviews have not provided insight into the EBMgt decision-making process.

**Theoretical framing**

The process perspective examines phenomena as dynamic sequences of actions that develop and change over time (Pettigrew, 1992). Human actors construct processes through their actions, their subjective interpretations change processes, and they mobilize aspects of the context to obtain outcomes important to them. The process perspective also highlights the importance of structures, as the context in which actions occur, and which both shape and are shaped by actions (Pettigrew, 1992, Pettigrew *et al.*, 2001). To guide our analysis, we juxtaposed three EBMgt frameworks in healthcare that present EBMgt as a process (Table I).

Kovner and Rundall (2006) conceptualized EBMgt as a linear decision-making process with a series of steps, where evidence can be incorporated in the steps of analyzing alternatives and selecting an alternative. This model assumes that managers are rational; they make a complete search of all alternatives and make decisions based on organizational goals (Langley *et al.*, 1995), and does not account for the impact of context (Dean and Bowen, 1994). Taking a bounded rationality approach, Baba and HakemZadeh (2012) conceptualized EBMgt a process executed at the individual level, and influenced by individual,
organizational, and institutional factors. These factors influence the evidence that managers use, the alternatives they generate, and their choice between alternatives. While Baba and HakemZadeh (2012) developed this model based on the extant literature, it does not explicate the details of the EBMgt process.

**Table I about here**

Sahakian et al., (2020)’s Grounded Model of the EBMgt Process (reproduced with permission, Figure 1) is an empirically-driven model of the evidence-based decision-making process and its contextual nuances in hospitals. It explicates using empirical data Baba and HakemZadeh (2012) proposed model and integrates elements of Kovner and Rundall (2006)’s stepwise process. It includes five dimensions: Process of Evidence-based decision-Making, Sources of Evidence, Barriers and Facilitators, Decision Criteria, and Lenses. The Process involves a series of eight steps, among these are the steps of acquiring evidence and appraising the quality of the evidence, which are the hallmarks of EBMgt (Barends et al., 2014). At the step of acquiring evidence, four Sources of Evidence are identified: experiential, organizational, scientific, and stakeholder. Managers’ progress through the steps is influenced by individual, organizational, and national factors. The dimensions of Barriers and Facilitators, Decision Criteria, and Lenses, capture these factors and their influence on the process. Barriers and Facilitators refer to factors that hinder or help evidence acquisition and use. Decision Criteria refer to contextual conditions that must be balanced alongside the evidence when deciding between decision alternatives. Finally, Lenses refer to managers’ motives and perception, which influence their decision-making process.
Figure 1. Sahakian et al’s (2020) Grounded Model of the EBMgt Process and Distribution of the Scoping Review Articles across its Dimensions
We decided to adopt the Grounded Model of the EBMgt Process (hereafter the Model) to guide our analysis for several reasons. First, the Model depicts the EBMgt process and the different contextual factors that influence it. Second, it pinpoints when and how these contextual factors impact the process. Finally, it was developed empirically. While the data was collected in hospitals in Lebanon; a middle-income Global South country in the Middle East, the Model is nonetheless embedded in the larger EBMgt literature with many of its themes overlapping with the literature (Sahakian et al., 2020).

Methods

We conducted a scoping review on the topic of EBMgt in hospital settings. We searched four online databases: PubMed, CINAHL, PsycINFO, and Cochrane Library, for peer reviewed, English-only journal articles without restrictions on publication year. We describe our search strategy briefly below, and in detail in Supplementary File 1.

Since the EBMgt literature is spread across several fields and does not strictly use EBMgt terminology (Briner et al., 2009), we developed a novel review methodology. It involved two systematic searches; first using EBMgt terminology, and second using terminology associated with the EBMgt concept. Our method is novel, compared to the traditional scoping reviews, because we used the results of the first search to derive keywords for the second search. This resulted in a 4-step methodology, which we implemented from April-2015 to October-2019.

General systematic search

First, we searched the four databases using the key-terms ‘evidence-based’ OR ‘evidence-driven’ OR ‘evidence-informed’ AND ‘healthcare’ AND ‘management’. These terms were included in the search since they often refer to similar concepts, though with some narrow variations in their definition (see Bowen et al., 2009, Nevo and Slonim-Nevo, 2011).

We removed duplicates and applied four filters to narrow down the articles. The first
two filters involved removing titles that reflected clinical (e.g., alginate dressings for leg ulcers) and irrelevant (e.g., World War II repression) topics. The third filter involved reading article abstracts and the fourth reading article full-texts and keeping articles that revolved around: non-clinical evidence-based decision-making by managers in (or including) hospital settings. Two researchers, including one of the authors, applied the filters separately and reconciled their differences after each filter. They also reviewed the reference lists of the remaining relevant articles.

**Keyword identification**

Second, we extracted the keywords from the remaining relevant articles to identify EBMgt-related terminology. We developed an expert panel involving the researchers who applied the filters and two of the authors. The panel reviewed the relevance of the words to EBMgt and based on consensus decided on a list of 21 keywords (e.g., evidence-informed improvement; full list in Supplemental File 1).

**Keyword systematic search and Reconciliation**

Third, we searched the four databases using the 21 keywords and ‘healthcare’ AND ‘management’ NOT ‘clinical’, applying the same search criteria and filters as the first search. Fourth, we examined the overlap of the articles across the two searches and removed duplicates.

**Analysis**

We analyzed the articles using a deductive content analysis approach (Elo and Kyngas, 2008). The foundation for the categorization was the Grounded Model of the EBMgt Process with its five dimensions encompassing 30 themes. Two of the authors conducted the categorization collaboratively by reading each article and assigning it to a relevant dimension(s) and theme(s). When articles did not fit the Model, they created new themes relying on inductive content analysis (Elo and Kyngas, 2008). Engaging an independent
coder, we assessed the reliability of our categorization (detailed in Supplemental File 1) and found moderate agreement, Cohen’s κ = .59 (95% CI, 0.44 to 0.75).

Results

The General Systematic Search yielded 23,142 articles and the Keyword Systematic Search 178,518 articles (Figure 2). Applying the four filters, we identified 218 unique relevant articles (listed in Supplementary File 2). Agreement between the researchers applying the filters was high during the General Systematic Search, Cohen’s κ = .85 (95% CI, 0.79 to 0.91), and moderate during the Keyword Systematic Search, Cohen’s κ = .57 (95% CI, 0.48 to 0.66).

Descriptive analysis

The first article was published in the year 1991 and the number of publications has increased steadily (Figure 3). Examining the geographic distribution of studies, half were conducted in North America (50.00%) and another quarter in Europe (25.69%). Some studies were conducted in Australia (5.96%), Asia (5.50%), and the Middle East (5.50%), and only a few in South America (2.75%) and Africa (0.92%). Moreover, some studies were cross-cultural (3.67%). In North America, most studies were conducted in USA (37.61%), and in Europe, most were conducted in the UK (7.80%). Notably, the Global North countries of USA, Canada, Australia, New Zealand, UK, EU states, Russia, Israel, Japan, Singapore, and South Korea accounted for 86.24% of all studies. Most articles were empirical in nature (68.81%), with the ratio of empirical to conceptual articles having increased over time (Figure 3).
Figure 2. Search and Filtering Strategy Results
Examining the methodology of the empirical articles, half used quantitative methods (50.67%), the rest used qualitative (36.00%) and mixed methods (13.33%). They used a range of data collection methods (Table II), sometimes in-combination, including single-case studies (38.67%), interviews (31.33%), and cross-sectional surveys (25.33%). As for the conceptual articles, 17.65% were systematic reviews while the rest were literature reviews.

**Table II about here**

**Content analysis**

Overall, the articles revolved around a range of hospital decisions, including financial, like resource allocation (Baghbanian et al., 2012), human resource, like nurse staffing (Kullberg et al., 2016), patient experience, like Emergency Department (ED) waiting times (Wiler et al., 2016), and information system decisions, like assessing the impact of Electronic Health Records (EHR, Plantier et al., 2017). We found that most of the articles could be categorized according to the five dimensions of the Model (Figure 1), except for a handful of
conceptual articles, which we categorized under a new theme ‘EBMgt concept’. We discuss some of the article under each dimension and theme below and summarize them all in the Supplementary Files 3-7.

The process of evidence-based decision-making

We identified 135 articles (83.70% empirical) that either focus on a specific step of the eight-step EBMgt process or the overall process (Supplementary File 3).

Specific step of the process. The articles focused on the steps of acquiring evidence, appraising the quality of the evidence, generating alternatives, making a decision, preparing for implementation, and assessing and adjusting. Among the steps that are core to EBMgt practice, acquiring evidence was studied extensively (45 articles). Some articles discussed strategies for evidence acquisition from different sources (strategies for searching the internet, Kibbe et al., 1997). Others discussed applied cases of evidence acquisition, like for an overcrowding problem in an ED (Elamir, 2018), underlining the context-dependent nature of the evidence. Others collected evidence for specific problems (nursing burnout, Steege and Dykstra, 2016). In comparison to acquiring evidence, the step of appraising the quality of evidence received little attention (four articles). These articles mostly described strategies for appraising evidence quality (strategies for rating evidence strength, Lohr, 2004).

Among the steps that are not unique to EBMgt, while only a couple of studies focused on generating alternatives (Elamir, 2018), and making a decision (Testik et al., 2017), many focused on preparing for implementation (13 articles) and assessing and adjusting (23 articles). The articles focusing on preparing for implementation were mostly applied cases. Some discussed tools to support implementation of evidence-based solutions, like simulations (Gignon et al., 2017). Others examined factors that influence implementation of different evidence-based solutions, like waiting time management initiatives (Pomey et al., 2013). The articles focusing on the step of assessing and adjusting were all applied cases evaluating the
impact of implementing specific initiatives on specific outcomes (EHR on quality of care, Plantier et al., 2017). The number of articles focusing on the steps of preparing for implementation and assessing and adjusting indicate that the success of EBMgt depends not only on the identification of evidence-driven solutions but also their successful implementation in the specific context of the organization.

The process overall. Some articles examined the EBMgt process among managers in hospitals (Baghbanian et al., 2012). Others developed tools, like digital platforms to support the application of the EBMgt process (Gartnera and Padmanb, 2017). While others were applied cases describing the EBMgt process managers adopted to solve specific problems, like nurse staffing (Kullberg et al., 2016) and patient throughput (Wiler et al., 2016) in specific hospitals.

Overall, the EBMgt process steps identified in these articles overlapped considerably with each other and with the Model. It is worth noting that the step of aggregating the evidence, which is highlighted in some definitions of EBMgt (Barends et al., 2014) and was part of appraising the evidence in the Model, was identified by only one article (Oetjen et al., 2008). This brings into question how necessary this step is in the process. Moreover, the articles discussed a wide range of problems, many of which, like ED crowding (Pines and Griffey, 2015), represent worldwide healthcare challenges, thus situating EBMgt at the core of tackling such pervasive problems.

Sources of evidence

This dimension refers to the sources from which managers acquire evidence. It includes experiential (i.e., experience, knowledge, and judgment of practitioners), scientific (i.e., research literature), organizational (i.e., internal data), and stakeholder (i.e., stakeholders’ input) evidence. We identified 25 articles (56% empirical) that fit under this dimension (Supplementary File 4).
Among these articles, Råholm (2009) argued for a re-conceptualization of evidence. Others examined the evidence that managers use in practice and found that they combine various types of evidence from the four sources. To illustrate, Shoemaker et al. (2010) identified that for a hospital design decision, managers used: literature searches (scientific evidence), consultation with architects (experiential evidence), financial costs (organizational evidence), and visits to other organizations (stakeholder evidence). While other articles argued for using specific types of evidence including specific types of scientific evidence (operations research, Capan et al., 2017), and organizational evidence (patient experience data from twitter posts, Hawkins et al., 2016). Overall, these studies highlight the different types of information that is available to hospital managers, and how they can use this information to inform decisions.

**Barriers and facilitators**

This dimension refers to factors that either hinder or help managers' acquisition and use of evidence. It includes the characteristics of the evidence (i.e., availability, appropriateness, and time), the characteristics of the decision-maker (i.e., competencies and position), organizational structure and culture factors influencing accessing, capturing, and using evidence, national structure and culture, and technology. We identified 76 articles (53.95% empirical) that either attempted to identify all EBMgt barriers and facilitators or focused on one specific barrier or facilitator (Supplementary File 5). We will discuss these articles according to the barriers and facilitators they identified from the Model.

Many articles identified characteristics of the evidence that hinder evidence use. As in the Model, articles found that evidence (un)availability (scarcity; Kovner et al., 200, or evidence overload; Liang et al., 2012), evidence (in)appropriateness (poor quality; Gallego et al., 2008, and focus on western contexts; Liang et al., 2012), and the time consuming nature of acquiring evidence (Ellen et al., 2014) limits its acquisition. To overcome these barriers,
articles suggested different methods to produce research evidence that fits managers’ needs, like evidence co-creation (Marshall, 2013).

Articles in the literature also found characteristics of the decision maker that facilitate evidence use. Like the Model, they found that certain competencies, including data analysis knowledge, business knowledge, and interpersonal skills, are necessary (Niedzwiedzka, 2003, Kovner et al., 2000) and discussed developing them through education and training (Liang et al., 2012, Finkler, 2002). Some articles also focused on managers’ position in the organization, and how it can be used to promote evidence use (Karamitri et al., 2017). Moreover, the articles in the literature identified two additional facilitators, which were not part of the Model. Specifically they found that certain demographic characteristics, like education level (Jbilou et al., 2007) and attitudes, like positive attitudes towards research are important for applying EBMgt (Niedzwiedzka, 2003).

The articles also identified organizational structural and cultural factors that hinder or facilitate evidence use. As in the Model, the articles identified that organizational factors that facilitate accessing evidence (access to electronic databases; Niedzwiedzka, 2003), and capturing evidence (electronic medical records; Karamitri et al., 2017) are necessary for evidence use. Adding to the Model, many articles found that organizational factors that facilitate producing evidence, like partnering with universities on research projects (Jbilou et al., 2007), and disseminating evidence, like establishing evidence dissemination units (Ellen et al., 2013), are important for evidence use. Finally, as in the Model, several articles found that several organizational factors that specifically emphasize using evidence are important. These factors included having a culture of evidence use, through incorporating EBMgt into the organizational mission (Kovner and Rundall, 2006), and having leaders who model EBMgt behavior (Karamitri et al., 2017). These factors also included having human resource practices that promote EBMgt adoption, like offering EBMgt training programs (Rundall et
Finally, the articles found barriers and facilitators related to national structure. As in
the Model, articles highlighted the importance of national cooperatives for research
production that unite healthcare management researchers and practitioners (Walshe and
Rundall, 2001). Articles also included additional national structural factors not identified in
the Model, like national information technology infrastructure (Clancy and Cronin, 2005),
and policy reforms to incentivize organizations (Leatherman and Sutherland, 2007).

Overall, the barriers and facilitators to EBMgt are at the intersection of healthcare
management research, education, practice, and governance. Therefore, the responsibility of
facilitating the adoption of EBMgt falls on these four groups working interdependently.
Furthermore, despite the overlap between the themes in the articles and the Model, there were
also discrepancies. The articles included some barriers and facilitators that are not part of the
model, thus, the model could be amended to make it more representative of the overall
literature. The Model also included some barriers and facilitators not found in the articles.
The Model included national cultural barrier, referring to a national culture of sharing
information, and specifically lack thereof in the Lebanese context where the Model was
developed. The Model also included a standalone facilitator; technology, referring to increase
in information availability resulting from overall advancement of healthcare technology, like
EHR. This discrepancy might also be due to the national context where the model was
developed where such technologies are not yet widespread (Saleh et al., 2016). We will
explore the issue of national context in the discussion.

Decision criteria

This dimension refers to contextual conditions that are considered alongside the
evidence when selecting between alternatives. Decision criteria are organizational (i.e.,
strategic plan, resources, culture, and politics), external contextual (i.e., external systems, culture, and politics), stakeholder interest and needs, ethicality and legality, and technical (i.e., specialty-specific requirements). We found 8 articles (75% empirical) that either identified decision criteria, pinpointed when decision criteria impact the EBMgt process, or both (Supplementary File 6).

The articles identified a range of decision criteria, including organizational (e.g., resource considerations, Shoemaker et al., 2010), stakeholder (patient safety, Gallego et al., 2008), external contextual (external politics and marketing initiatives, Gallego et al., 2008), ethics, and technical medical considerations (Baghbanian et al., 2012). Moreover, while some (Oetjen et al., 2008) conceptualized that these criteria are defined once a problem is identified and are used to evaluate decision alternatives, others (Baghbanian et al., 2012) found that, in practice, these criteria are not predetermined early in the process. The latter finding is aligned with the Model and research showing that decision criteria are considered implicitly when choosing between alternatives (Mintzberg et al., 1976).

Interestingly, these criteria emerged when researchers were examining the EBMgt process in practice. This indicates the importance of focusing on context when examining EBMgt in practice. Moreover, two criteria identified in the articles, namely external funding and marketing initiatives, which we categorized as external contextual criteria, were not part of the Model. This suggests that the Model could be potentially amended to reflect the literature. Furthermore, the Model included criteria not identified in the literature, which suggests a potential gap in our knowledge on decision criteria and room for more research.

**Lenses**

This dimension refers to managers’ motives and perceptions that impact how they make decisions, the evidence they use, and the decision criteria they prioritize. Lenses differ from Barriers and Facilitators because they do not directly impact evidence acquisition; rather
they impact other parts of the process or the process overall. Kyratsis et al. (2012)’s study, which proposed to explore managers’ motives and determine “why different understandings and meanings emerge for one observation and how this explains different views of scientific evidence” (p. 5), could fall under this dimension. We will discuss the implication of finding only one article in this review that fits under the Lenses dimension in the discussion.

**EBMgt concept**

We identified several conceptual articles discussing EBMgt in healthcare (Supplementary File 7) that did not fit the Model. Some of these articles discussed the main principles of EBMgt (Axelsson, 1998). Others argued for its application to different healthcare management subfields, like healthcare human resource management (Cohen, 2011). Finally, Hewison (2004) critiqued EBMgt, arguing that it is incongruent with current management practice.

**Discussion**

The COVID-19 pandemic highlighted the necessity of using evidence in decision-making and put EBMgt at the forefront of hospital management. To better understand EBMgt in hospital settings and how to leverage it in practice, we conducted a scoping review, integrating current knowledge, identifying the gaps, and delineating areas for future research. We developed a novel review methodology, which involved systematically searching the literature twice; first using EBMgt terminology, and second using terminology associated with the EBMgt concept. We integrated the resulting 218 articles into the Grounded Model of the EBMgt Process and found that most of the articles could be captured by the model’s dimensions, except for a handful of articles that discussed the EBMgt concept.

We make two major contributions to the literature. First, we identified the gaps in our knowledge of the EBMgt process in hospital settings and delineated areas for future research. The major gaps related to the lenses that influence the EBMgt process, the outcomes of
EBMgt application, and the representation of Global South countries in the English language literature. Second, we developed a new methodology of identifying keywords for scoping reviews that could capture the fragmented literature on EBMgt. Using this methodology, we not only gained a deeper understanding of the state of the knowledge on EBMgt, but also contribute a methodology that has promise for scoping reviews of interdisciplinary topics. We discuss these contributions in detail below.

**Gaps in our knowledge and future research**

The research on EBMgt in hospital settings has focused on two aspects, the EBMgt concept and EBMgt application. Research on the EBMgt concept included conceptual articles discussing EBMgt principles and advocating its application. While the general management EBMgt literature is dominated by such articles (Rynes and Bartunek, 2017, Reay et al., 2009), they were not prominent in the current review. Rather, we found that unlike the general management setting (Rynes and Bartunek, 2017), the articles on EBMgt in hospital settings are primarily empirical in nature, examining EBMgt application in practice.

Mapping these article about EBMgt application onto the Grounded Model of the EBMgt Process (Sahakian et al., 2020), we found several areas that future research can focus on. For example, within the process of evidence-based decision-making, the step of appraising the evidence has not received much research attention. This scarcity is at odds with the fundamental premise of EBMgt that the quality of decisions is likely to improve the more managers use reliable evidence. As another example, the decision criteria have received little research attention. The identification of these criteria is starting to build a case that in addition to evidence certain contextual factors are also considered during EBMgt (Sahakian et al., 2020). Thus, more research is necessary to examine the influence of these criteria on EBMgt. The results of such research could also be used to reflect on the Grounded Model of the EBMgt Process and refine the representation of decision criteria within it.
discussion we will focus in-depth on three areas we believe pose major gaps in our knowledge of EBMgt in hospital settings.

**Lenses: managers’ subjectivity shaping EBMgt**

Lenses, which represent managers’ perceptions of situations and motives that impact the EBMgt decision-making process, were neglected in the literature. The strategy process literature highlights the importance of considering the influence of perceptions (Pettigrew, 1992, Pettigrew et al., 2001). This literature stresses that process cannot be discussed without considering how the subjective interpretation of actors within a certain context can change such processes. This aspect has been overlooked in EBMgt, although implementation of EBMgt involves a dynamic process where agents continuously interpret information in light of their knowledge, aims, and power (Baba and HakemZadeh, 2012). Critics of EBMgt have argued that to better understand issues like power, politics, and ethics there has to be greater study of how managers perceive situations and how this impacts EBMgt practice (Morrell and Learmonth, 2015). Moreover, the strategy process literature notes that actors use aspects of context to obtain outcomes important to them. Recent research into EBMgt has found preliminary evidence that managers use evidence for different purposes, including problem solving or giving legitimacy to predetermined actions (Sahakian et al., 2020). Therefore, more research into the impact of managers’ motives for using evidence is necessary to better understand EBMgt practice. This could possibly be done through using the critical incident technique to explore managers’ motives and perceptions in specific incidents of EBMgt. It could also be done through using multiple case studies to examine different evidence-based decisions and managers’ differing perceptions and motives. The results of such research could also be used to reflect on the Grounded Model of the EBMgt Process and refine the representation of lenses within it.

**EBMgt outcomes: evidence for effectiveness**
We can view outcomes of EBMgt decision-making from a temporal perspective, in proximal and distal terms. Proximal outcomes are the outcomes targeted by a specific EBMgt decision. Distal outcomes refer to the long-term outcomes of EBMgt application that result from many factors. Our review includes many studies that showed that hospitals implementing evidence-based solutions attained positive outcomes, and better outcomes than before. To illustrate, Plantier et al. (2017) found a significant positive impact of implementing EHR on the hospital quality of care. Such studies presenting cases of EBMgt application provide evidence that EBMgt can improve proximal outcomes of a decision.

Our review did not reveal, however, any studies assessing the effectiveness of EBMgt as an overall decision-making approach. There is no evidence that hospitals that regularly apply EBMgt have better outcomes than before, or in comparison with hospitals that do not. Thus, evidence of distal outcomes of EBMgt application is lacking in the literature in hospital settings, similar to the EBMgt literature overall (Rynes and Bartunek, 2017), and is an important area for future research. While methodologically challenging, longitudinal studies could be conducted with managers receiving EBMgt training that assess the extent of their implementation of EBMgt and its effect on different outcomes (Rynes and Bartunek, 2017). Alternatively, organizational outcomes can be examined before and after the implementation of certain organizational-level EBMgt facilitators.

The global south: neglected in English language publications

Reflecting on the generalizability of the literature across contexts, we notice that certain national contexts were neglected in the literature. We found that most studies in this review were conducted in Global North countries. Similar to the literature on human behavior overall (Thalmayer et al., 2020), the English language literature on EBMgt in hospital settings has neglected about 90% of the World population, with only 15% of the articles representing Global South countries. This lack of representation may not be an omission of
the literature but a limitation of our search, which involved only English language publications. However, we argue that the neglect of the Global South in the English language EBMgt literature is nonetheless a major gap.

English is the lingua franca of international science (Di Bitetti and Ferreras, 2017) and it dominates much of the world’s healthcare information (Adams and Fleck, 2015). Furthermore, most of the journals included in prestigious journal indices (e.g., Web of Science, Scopus), which have broad readership and are where scientists try to submit their best work, are in English (Mongeon and Paul-Hus, 2014). The lack of representation of the Global South in such publication is problematic because they starkly differ from the Global North in critical areas including income, education, and health (Henrich et al., 2010). Given that most of our knowledge and understanding of EBMgt in hospital settings published in the English language is based on the Global North, this could have implications for the conclusion we can draw about EBMgt in differing national contexts and the theories we can build.

Additionally, while language of such publications may be a barrier, the more prominent issue is the generalizability of the findings to hospitals in the Global South, where the socio-politico-economic contexts, and consequently the healthcare systems, are very different. Whilst healthcare systems around the globe face challenges, there is a disparity between and within these systems in the Global North and South. Examples of these disparities relate to state capacity in terms of regulation and financing of the systems, burden of diseases, per-capita spending, and the healthcare provider-inhabitant ratio (de Carvalho et al., 2021). Discrepancies at the system level therefore create healthcare organizational contexts where findings from studies dominating the literature may not be generalizable.

While this literature fit well under the Grounded Model of EBMgt Process, which is based on the Lebanese context, there were certain discrepancies. Certain sub-themes under
barriers and facilitators (e.g., establishing national reforms) and decision criteria (e.g., impact of marketing initiatives) were unique to the literature, while others (e.g., technology) remained unique to the model. Thus, future English language research studying EBMgt in hospitals should focus on the remaining parts of the World to better understand the impact of differences in contexts.

Methodological contribution: systematically scoping a fragmented literature

Systematically reviewing the EBMgt literature in hospital settings has a few challenges. Namely, the EBMgt terminology is new and not widespread (Briner et al., 2009), and research on EBMgt in healthcare management is spread across different disciplines, including management, medicine, and nursing. To overcome these challenges, we developed a novel four-step methodology. While step one of our process; systematically searching the literature using EBMgt terminology, was not novel, the remaining steps were. These involved using an expert panel to identify the relevant keywords used by articles resulting from step one, conducting a second search using these keywords, and reconciling the results across the searches. Using this methodology, we widened the scope of our search exponentially, identifying an additional 180 unique articles that did not use the EBMgt terminology, and better captured a fragmented literature that is dispersed across disciplines. As a result, our review provides a more holistic understanding of the current state of the knowledge on EBMgt in hospital settings.

Moreover, given the complexity of problems facing society today, great emphasis is placed on interdisciplinary research (Pedersen, 2016). Our novel methodology can be used to capture all relevant terminology related to an interdisciplinary topic across different fields. It can therefore prove useful for synthesizing topics that, similar to EBMgt, are dispersed across different bodies of literature.

Practical implications
This review provides managers some resources to facilitate EBMgt practice, including for example articles that discuss tools to support evidence acquisition, evaluation, and use (Lohr, 2004, Kibbe et al., 1997). The review also indicates the different competencies that might be necessary for EBMgt; organizations could rely on these competencies to make selection decisions or to develop training programs. They can also use the barriers and facilitators to identify the role their internal structure, culture, and practices play to support EBMgt, and to identify potential solutions. Researchers, educational institutions, and government agencies can also use the barriers and facilitators to examine their role in hindering EBMgt practice, and the proposed solutions to take a more active role in enabling EBMgt application in practice.

Limitations

Some limitations must be noted when considering the results of this study. First, we did not include the grey literature, because our study was the first scoping review of the literature on EBMgt using a new methodology. This may have limited our findings because grey literature can identify studies commissioned by organizations (Briner et al., 2009) and studies with null results (Adams et al., 2017) and provides an opportunity for future research. Second, not limiting the search to English language publications might have provided a better idea of the geographic distribution of the literature and provides an opportunity for future research. Third, our novel methodology, while exhaustive, was very time consuming. This explains why the latest studies in this review are two years old. This presents an opportunity to further refine this methodology.

Conclusion

We set out to integrate the literature on EBMgt in hospital settings, identify the gaps and delineate areas for future research. We conducted a systematic scoping review, identified 128 articles, and categorized them within an EBMgt framework. We made two major
contributions to the literature. First, we identified the major gaps in the literature on EBMgt in hospital settings and outlined areas for future research. We found that the English language literature provides limited insight into the role of managers’ perceptions and motives in EBMgt, the practice of EBMgt in Global South countries, and the outcomes and effectiveness of EBMgt. Second, we developed a novel review methodology for reviewing phenomena, like EBMgt, that are not unified by common terminology and are studied across disciplines, thus contributing to the scoping review literature.
References


Di Bitetti, M. S. and Ferreras, J. A. (2017), "Publish (in English) or perish: the effect on citation rate of using languages other than English in scientific publications", *Ambio*, Vol. 46 No. 1, pp. 121-127.


Mintzberg, H., Raisinghani, D. and Theoret, A. (1976), "The structure of" unstructured"

Mongeon, P. and Paul-Hus, A. (2014), "The journal coverage of bibliometric databases: A
comparison of Scopus and Web of Science. The journal coverage of Web of Science

1176-1197.

Niedzwiedzka, B. M. (2003), "Barriers to evidence-based decision making among Polish
106-115.

stepwise method", The health care manager, Vol. 27 No. 1, pp. 4-12.

Pedersen, D. B. (2016), "Integrating social sciences and humanities in interdisciplinary

Pettigrew, A. M. (1992), "The character and significance of strategy process research",

change and development: challenges for future research", Academy of Management
journal, Vol. 44 No. 4, pp. 697-713.

Pines, J. M. and Griffey, R. T. (2015), "What we have learned from a decade of ED crowding
research?", Academic Emergency Medicine, Vol. 22 No. 8, pp. 985–987.

(2017), "Does adoption of electronic health records improve the quality of care
management in France? Results from the French e-SI (PREPS-SIPS) study",


performance in an urban academic emergency department", "The Joint Commission
Journal on Quality and Patient Safety, Vol. 42 No. 6, pp. 271-AP274.
### Table I. Juxtaposing Three Frameworks of EBMgt in Healthcare

<table>
<thead>
<tr>
<th>EBMgt Framework</th>
<th>Assumption</th>
<th>Decision-making Process</th>
<th>Considers Context</th>
<th>Basis for Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baba and HakemZadeh (2012)</td>
<td>Bounded rationality</td>
<td>Dynamic process</td>
<td>Multi-level</td>
<td>Yes</td>
</tr>
<tr>
<td>Sahakian et al. (2020)</td>
<td>Bounded rationality</td>
<td>Sequential &amp; iterative process</td>
<td>Multi-level</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Table II. Data Collection Method of Empirical Articles

<table>
<thead>
<tr>
<th>Method</th>
<th>Frequency</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Single case study</td>
<td>58</td>
<td>38.67</td>
</tr>
<tr>
<td>Interview</td>
<td>47</td>
<td>31.33</td>
</tr>
<tr>
<td>Cross-sectional survey</td>
<td>38</td>
<td>25.33</td>
</tr>
<tr>
<td>Pretest–post-test design</td>
<td>18</td>
<td>12.00</td>
</tr>
<tr>
<td>Secondary data</td>
<td>9</td>
<td>6.00</td>
</tr>
<tr>
<td>Multiple case studies</td>
<td>7</td>
<td>4.67</td>
</tr>
<tr>
<td>Focus group discussion</td>
<td>4</td>
<td>2.67</td>
</tr>
<tr>
<td>Quasi-experimental design</td>
<td>4</td>
<td>2.67</td>
</tr>
<tr>
<td>Experimental design</td>
<td>2</td>
<td>1.33</td>
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<tr>
<td>Longitudinal design</td>
<td>2</td>
<td>1.33</td>
</tr>
<tr>
<td>Delphi study</td>
<td>1</td>
<td>0.67</td>
</tr>
</tbody>
</table>
Figure 1. Sahakian et al’s (2020) Grounded Model of the EBMgt Process and Distribution of the Scoping Review Articles across its Dimensions

675x397mm (96 x 96 DPI)
Figure 2. Search and Filtering Strategy Results
Figure 3. Frequency of Articles over Time and Distribution of Conceptual versus Empirical Articles

42x32mm (600 x 600 DPI)
Supplemental File 1. Detailed Search and Filtering Strategy and Analysis

We conducted a scoping review for peer-reviewed journal articles on the topic of EBMgt in hospital settings. We searched four online databases: PubMed, CINAHL, PsycINFO, and Cochrane Library, with no restrictions on publication year. These databases were selected to be wide in scope, encompassing disciplines related to health, life, social, and behavioral sciences, and business, to cover the hospital setting, and to be inclusive of all management levels.

The main challenges were that the EBMgt literature is spread across several fields and may not be using the EBMgt terminology. Existing reviews of the EBMgt literature have searched the literature either only using EBMgt terminology (i.e. EBMgt, evidence-informed management, Jaana et al., 2014, Roshanghalb et al., 2018, Rynes and Bartunek, 2017) or EBMgt terminology and related terms identified by expert librarians (i.e. research utilization, research to practice etc, Currie, 2013, Reay et al., 2009). We adapted these two approaches and developed a novel methodology that involved two systematic searches; one using EBMgt terminology, and a second using terminology associated with the EBMgt concept, which we derived from the results of the first search. This resulted in a 4-step process, discussed further below, which we implemented from April 2015- October 2019. The novelty of this process is in its use of the results of a first search to derive more keywords to conduct a second more expanded search.

General systematic search

First, we searched the four databases using the key-terms: ‘evidence’ AND ‘based’ OR ‘driven’ OR ‘informed’ AND ‘healthcare’ AND ‘management’. We specified peer reviewed, English-only journal articles, involving only human subjects. We exported the results from the databases into Microsoft Excel and merged all the results to identify and remove duplicates. We applied four filters to narrow down the articles:
(1) Removed titles that reflect clinical topics (e.g., alginate dressings for venous leg ulcers)
(2) Removed titles that are irrelevant (e.g., comment on World War II repression)
(3) Read abstracts keeping those related to non-clinical evidence-based decision-making,
    decision-making in healthcare, decision-making by healthcare managers, and practice
    guideline development
(4) Read full texts keeping those related to evidence-based hospital processes, procedures,
    and design, non-clinical evidence-based decision-making by hospital managers,
    evidence-based decision-making in hospitals.

Two researchers, including one of the authors, applied each of the filters separately and
then reconciled their differences after each filter, consulting the rest of the authors when
necessary. The two researchers also reviewed the reference lists of the remaining relevant
articles.

**Keyword identification**

Second, we extracted the keywords of the articles remaining from the first step to
determine EBMgt related terminology that might be used by relevant articles. We developed an
expert panel involving the researchers who applied the filters and two of the remaining authors.
To ensure that the search would not be limited in scope, the panel removed keywords that pertain
to specific fields (e.g. community-health), practices (e.g. telehomecare), and countries (e.g.
Canada). They then reviewed the relevance of the remaining words to EBMgt and based on
consensus decided on a list of 21 keywords (Table I).

**Table I. Keywords Identified from the Focused Keyword Identification Step.**

<table>
<thead>
<tr>
<th>Focused Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td>decision makers</td>
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<tr>
<td>knowledge based value creation</td>
</tr>
<tr>
<td>decision making</td>
</tr>
<tr>
<td>organizational decision making</td>
</tr>
<tr>
<td>decision science</td>
</tr>
<tr>
<td>research capacity building</td>
</tr>
<tr>
<td>evidence</td>
</tr>
<tr>
<td>research transfer</td>
</tr>
</tbody>
</table>
evidence informed improvement  research use
evidence based design  research practice gap
evidence based management  scientific evidence
evidence based practice  strength of evidence
knowledge flow  translation*
knowledge management  knowledge transfer
knowledge process

* Referring to transfer of knowledge or evidence into practice

**Keyword systematic search**

Third, we searched the four databases using the 21 keywords, in addition to “healthcare AND management NOT clinical”. We applied the same specifications as the first search, exported and merged the results, removed duplicates, and applied the same four filters.

**Reconciliation**

Fourth, to ensure the uniqueness of the final list of relevant articles from the two searches, we examined the overlap of the articles across the two searches and removed duplicates.

**Analysis**

We analyzed the articles using a deductive content analysis approach (Elo and Kyngas, 2008). The foundation for the categorization was the Grounded Model of the Evidence-based Management Process (hereafter the Model) with its five dimensions encompassing 30 themes.

**Coding**

We tabulated key information about each article including their objectives, methodology, results, and limitations on Microsoft Excel. Two of the authors conducted the categorization simultaneously and collaboratively. They familiarized themselves with each of the articles, paying attention to the objectives and results of each, and assigned each article a code based on the dimensions and themes of the Model. Articles were assigned to a relevant dimension or set of dimensions, as well as, theme or set of themes from the model. When articles did not fit the
dimensions and themes provided by the model, we created new themes derived from the data to encompass these articles based on the principles of inductive content analysis (Elo and Kyngas, 2008).

**Reliability**

To increase reliability of the categorization of articles according to the Model we engaged an independent coder, a PhD candidate in organizational psychology. We provided the coder with definitions of each of the dimensions and, based on Lacy and Riffe’s (1996) recommendations, asked them to code a random sample of 70 articles. We assessed inter-coder reliability and found moderate agreement between our categorization and the independent coder’s, Cohen’s $\kappa = .59$ (95% CI, 0.44 to 0.75). We revisited the disagreements, made a change to the categorization of one article, and found that most disagreements were due to the coders’ lack of familiarity with the concepts.

**References**


Supplemental File 2. List of Articles Resulting from the Systematic Scoping Review


Kibbe, D. C., Smith, P. P., LaVallee, R., Bailey, D. and Bard, M. (1997), "A guide to finding and evaluating best practices health care information on the Internet: the truth is out there?"


### Process of Evidence-based Decision-Making Dimension

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub-Theme</th>
<th>Articles</th>
<th>Example Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquiring Evidence</td>
<td><strong>Tools for Acquisition</strong></td>
<td>Abidi (1999)</td>
<td>&gt; Abidi (1999) proposed a software that uses data mining as a tool to derive knowledge from healthcare databases to use in decision-making.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Atack et al. (2010)</td>
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<td></td>
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<td>Chan et al. (2004)</td>
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<td></td>
<td></td>
<td>Davidson (2017)</td>
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<td></td>
<td></td>
<td>Devine et al. (2008)</td>
<td></td>
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<td></td>
<td></td>
<td>Doods (2005)</td>
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<td></td>
<td></td>
<td>Kibbe et al. (1997)</td>
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<td></td>
<td></td>
<td>Marshall (2013)</td>
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<td></td>
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<td>Mathew (2011)</td>
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<td></td>
<td></td>
<td>Ozyapici and Tanis (2016)</td>
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<td></td>
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<td>Player (1998)</td>
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<td></td>
<td></td>
<td>Testik et al. (2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Applied Cases</strong></td>
<td>Aguado-Correa et al. (2016)</td>
<td>&gt; Brady et al. (2017) described acquiring evidence about the nature of out-of-hours communication between nurses and doctors in a hospital in Ireland.</td>
</tr>
<tr>
<td></td>
<td>Patient flow</td>
<td>Elamir (2018)</td>
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<td></td>
<td></td>
<td>Zafar et al. (2016)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Facility design</strong></td>
<td>Mazur et al. (2017)</td>
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<tr>
<td></td>
<td><strong>Medication management</strong></td>
<td>Debono et al. (2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Patient experience</strong></td>
<td>Xie and Or (2017)</td>
<td></td>
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<tr>
<td></td>
<td><strong>Policy</strong></td>
<td>Mahmoudian-Dehkordi and Sadat (2017)</td>
<td></td>
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<tr>
<td></td>
<td><strong>Team communication</strong></td>
<td>Brady et al. (2017)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Acquiring Evidence about a Problem</strong></td>
<td>Furnham et al. (2003)</td>
<td>&gt; Attree (2001) conducted a qualitative study to acquire evidence about how nurses, doctors, managers, patient, and relatives describe quality of care and what criteria they use to evaluate it.</td>
</tr>
<tr>
<td></td>
<td>Nursing burnout &amp; fatigue</td>
<td>Myers et al. (2016)</td>
<td></td>
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<td></td>
<td></td>
<td>Nantsupawat et al. (2017)</td>
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<tr>
<td></td>
<td></td>
<td>Steege and Dykstra (2016)</td>
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<tr>
<td></td>
<td></td>
<td>Steege et al. (2017)</td>
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<tr>
<td></td>
<td>Quality &amp; safety</td>
<td>Attree (2001)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>DeWulf et al. (2017)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Finkelstein et al. (1997)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Steuten and Buxton (2010)</td>
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</tr>
</tbody>
</table>
be applied to address the problem of overcrowding in Emergency Departments.

> Jiang and Verderber (2017) conducted a systematic review to acquired evidence about the relationship between the design of hospital circulation zone (i.e. corridors, lobbies, elevators) and health-related outcomes (i.e. stress, satisfaction, patient falls).

> Myers et al. (2016) conducted a qualitative study to acquire evidence about nurses’ experiences of horizontal violence (i.e. hostile behavior by nurses towards nurses) in different types of hospitals.

Delias et al. (2015) introduced a method to analyze emergency department process data to support decision making.

Lohr (2004) classified and evaluated existing systems for grading the quality of research articles and bodies of evidence.

Elamir (2018) described how several evidence-based alternates were generated using organizational data and scientific literature to solve overcrowding in a hospital Emergency Department in Kuwait.

Testik et al. (2017) developed and tested a tool for objectively choosing between different alternatives.

Pomey et al. (2013) conducted a

<table>
<thead>
<tr>
<th>Appraising the Quality of the Evidence</th>
<th>Analyzing Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategies &amp; Tools for Appraisal</td>
<td>Davidson (2017)</td>
</tr>
<tr>
<td></td>
<td>Kibbe et al. (1997)</td>
</tr>
<tr>
<td></td>
<td>Lohr (2004)</td>
</tr>
</tbody>
</table>

| Generating Alternatives          | Elamir (2018) |

| Making a Decision               | Testik et al. (2017) |

| Preparing for Factors Impacting | Gallego et al. (2008) |

> > >
| Implementation | Implementation | Gignon et al. (2017) | Gignon et al. (2017) discuss how simulation can be used to design, plan, and assess a new hospital building before opening it for patient care.

|----------------------------------------|------------------------|----------------------|--------------------------|

| Applied Cases | Facility Design | Chiarini and Baccarani (2016) | Mazur et al. (2017) described how they applied lean management principles and strategies during the design phase of a new surgery building.

|---------------|------------------|-----------------------|--------------------|

| Assessing & Adjusting | Applied Cases | Jessup et al. (2016) | Büchner et al. (2016) assessed the impact of entering a health system on hospital efficiency and profitability in hospitals in Germany.

| Admission        | Admission       | Karlner et al. (2017) | de-Carvalho et al. (2017) assessed the implementation of an automated drug-dispensing system on errors in drug administration in a hospital in Brazil.

| Bed Allocation   | Bed Allocation  | Doorduijn et al. (2016) | Karlner et al. (2017) assessed the impact of having easy access to professional interpreters at each hospital bedside on readmission rates, length of stay, and hospital expenditures in USA.

| Discharge        | Discharge       | Holland et al. (2017) | Plantier et al. (2017a, 2017b) assessed the implementation of Electronic Health Record on the performance of surgical units and overall quality of care in hospitals.

| Electronic health records | Electronic health records | Plantier et al. (2017a) | Plantier et al. (2017b) |

|------------------|------------------|-----------------------|-----------------------|


|-------------------|-------------------|---------------------------|--------------------------|

|-------------------|-------------------|----------------------|---------------------|

| Accreditation     | Accreditation     | Chen et al. (2016) | Büchner et al. (2016) |

| Foodservices      | Foodservices      | Plantier et al. (2017b) | Plantier et al. (2017a) |

<p>| Forecasting       | Forecasting       | Schachner et al. (2017) | Schachner et al. (2017) |</p>
<table>
<thead>
<tr>
<th>Category</th>
<th>Study/Methodological Approach</th>
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<tbody>
<tr>
<td>Health systems</td>
<td>de-Carvalho et al. (2017)</td>
</tr>
<tr>
<td>Medical Equipment</td>
<td>Chiarini and Baccarani (2016)</td>
</tr>
<tr>
<td>Medication Management</td>
<td>Buttigieg et al. (2016)</td>
</tr>
<tr>
<td>Performance Improvement</td>
<td>Foglia et al. (2017)</td>
</tr>
<tr>
<td>Quality Improvement</td>
<td>Chen et al. (2016)</td>
</tr>
<tr>
<td>Technology Assessment</td>
<td>Doorduijn et al. (2016).</td>
</tr>
</tbody>
</table>

**Overall Process**

**Mapping the Process**
- Baghbanian et al. (2012)
- Brown and Ecoff (2011)
- Gallego et al. (2008)
- Janati et al. (2018)
- Oetjen et al. (2008)

**Support Tools**
- Fernandez et al. (1997)
- Gartnera and Padmanb (2017)

**Applied Cases**

**Forecasting**
- Afilal et al. (2016)
- Barak-Corren et al. (2017)
- Calegari et al. (2016)
- Lucini et al. (2017)
- Parente et al. (2018)

**Patient flow**
- Fulbrook et al. (2017)
- Lovett et al. (2016)
- Tibor et al. (2016)
- Venugopal et al. (2017)
- Wiler et al. (2016)

**Information system**
- Krugman and Sanders (2016)
- Nippak et al. (2016)
- Qin et al. (2017)
- Ruland (2001)

**Patient experience**
- Bellamkonda et al. (2016)
- Gillespie and Reader (2016)
- Nelson and Staffileno (2017)
- Pottenger et al. (2016)

**Process improvement**
- Bell et al. (2016)

throughout France.

> Repplinger et al. (2017) assessed the impact of redesigning the emergency department front-end on patient satisfaction scores in a hospital in USA.

> Brown and Ecoff (2011), through a conceptual study, proposed an eight-step approach to evidence-based decision making in the context of healthcare facility design.

> Gartnera and Padmanb (2017) developed a digital workbench for hospital resource planning decisions.

> Fulbrook et al. (2017) proposed and assessed having nurse navigators to facilitate patient movement through the Emergency Department on throughput in a hospital in Australia.

> Hicks et al. (2017) designed and tested a quality improvement initiative to reduce unnecessary blood transfusions in the Department of Surgery of a hospital in USA.

> Khalifa (2017) conducted a root cause analysis to identify reasons for delays in discharging inpatients. They then designed and launched a performance improvement project, which involved collecting data, applying several interventions, and assessing their impact on discharge and average length of stay in a hospital in the
<table>
<thead>
<tr>
<th>Topic</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staffing</td>
<td>Bowen <em>et al.</em> (2016)</td>
</tr>
<tr>
<td></td>
<td>Hicks <em>et al.</em> (2017)</td>
</tr>
<tr>
<td></td>
<td>Khalifa and Zabani (2016b)</td>
</tr>
<tr>
<td></td>
<td>Butler <em>et al.</em> (2012)</td>
</tr>
<tr>
<td></td>
<td>DeRienzo <em>et al.</em> (2017)</td>
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<td></td>
<td>Kullberg <em>et al.</em> (2016)</td>
</tr>
<tr>
<td></td>
<td>Respicio <em>et al.</em> (2018)</td>
</tr>
<tr>
<td>Emergency department crowding</td>
<td>Eiset <em>et al.</em> (2016)</td>
</tr>
<tr>
<td></td>
<td>Siddharthan <em>et al.</em> (1996)</td>
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<td></td>
<td>Wallingford Jr <em>et al.</em> (2018)</td>
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<td></td>
<td>Vissers (1995)</td>
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<tr>
<td>Quality improvement</td>
<td>Gold <em>et al.</em> (2016)</td>
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<tr>
<td></td>
<td>Nates <em>et al.</em> (2017)</td>
</tr>
<tr>
<td>Test turnaround time</td>
<td>Inal <em>et al.</em> (2018)</td>
</tr>
<tr>
<td></td>
<td>White <em>et al.</em> (2017)</td>
</tr>
<tr>
<td>Employee Satisfaction</td>
<td>Yurumezoglu and Kocaman (2012)</td>
</tr>
<tr>
<td>Hospital design</td>
<td>Yoder (2008)</td>
</tr>
<tr>
<td>Patient discharge</td>
<td>Khalifa (2017)</td>
</tr>
<tr>
<td>Policy selection</td>
<td>Carnero and Gómez (2016)</td>
</tr>
<tr>
<td>Priority setting</td>
<td>Astley and Wake-Dyster (2001)</td>
</tr>
</tbody>
</table>

> Lucini *et al.* (2017) proposed and tested a Text Mining approach to analyze free-text medical records from Emergency Department patients soon after they make first contact with Emergency Department physicians to better predict admission in a hospital in Brazil.

> Qin *et al.* (2017) actively involved nurses in the design, development, and implementation of an intensive care information system and examined the impact on nursing care processes and nurse satisfaction in a hospital in China.

> White *et al.* (2017) applied and tested a series of process improvement interventions based on lean methodologies to address delays in radiology test turnaround time in an Emergency department of a hospital in USA.
Supplementary File 4. Categorization of Articles under the Sources of Evidence Dimension

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sources Mapped onto Model</th>
<th>Articles</th>
<th>Example Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept of evidence</td>
<td></td>
<td>Råholm (2009)</td>
<td>Råholm (2009) argued that the concept of evidence in EBMgt is rigid, portrayed it from a multidimensional perspective, and argued for rethinking it.</td>
</tr>
<tr>
<td>Evidence used in Practice</td>
<td>Experiential, Scientific, Organizational, Stakeholder</td>
<td>Guo et al. (2017)</td>
<td>&gt; Guo et al. (2017) examined the types of evidence hospital managers across the USA used in their decision-making.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Janati et al. (2018)</td>
<td></td>
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<td></td>
<td></td>
<td>Liang et al. (2012)</td>
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<td></td>
<td></td>
<td>Spiers et al. (2016)</td>
<td></td>
</tr>
<tr>
<td>Applied Cases</td>
<td>Experiential, Scientific, Organizational, Stakeholder</td>
<td>Shoemaker et al. (2010)</td>
<td>&gt; Shoemaker et al. (2010) described the different types of evidence used for a facility design decision in a hospital in USA.</td>
</tr>
<tr>
<td></td>
<td>Scientific, Organizational, Stakeholder</td>
<td>Richer et al. (2013)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organizational, Stakeholder</td>
<td>Beglinger (2006)</td>
<td></td>
</tr>
<tr>
<td>Encouraging the use of a specific type of evidence</td>
<td>Organizational</td>
<td>Ginsburg (2003)</td>
<td>&gt; Capan et al. (2017) argued for the use of operations research to inform healthcare delivery decision-making and highlighted potential opportunities for its use.</td>
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<tr>
<td></td>
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<td>Jan (2003)</td>
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<td></td>
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<td>Murphy et al. (2013)</td>
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<td>Mykkänen et al. (2016)</td>
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<td>Schaeffer et al. (2017)</td>
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<td></td>
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<td>Simonen et al. (2012)</td>
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<td>Peters et al. (2013)</td>
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<tr>
<td></td>
<td>Organizational</td>
<td>Fagerström (2009)</td>
<td>&gt; Patrick and Puterman (2008) discussed the benefit of using operations research in healthcare management and demonstrated its</td>
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<tr>
<td></td>
<td></td>
<td>Gignon et al. (2017)</td>
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<td>Hawkins et al. (2016)</td>
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<td>Margrif (1991)</td>
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<td>Seifan and Shemer (2005)</td>
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<tr>
<td></td>
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<td>Vissers (1995)</td>
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</tbody>
</table>
Patrick and Puterman (2008)
Schaeffer et al. (2017) argued for the use of big data and discussed its potential benefits to hospitals.
Supplementary File 5. Categorization of Articles under the Barriers & Facilitators Dimension

<table>
<thead>
<tr>
<th>Theme</th>
<th>Barriers Mapped onto Model</th>
<th>Article</th>
<th>Example Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examining one Barrier/Facilitator</td>
<td>Characteristics of the Evidence</td>
<td>Aldrich et al. (2006)</td>
<td>&gt; Alexander et al. (2007) examined the types of information hospital chief executive officers need to address cost and quality problems and the extent to which health services research is meeting those needs.</td>
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<tr>
<td></td>
<td></td>
<td>Alexander et al. (2007)</td>
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<td></td>
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<td>Attack et al. (2010)</td>
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<td>Bai et al. (2018)</td>
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<td>Barton (1994)</td>
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<td></td>
<td></td>
<td>Finkler and Ward (2003)</td>
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<td></td>
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<td>Gautam (2008)</td>
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<td></td>
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<td>Green (2011)</td>
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<td></td>
<td></td>
<td>Kontio et al. (2013)</td>
<td>&gt; Zborowsky and Bunker-Hellmich (2010) discuss evidence-based design decision-making and the challenges and opportunities that exist related to the existing research evidence.</td>
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<tr>
<td></td>
<td></td>
<td>Lomas (2005)</td>
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<td>Matchar et al. (2005)</td>
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<td>Poot et al. (2018)</td>
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<td>Pope et al. (2006)</td>
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<td>Treveek et al. (2013)</td>
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<tr>
<td></td>
<td></td>
<td>Tricco et al. (2016)</td>
<td>&gt; Zwijnenberg et al. (2016) examined how information presentation effects the way it is understood and used for quality improvement.</td>
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<tr>
<td></td>
<td></td>
<td>Ulrich et al. (2010)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Zborowsky and Bunker-Hellmich (2010)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zwijnenberg et al. (2016)</td>
<td></td>
</tr>
<tr>
<td>Characteristics of the Decision Maker</td>
<td></td>
<td>Adams et al. (2016)</td>
<td>&gt; Finkler (2002) discuss the necessity of providing research-oriented education as a way to overcome barriers to evidence-based management.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bigelow and Arndt (2003)</td>
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<td>Browman et al. (2003)</td>
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<td>Burgess and Currie (2013)</td>
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<tr>
<td></td>
<td></td>
<td>Finkler (2002)</td>
<td>&gt; Nicklin and Stipich (2005),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fischer et al. (2016)</td>
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</tbody>
</table>
Fletcher and Thornhill (2009) described the goals of a program aimed to enhance healthcare executives’ skills in using research for decision making.> Ellen et al. (2013) examine the different programs, interventions, instruments, and tools that healthcare organizations in Canada have to support evidence-informed decision-making and which are perceived to actually facilitate evidence-based decision-making.> Thornhill et al. (2009) discussed a self-assessment tool that can be used by healthcare organizational to examine their capacity to acquire, interpret, and rely on research evidence to make decisions and deliver healthcare services.> Ellen et al. (2014) identified the barriers and facilitators to implementing programs, interventions, instruments, and tools to support evidence-informed decision-making in Canadian healthcare organizations.

|-----------------------------------|-------------|------------------|-------------------|----------------|---------------|-----------------------|--------|-------------------------|----------------------|-------------------------|------------------|-------------------|-----------------|----------------|----------------------|---------|----------------------|

Wilson et al. (2012) documented five Canadian contributions to facilitate the acquisition and use of research evidence.

Examining overall Barriers & Facilitators

|---------------------------------|----------------|---------------------|---------------------|-------------------|

> Ellen et al. (2014) identified the barriers and facilitators to implementing programs, interventions, instruments, and tools to support evidence-informed decision-making in Canadian healthcare organizations.
Jih et al. (2006)  
Marshall (2013)  
Clancy and Cronin (2005)  
Leatherman and Sutherland (2007)  
Ellen et al. (2014)  
Jbilou et al. (2007)  
Karamitri et al. (2017)  
Langaneer and Worthington (2010)  
Niedzwiedzka (2003)  
Simonen et al. (2012)  
Liang et al. (2012)  
Guo et al. (2017)  
Champagne et al. (2014)  
Janati et al. (2018)  
Shoemaker et al. (2010)  
Spiers et al. (2016)  
Williams (2006)  
Canaway et al. (2017)  
Kovner and Rundall (2006)  
Walshe and Rundall (2001)  

> Golenko et al. (2012) assessed the barriers and facilitators to research capacity building from the perspective of senior healthcare managers in allied health.  
> Guo et al. (2017) examined the influence of managers’ demographic characteristics and attitudes, and the size of the healthcare organization on healthcare managers’ use of evidence-based management.  
> Karamitri et al. (2017) systematically reviewed the literature on knowledge management in healthcare settings and identified the barriers to implementation of knowledge management.  
> Kovner and Rundall (2006) suggest practical strategies that healthcare organizations in USA can adopt to strengthen the implementation of evidence-based management.  
> Liang et al. (2012) conducted a systematic review on evidence-informed decision-making, including the barriers to its practice among health service managers.  
> Niedzwiedzka (2003) examined the individual and environmental...
factors that influence healthcare managers’ information use in hospitals in Poland.
Supplementary File 6. Categorization of Articles under the Decision Criteria Dimension

<table>
<thead>
<tr>
<th>Decision Criteria Dimension</th>
<th>Theme</th>
<th>Decision Criteria Mapped onto Model</th>
<th>Articles</th>
<th>Example Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying Criteria</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Organizational</td>
<td>Friedman (1999)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organizational, External</td>
<td>Spiers et al. (2016)</td>
<td>Spiers et al. (2016) examined nurse leaders’ evidence-based decision-making process in a context of continuous restructuring, and found that political and fiscal criteria inherent in system restructuring took precedent over patient needs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organizational, Stakeholder</td>
<td>Shoemaker et al. (2010)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Organizational, Stakeholder, External</td>
<td>Gallego et al. (2008)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Ethico-Legal</td>
<td>Janati et al. (2018)</td>
<td></td>
</tr>
<tr>
<td>Pinpointing Criteria in the Process</td>
<td></td>
<td></td>
<td>Oetjen et al. (2008)</td>
<td>Oetjen et al. (2008) offered a conceptually developed evidence-based managerial decision-making modal, which included developing and ranking criteria once a problem is identified and then using the criteria to choose between alternatives.</td>
</tr>
<tr>
<td>Pinpointing &amp; identifying Criteria in the Process</td>
<td></td>
<td>Organizational, Ethico-Legal, Technical</td>
<td>Baghbanian et al. (2012)</td>
<td>Baghbanian et al. (2012) empirically developed a decision-making model for resource allocation, which depicted different decision criteria that are used to evaluate possible positions and create contextual fit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organizational, Stakeholder</td>
<td>Beglinger (2006)</td>
<td></td>
</tr>
</tbody>
</table>
Supplementary File 7. Categorization of Articles under the Evidence-based Management Concept

<table>
<thead>
<tr>
<th>Evidence-based Management Concept</th>
<th>Example Research</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EBMgt Introduction &amp; Promotion</strong></td>
<td>Healthcare Management</td>
</tr>
<tr>
<td>Axelsson (1998)</td>
<td>&gt; Walshe and Rundall (2001) introduced the core principles of evidence-based management in healthcare, compared it to evidence-based medicine, described its increasing acceptance, and explored the reasons behind it.</td>
</tr>
<tr>
<td>Clancy and Cronin (2005)</td>
<td></td>
</tr>
<tr>
<td>Kovner and Rundall (2006)</td>
<td></td>
</tr>
<tr>
<td>Kovner et al. (2000)</td>
<td></td>
</tr>
<tr>
<td>Ovretveit (1999)</td>
<td></td>
</tr>
<tr>
<td>Walshe and Rundall (2001)</td>
<td></td>
</tr>
<tr>
<td>Young (2002)</td>
<td></td>
</tr>
<tr>
<td><strong>EBMgt Promotion</strong></td>
<td>Facility Design</td>
</tr>
<tr>
<td>Sadler et al. (2008)</td>
<td></td>
</tr>
<tr>
<td>Ulrich et al. (2010)</td>
<td></td>
</tr>
<tr>
<td>Zborowsky and Bunker-Hellmich (2010)</td>
<td></td>
</tr>
<tr>
<td><strong>Financial Management</strong></td>
<td></td>
</tr>
<tr>
<td>Finkler (2004)</td>
<td></td>
</tr>
<tr>
<td>Finkler and Ward (2003)</td>
<td></td>
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<tr>
<td><strong>Nursing Management</strong></td>
<td></td>
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<tr>
<td>Williams (2006)</td>
<td></td>
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<tr>
<td><strong>Health Technology Assessment</strong></td>
<td></td>
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<tr>
<td>Juzwishin (2010)</td>
<td></td>
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<tr>
<td><strong>Human Resource Management</strong></td>
<td></td>
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<tr>
<td>Cohen (2011)</td>
<td></td>
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<tr>
<td><strong>Risk Management</strong></td>
<td></td>
</tr>
<tr>
<td>Card et al. (2012)</td>
<td></td>
</tr>
<tr>
<td><strong>EBMgt Criticism</strong></td>
<td></td>
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</tbody>
</table>