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Three perspectives on evidence-based management: rank, fit, variety

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Abstract

Purpose – The debate on evidence-based management (EBMgt) has reached an impasse. The persistence of meaningful critiques highlights challenges embedded in the current frameworks. The field needs to consider new conceptual paths that appreciate these critiques, but move beyond them. The paper aims to discuss this issue.

Design/methodology/approach – This paper unpacks the concept of finding the "best available evidence," which remains a central notion across definitions of EBMgt. For each element, it considers relevant theory and offers recommendations, concluding with a discussion of "bestness" as interpreted across three key dynamics – rank, fit, and variety.

Findings – The paper reinforces that EBMgt is a social technology, and draws on cybernetic theory to argue that the "best" evidence is produced not by rank or fit, but by variety. Through variety, EBMgt more readily captures the contextual, political, and relational aspects embedded in management decision making.

Research limitations/implications – While systematic reviews and empirical barriers remain important, more rigorous research evidence and larger catalogues of contingency factors are themselves insufficient to solve underlying sociopolitical concerns. Likewise, current critiques could benefit from theoretical bridges that not only reinforce learning and sensemaking in real organizations, but also build on the spirit of the project and progress made towards better managerial decision making.

Originality/value – The distinctive contribution of this paper is to offer a new lens on EBMgt drawing from cybernetic theory and science and technology studies. By proposing the theoretical frame of variety, it offers potential to resolve the impasse between those for and against EBMgt.

Keywords Management theory, Knowledge management, Implementation, Evidence-based management, Management strategy, Theory of evidence

Paper type General review

1. Introduction

Over the past decade, the evidence-based management (EBMgt) debate has arrived at an impasse, with two strands of scholarship developing in tandem, yet in relative isolation. Despite a few attempts at comprehensive theory building (Baba and HakemZadeh, 2012; Mankelwicz and Kitahara, 2008), the field remains perilously undertheorized. A manager newly venturing into this literature could easily develop some confusion about EBMgt and its practice.

On the one hand, arguments for EBMgt have largely built upon and refined early definitions in a realist orientation (Martelli, 2012). For those adherent, EBMgt has been defined as the "systematic application of the best available evidence to the evaluation of managerial strategies for improving [organizational] performance" (Kovner and Rundall, 2006). Over time, this definition has been refined into one or another version of "making decisions through the conscientious, explicit and judicious use of the best available evidence from multiple sources by asking, acquiring, appraising, aggregating, applying, and assessing to increase the likelihood of a favorable outcome" (Barends *et al.*, 2014).

On the other hand, arguments against EBMgt have typically taken a social constructivist orientation (Martelli, 2012), and have eschewed existing definitions on theoretical and practical grounds. Authors from this position write that, "despite claims to be scientific and impartial, EBMgt is managerialist: i.e., it is for management not about management"

(Morrell and Learmonth, 2015; see also, Arndt and Bigelow, 2009; Mowles, 2011). In particular, a consistent rebuttal is that EBMgt minimizes the range evidence can take by marginalizing other forms besides research evidence. In this, it "devalues stories or narrative forms of knowledge. Yet […] is itself a story about relations between research and practice, one of many possible stories" (Morrell and Learmonth, 2015).

Recent reviews have called for a pause in theory building and an increase in "the production of high-quality empirical studies in EBMgt" (Rynes and Bartunek, 2017). However, it is difficult to advance the field without implementing EBMgt practices built upon a strong theoretical foundation such that practices are comparable and replicable. It is important to note that EBMgt has a dual nature, both as a suggested method of improving socio-behavioral technologies in the organization, as well as a socio-behavioral technology in itself.

If we are to consider EBMgt "a simple idea […] [that] means finding the best evidence that you can, facing those facts, and acting on those facts" (Pfeffer and Sutton, 2006), then it is important to consider, within the management context, what counts as evidence, what its purpose is, and how it fits into the decision-making process.

The aim of this paper is to reimagine EBMgt in a way that is sensitive to both the aspirations and limitations of the project. In Section 2, it reviews the similarities and differences between Evidence-based Medicine and EBMgt, highlighting the unique features of healthcare organizations' contexts. In challenging the realist core of the "best available evidence," Section 3.1 stresses the social aspects of evidence, describing EBMgt as a social technology. Section 3.2 discusses availability in terms of literal availability of sources and cognitive availability. "Bestness" is then operationalized as "hierarchical ranking" and "fit between situation and evidence" in Section 4, with both operationalizations falling short when uncertainty abounds. The third operationalization, in Section 5, suggests that employing a variety of knowledge types is a preferable approach in healthcare because it increases organizational regulation states, shapes interpersonal knowledge structures, and directs organizational attention.

This general review paper derives from a multi-stage and multidisciplinary literature review conducted over several research projects, including the authors' dissertation and thesis work and associated research studies funded by Agency for Healthcare Research and Quality, the Gordon and Betty Moore Foundation, and the National Science Foundation. Thus, the literature presented here comes not from a single review methodology, but from a series of reviews over a decade, feedback in multiple professional venues, and conversations with prominent scholars in the field.

2. EBMgt for performance improvement in healthcare

The earliest formulations of EBMgt were based on the design of its forerunner concept, evidence-based medicine. These models favored the increased use of research literature as the main function of the process, arguing not only that the evidence being used is sub-optimal, but also implicitly that much of it is simply not evidence. However, just as healthcare management is not the provision of healthcare, EBMgt in healthcare is not evidence-based medicine. As Walshe and Rundall (2001) note:

> Overall, the tightly defined, well-organized, highly quantitative, and relatively generalizable research base for many clinical professions provides a strong and secure foundation for evidence-based practice and lends itself to a systematic process of review and synthesis and to the production of guidelines and protocols. In contrast, the loosely defined, methodologically heterogeneous, widely distributed, and hard-to-generalize research base for healthcare management is much more difficult to use in the same way.

On one hand, Pfeffer and Sutton (2006), argue that "managers (like doctors) can practice their craft more effectively if they are routinely guided by the best logic and evidence."

On the other hand, Learmonth and Harding (2006) argue: nevertheless, "the basic doctrine of EBMgt remains one appropriated from evidence-based healthcare: that a consideration of evidence will increase the rationality and thus the effectiveness of managers' decisions."

The pursuit of improvement in healthcare provides a perfect setting to explore the concerns above. First, there is "plenty of evidence that a research practice gap also exists in healthcare policy and management" (Walshe and Rundall, 2001). Second, healthcare represents a form of complex service organization in which uncertainty is present (Plsek and Greenhalgh, 2001), and failure is never desired, though highly likely (Edmondson, 2010). Third, health services and hospitals compose a knowledge-intensive, knowledge-centered industry, in which speed of change and expertise play critical roles (Brint, 2001). Fourth, in the delivery of healthcare, "complexity is reflected in the number, variety, and fragmentation of producers involved," including mutually interactive, dynamic and non-linear relationships between system parts (Begun *et al.*, 2003). Moreover, decision making in this domain is "quasi-scientific, in a particular sense: competent decision making requires scientific knowledge, but scientific knowledge is not sufficient to make decisions" (Turner, 2004). Finally, while medicine operates in an "environment of fairly high validity," where validity refers to the stability of relationships between "objectively identifiable cues and subsequent events or between cues and the outcomes of possible actions," (Kahneman and Klein, 2009), the management of healthcare, like management in general, is more likely operating in a low validity environment.

The discussion below presents an argument generic in nature, though particularly amenable to strategic improvement initiatives. As such, the target audience is healthcare administrators responsible for strategic or high-level operational decisions related to the restructuring, positioning, prioritizing, and financing of care delivery. Improvement in healthcare requires contending with highly differentiated yet highly reciprocal tasks in a setting where "physicians align with technical expertise, nurses with reliability and safety, and health administrators with efficiency," and "while health administrators may advocate for organizational change, they typically do not have real administrative authority over health professionals" (Garman *et al.*, 2006).

With these factors in mind, this paper elaborates on the nature of EBMgt as a social technology and offers three perspectives on its operationalization.

3. What is the "best available evidence?"

Embedded in the definition of EBMgt is the implication that the "best available evidence" should be marshaled in management decision making. Table I presents several accepted definitions that highlight the importance of this concept. Though the breadth of application changes over time, the underlying intention of "bestness" remains. For this reason, it is useful to briefly overview what is meant by each of these three terms, and the consequences of framing decision making accordingly.

3.1 Evidence is social, EBMgt is a social technology

Evidence is "ground for belief; testimony or facts tending to prove or disprove any conclusion" (Oxford English Dictionary 2nd ed., 1989). That observation is theory-laden is sufficient to show that individual knowledge is distinct from objectively true facts or information about entities in the world (Kuhn, 1962). This distinction magnifies in a social context, where the shared perspectives, standards, and goals of a community influence the status of knowledge claims. Evidence is context specific and relational; tied to a particular stance, perspective, or intention; and is compiled in support of a particular end. Whereas knowledge can exist free-form, evidence can only exist as a package of knowledge directed towards a goal. For organizations, this means that evidence is wrapped up in context, shared meaning, and interpersonal goal reconciliation.

Source	Definition
Kovner *et al.* (2000)	[T]he conscientious, explicit, and judicious use of current *best reasoning and experience* in making decisions about strategic interventions
Kovner and Rundall (2006)	The systematic application of the *best available evidence* to the evaluation of managerial strategies for improving the performance of organizations
Rousseau (2006)	[EBMgt] means translating research principles based on *best evidence* into organizational practice
Pfeffer and Sutton (2006)	[EBMgt] is a commitment to finding and using the *best theory and data available* at the time to make decisions
Briner *et al.* (2009)	EBMgt is about making decisions through the conscientious, explicit, and judicious use of four sources of information: practitioner expertise and judgment, evidence from the local context, a critical evaluation of the *best available research evidence*, and the perspectives of those people who might be affected by the decision
Rynes *et al.* (2014)	[EBMgt] is about making decisions through the conscientious, explicit, and judicious use of the *best available evidence* from multiple sources to help managers choose effective ways to manage people and structure organizations
Barends *et al.* (2014)	Evidence-based practice in management is about making decisions through the conscientious, explicit, and judicious use of *the best available evidence* from multiple sources by asking, acquiring, appraising, aggregating, applying and assessing

Table I.
Common definitions of EBMgt

Kuhn (1962) underscored the importance of shared meaning by proposing the common values (i.e. empirical accuracy, consistency, broad scope, simplicity, and fruitfulness) by which individuals can discuss and reconcile different scientific paradigms. Referring especially to evidence-based practice, Donaldson (2009) proposes relevance, coherence, verisimilitude, justifiability, and contextuality as the common values which govern the use of evidence in organizations. Likewise, Baba and HakemZadeh (2012) propose that "the best evidence needs to be evaluated against methodological fit, contextualization, transparency, replicability, and consensus." Like most social propositions, the dimensions of value in evidence are often in tension - for example, Keller (2009) suggests that features of salience, credibility, and legitimacy are interconnected such that procedures developing one tend to undermine another. In sum, rhetoric plays a large role in persuading individuals to switch gestalts between positions using an evidence-based process.

This paper suggests that EBMgt is not merely a tool or process, but a social technology inextricably embedded in personal and organizational values and culture. As such, EBMgt is not a value neutral tool to be used by technocratic managers, but is "situated in culture and embedded in history" (Jasanoff, 2012) with actors making decisions in social contexts involving power dynamics. For instance, Arndt and Bigelow (2009) elaborate on the consideration of evidence in healthcare contexts by noting that "'Best evidence,' in turn, is an artifact of the social processes that lead to its creation, reflecting researchers' or organizations' interests in the selection of topics, what questions to ask, and what sources of information to legitimate." Regulation of epistemic uncertainty in an organizational management context depends on social perception, and complex environments alter the structure of decision making, since "the environment in which decisions are made is key, not simply […] as a setting but as an embedded entity which forms both 'substance' and 'arena' for the strategic actors" (Gore *et al.*, 2006). In socio-cultural systems, mental models are formed interpersonally, and form the regulatory mechanisms by which organizations discriminate, act upon, and respond to uncertainty in the environment.

Barends *et al.* (2014) propose that evidence-based practitioners ask, acquire, appraise, aggregate, apply, and assess four unique sources of evidence: scientific, organizational, experiential, and stakeholder. In that same order, such sources deal with published research findings, data from the organization, tacit knowledge from professional experience, and the

values and concerns of stakeholders "who may be affected by an organization's decisions and their consequences." This model is concerned with how stakeholders "tend to react to the possible consequences of the organization's decisions," imagined as a tool that provides a "frame of reference." An appreciation of EBMgt as a social technology, however, demands that one envision factors like culture and values as inextricable parts of the social context enveloping how decisions are formulated, acted upon, and received. Such factors should not be divorced from other sources of evidence, and should be interpreted reflexively. Managers in healthcare should realize the variance of "ideas and experiences and engage in dialogue that is critical, open, and questioning" (Cunliffe and Jun, 2005) within their social realities, being careful to not "ignore the situated nature of that experience and the cultural, historical, and linguistic traditions that permeate [their] work" (Cunliffe, 2003). Just as "the skilled clinician does not first collect and deploy evidence and then soften it up with narrative" (Charon and Wyer, 2008), so should managers in healthcare vigilantly remain reflexive to the conditions surrounding a decision and their own role in specifying them.

To that end, this paper argues a decision-making approach more in the tradition of the rational decision logic of appropriateness, which is concerned with ambiguity and attention, than the rational decision logic of consequences, which privileges intentionality and bounded rationality (Frederickson and Smith, 2003). The logic of appropriateness emphasizes that "behavior in a specific situation is said to follow from the rules that govern the appropriate course of action for a given role or identity" (Balsiger, 2016). In healthcare particularly, shared values and norms within professions play a compelling role in establishing and maintaining the assumptions underlying otherwise rational justifications. Keeping in mind this complex climate of healthcare and the social nature of evidence embedded in it, it is important to discuss how the availability of such evidence is imagined with respect to decision making.

3.2 Availability takes two forms

Using the best evidence implies that it is available to the decision-maker at the time of the decision. Available can be interpreted in two ways. Evidence is transmitted through sources, yet sometimes these sources are literally unavailable to them in time for a decision. Implementation research has documented various common technical barriers and facilitators to compiling evidence, such as the cost of journals and difficult technological interfaces (Rundall *et al.*, 2009). These are important, but comparatively simple issues to address. Available can also refer to what can be comprehended by the decision-maker or organization – a sort of cognitive availability. Individuals modeling their worlds under certain assumptions may not be able to conceive of competing knowledge claims and may reject evidence as rhetorically unpersuasive. Models of decision choice under uncertainty are subject to the incompleteness hypothesis, which asserts that "because [a decision] model fails to capture all relevant aspects of the problem, it will yield inaccurate estimates of the expected benefits of any given course of action" (Quiggin, 2004).

Likewise, organizations have limited attention available to search and process evidence, where attention is defined as the "noticing, encoding, interpreting, and focusing of time and effort by organizational decision makers on both (a) issues […] and (b) answers" (Ocasio, 1997). Firms faced with "too much data and not enough information," compel organizational decision makers to "oversimplify to deal with overload" (Matheson and Matheson, 1998). The focus of attention is important for discovery, innovation, and strategic action. For instance, both the total number of sources, and the number of sources across several knowledge types used exhibit an inverted-U shaped relationship with corporate innovation (Laursen and Salter, 2006) – search breadth alone itself doesn't yield more robust attention. Organizations may also have influential individuals or sub-systems that attend to certain types of evidence more than others, leading the organization, through socio-behavioral

drivers, to privilege that evidence in rhetorical justification to the exclusion of others. In this case, the evidence similarly becomes unavailable to decision makers.

Uncertainty, and how an individual, or a community of individuals, comes to know the unknown remain the motivating issues. On this, Rousseau (2016) commented in an online group discussion on EBMgt: "I would bet (really) that [EBMgt] practice will lead to greater diversity of decision processes as practitioners come to recognize the degree of uncertainty that actually exists in management decisions. Thus I would expect differences in processes used to deal with low uncertainty decisions vs high uncertainty decisions and whatever is in between." Understanding how such processes vary depends on how "bestness," in addition to availability, is interpreted, and how the dynamics of each conceptualization affects practice.

4. Best as rank or fit
As a thought experiment, assume that a "best" set of evidence for a decision existed. How would you know what is was? How would you compile it?

Two immediate interpretations come to mind. First, consider an interpretation which evaluates "bestness" according to a hierarchy of evidence. This ranking perspective would imply that a certain type of evidence, or perhaps evidence generated by certain processes, will rank higher or lower in its capacity to support truth claims.

Best has traditionally been established with an underlying assumption of logos (i.e. an appeal to the strength and consistency in logical argument), with the "best" evidence meeting the epidemiological standard of the randomized controlled trial (RCT). However, where evidence is better, it is also worse. In evidence-based medicine, virtually all institutional reviewers of evidence (i.e. USPSTF, ICSI, SORT, GRADE, Oxford Center) grade expert assessment as the lowest strength of evidence. The problem with this characterization in socio-behavioral settings is twofold.

First, consider the example of a "parachute approach to evidence-based medicine" (Potts *et al.*, 2006), referring to an earlier tongue-in-cheek article calling for an RCT to establish definitively whether parachute use prevents trauma due to "gravitational challenge." This view advocates making policy decisions on "good science" even when RCTs are unavailable. In health research, circumspection about the RCT has manifested as the "real-world evidence" (RWE) movement, which promotes evidence gathered "in clinical care and home or community settings as opposed to research intensive or academic environments" (Sherman *et al.*, 2016). Potential sources of data expand to claims data, disease registries and health-monitoring devices (FDA, 2018). Yet, using only codified sources of evidence assumes they can act as substitutes for non-codifiable types of knowledge in the rhetoric of decision making. Moreover, the strength of evidence is one of many considerations including the fiscal and sociopolitical climate within which governments, institutions and communities operate (Tang *et al.*, 2003).

Second, evidence derives its potency from the knowledge it represents, and knowledge is theory-laden and embedded in the language and rhetoric of a given paradigm of inquiry (Kuhn, 1962). The ranking approach privileges experimentally collected, codifiable, and quantifiable knowledge about causal efficacy. Yet, knowledge takes various forms ranging from the nature of relationships between variables to a pragmatic understanding about implementation, and can be categorized along several useful dimensions such as publicness, tacitness and codifiability. Researchers have characterized a larger typology of knowledge types important to the EBMgt process, which include knowledge about the relationships between values and policy directions (i.e. know why) and knowledge about how to build and engage alliances for action (i.e. know who) (Ekblom, 2002; Nutley *et al.*, 2003; Gasson, 2005).

Probably the best known of these knowledge types is the individual, tacit, and qualitative form of "know-how" (namely. expertise), which draws on Polanyi's (1962)

explication of tacit knowledge. In the case of experts, classifying their guidance as "low quality" is misclassifying the role that they play in decision making. Experts are often expected to engage in prediction – yet research suggests that experts are no better than non-experts in prediction and making judgments outside of their domain, as evidenced by their poor long-term forecasting (Tetlock, 2017) and "fractionated expertise" (Kahneman and Klein, 2009). Instead, experts play a crucial role in decision making by providing "valuable and reliable information on the state of the knowledge in their field, how to solve problems, and on the certainty of their answers" (Meyer and Booker, 2001). This tacit, background knowledge also "allows individuals to limit the factors which they consider to be important in a decision," to systematically structure them, and to discriminate among information (Bennett, 1998). Experts also use "fast and frugal" heuristics to process information (Gigerenzer and Goldstein, 1996), and are able to define a problem space and focus attention to its features (Chisholm, 1995), reducing the parameters considered in problem formulation.

Proponents of a realist EBMgt platform offer a twofold response, thereby settling the debate about "bestness" as rank alone. First, call the process not evidence-based, but evidence-informed, to reinforce that decision makers must incorporate judgement. Second, forego a strict ranking perspective, widening the notion of evidence to incorporate a portfolio. For instance, a given portfolio might consist of "four sources of information: practitioner expertise and judgment, evidence from the local context, a critical evaluation of the best available research evidence, and the perspectives of those people who might be affected by the decision" (Briner *et al.*, 2009).

The portfolio is an excellent insight into the problem, but seems to be incomplete in terms of what is "best." Increasing the amount of evidence within a given type leaves "the disturbing possibility that when people experience uncertainty and gather information to reduce it, this often backfires, and uncertainty increases" (Dörner, 1996, quoted in Weick, 2001). In other words, more information is not always better – a knowledge regulation structure is necessary to control epistemic uncertainty.

Second, consider an interpretation which evaluates "bestness" according to the exactness of fit between a situation at a point in time and the evidence compiled for that situation. This contingency perspective would imply that the true conditions associated with decision making, such as the "congruence between properties of knowledge, properties of units, and properties of relationships between units" (Argote *et al.*, 2003) are known with enough certainty.

Researchers associated with the Research Unit on Research Utilization at the University of St Andrews have modeled the problem in such a way (see e.g. Nutley *et al.*, 2007). In this framework, studies of organizational implementation successes and failures are aggregated by disciplinary application to suggest combinations of organizational, individual, evidentiary, source, and search factors that promote high performance. Although reasonable under stable conditions, this approach becomes problematic under more turbulent conditions. Consider that finding the right evidence to support actions given a contingency of multiple social factors depends on knowing what those factors are, and whether and when they are permanent or changing features. When epistemic uncertainty is the highest, the organization is least likely to be able to determine and adequately manage at least some of the necessary factors of contingency.

From what is known about the role of evidence in decision making, the conditions to specify fit are extensive, including, at a minimum, the characteristics of:

- the evidence itself, including its ability to represent and control aspects of the world and its stickiness/transferability in an organizational context;
- the evidence source, with special emphasis on legitimacy, status and network position;
- the organizational search routines and procedures related to evidence search and incorporation;

- the decision at hand, especially whether focused on discovery (e.g. strategy/innovation/non-routine) or justification (e.g. operational/routine);

- the decision makers, including their professional affiliation and dispositional factors (e.g. integrative complexity);

- the organization's capability to translate evidence into action, such as culture, formal structure, and absorptive capacity; and

- the severity of the outcome errors that might accrue after an EBMgt process, particularly the immediacy and reversibility of results and the interdependence between target organizational or environmental components.

In short, the contingency solution is likely as difficult to specify as the problem itself, and the tension between exploration and exploitation looms.

When the above conditions are clear, the contingency framework could be sufficient, and perhaps even preferable, to produce the best evidence for management. However, for conditions to be clear, the environment of the evidence use should be relatively stable (i.e. low turbulence) and the attendant uncertainty surrounding the decision relatively low. Yet, the often relatively unstable setting of healthcare presents the need for an intricate attention-orienting mechanism that both respects the social nature of evidence and the reflexivity necessary to characterize a decision and its environment.

5. Best as variety

Uncertainty is a special concept which is prone to confusion in common usage, and its character has important consequences for the manner in which an organization registers its potential severity and the strategies to be enacted. In strict logical usage, uncertainty refers to the "absence [or] insufficiency of a certain kind of knowledge," and is distinct from vagueness and inexactness (Mattesich, 1978). Wallsten and Budescu (1995) note that uncertainty takes two forms: it may be "due to external, quantifiable, sources of random variation (aleatory), or to internal sources such as imperfect, or incomplete, information (epistemic)." If the uncertainties affecting organizations are aleatory, then faster, higher quality collection of technical data and more adept statistical analysis are the key features in characterizing solutions. However, if the uncertainty is of an epistemic character, then the absence or insufficiency of particular knowledge, and the nature of knowledge in forming opinion and providing foundation and value are critical features in determining how an organization should represent and respond to environmental threats (Quiggin, 1993).

Improving performance in organizations requires contending with both forms of uncertainty. The promise of the received version of EBMgt appears to largely focus on the reduction of aleatory uncertainty through the accumulation of evidence – an issue roughly akin to Pfeffer and Sutton's (1999) "knowing-doing" gap. In terms of performance improvement, the contingency framework seems most applicable when decisions are relatively algorithmic and programmable.

However, when the conditions are unclear or if the decision makers are unsure whether the conditions are clear, then relying on the contingency specification of EBMgt becomes problematic. The problem is not merely an issue of bounded rationality, but derives from the mathematics of diversity and the epistemological problem of the underspecification of theories by evidence. To the extent that we know what drives performance, "we should select the best collection on the basis of that information […] [however,] if we are not sure of what we're doing, we should err toward greater diversity" (Page, 2011), particularly "on complex tasks that involve multiple dimensions or variables" (Page, 2017). The challenge of identifying which parameters should be incorporated in an EBMgt strategy suggests a different solution. Drawing from the cybernetic tradition, this paper extends a third interpretation of "bestness."

5.1 Insights from the cybernetics movement

Starting in 1942, a series of interdisciplinary meetings between anatomists, psychologists, philosophers and social scientists sought to reconcile insights on how organizations exist in relation to and under the constraints of complex systems (Dupuy, 2000). The field was dubbed cybernetics, deriving from the ancient Greek "Κυβερνήτης" (helmsman), a term related to steering, ruling and government. In addressing the way in which organisms self-regulate in complex environments, the cyberneticists became fascinated with the way in which organizations sense, measure, and respond to the diversity of constraints the environment posed. Drawing on Norbert Weiner's work on how living systems exhibit control functions and Claude Shannon's theorem on disturbance in communication channels, W. Ross Ashby (1956) proposed the law of requisite variety, which posited that only a variety in responses can "destroy" the variety in disturbances. His great insight was to focus on the notion of the variety of states and its consequences to a system's regulation of diverse environmental disturbances. From that insight, it should follow that creating and retaining diversity in knowledge types is a key way of increasing the organizational capacity to recognize relevant patterns of information from the environment.

In the above sections, this paper suggested that making inferences is a social process, and that knowledge, and not evidence or information, should be the focus of EBMgt. Extending such arguments through a requisite variety lens evokes Buckley's (1968/2008) suggestion:

> The concept of requisite deviation needs to be proffered as a high-level principle that can lead us to theorize: a requisite of socio-cultural systems is the development and maintenance of a significant level of non-pathological deviance manifest as a pool of alternate ideas and behaviors with respect to the traditional institutionalized ideologies and role behaviors.

In socio-cultural systems, Buckley (1968/2008) argues that an organization can control external variety by acquiring regulatory features, such as information, that allow it to discriminate, act upon, and respond to its environment. The cybernetic view of an organization interacting with an open, complex environment is predicated on the conceptualization of a social system as a "set of elements linked almost entirely by the intercommunication of information" (Zaltman et al., 1973). A study of general systems by complexity suggests that social systems are distinguished by the fact that "symbol-processing actors who share a common social order organize information from the environment into a knowledge structure" (Anderson, 1999; Boulding, 1956). In socio-cultural systems, subjective knowledge structures are formed interpersonally, and these form the regulatory mechanisms by which organizations discriminate, act upon, and respond to uncertainty in the environment. EBMgt can function as that technology which aims to reduce organizational uncertainty.

The exchange of organizational knowledge requires shared mental models, and the "ability to define relevant knowledge-domains is essential for collaborative sensemaking" (Gasson, 2005). Mental models are collective cognitive representations that range from a distributed configuration of representations with no overlap between individuals, to overlapping representations, to identical representations among individuals (Klimoski and Mohammed, 1994). Maintaining a variety of knowledge types ensures that they are available to decision makers as a "consensually validated grammar for reducing equivocality," where equivocality is defined as "the multiplicity of meanings which can be imposed on a situation" (Weick, 1979). The organizational complexity retained by maintaining a diverse set of regulatory knowledge states can be conceived of as a "solution for a problem yet to be described" (Ahlemeyer, 2001). Cognitive diversity in particular increases perspective taking and "improves outcomes when making predictions and solving problems" (Page, 2017). In other words, the variety of knowledge governs the sense made in sensemaking.

The aim of pursuing variety in EBMgt is not only to ensure that individuals share and reconcile relevant knowledge, but also to prevent the circumstance where regulators (i.e. people) systematically notice and represent problems in the same way. Compiling more evidence does not necessarily imply compiling a wider range of knowledge types. Likewise, compiling evidence across a portfolio does not necessarily imply a balanced distribution of types across the decision makers in the organization. Individuals specialized to focus on one knowledge type devote their attention to perceiving one element of the uncertainty that they apprehend, which, under the logic of appropriateness, creates an organizational attention issue. In the context of reducing epistemic uncertainty, variety assists the organization in balancing the "valuation and legitimization of issues and answers" (Ocasio, 1997) across the knowledge types, reducing the danger of becoming anchored or directing too much attention to a particular framing.

In the healthcare setting, technical evidence (i.e. quantified, codified) displays extraordinary rhetorical power to frame issues and drive decision making. Without dedicated effort, the organization's attention might naturally drift toward these justifications. To prevent this drift, decision makers can ensure the incorporation of other forms of knowledge through processes of collaborative sensemaking. By enforcing the reconciliation of arguments across knowledge types, management can ensure that the technical rhetoric doesn't crowd out relevant knowledge. Under highly routine decisions or given a stable environment, expanding one type of evidence or merely accruing perspective from a given stakeholder may suffice. However, under unclear conditions, the diversity benefits of knowledge can only accrue through argument and discussion across individuals.

Table II presents an illustration of a knowledge typology as applied to a decision to implement a given safety culture intervention in a hospital setting. Note that each knowledge type confers a different perspective on the potential intervention. Consistent with the sociotechnical embeddedness of knowledge in evidence, it is insufficient to slot one source into one type of knowledge; rather each source presents every type of knowledge, and decision makers together ascertain their value.

Category of knowledge	Definition	Example	Incorporating and reconciling
Know about problems	The nature, formulation, natural history and interrelations of social problems	Definition of safety culture and the mechanisms by which it affects communication in groups	Concepts Research definitions and mechanisms
Know why (you might implement a change)	Explaining the relationship between values and policy directions	Symbolic, emotional, ethical and cultural meaning of enacting a safety culture intervention	Stories Explanations of why it is important to change
Know what (has worked)	What policies, strategies or specific interventions have brought about desired outcomes, at acceptable costs and with few enough unwanted consequences	Existing safety culture interventions, such as training sessions, that have produced desired outcomes	Exemplars The things that have worked elsewhere
Know how (to put a change into practice)	Pragmatic knowledge about program implementation	How to practically implement and evaluate an effective safety culture-focused intervention	Skills The know-how to solve problems
Know who (to involve)	Building alliances for action	Internal and external collaborators to advise and support a given safety culture intervention	Networks People who can advise and support

Table II.
Knowledge typology illustration

Notes: Table content developed based on Ekblom (2002), Gasson (2005), Nutley *et al.* (2007) and Martelli (2012)

6. Conclusion

Lack of agreement about the fundamental nature of EBMgt has led to an impasse between proponents who take the endeavor as an inevitable, incremental, and realist approach to decision making and opponents who argue from a constructivist, learning, and power/politics perspective. This impasse prevents an extension of argumentation beyond "use more" vs "watch out." While systematic reviews and empirical barriers remain important, more rigorous research evidence and larger catalogues of contingency factors are themselves insufficient to solve underlying sociopolitical concerns. Likewise, current critiques could benefit from theoretical bridges that not only reinforce learning and sensemaking in real organizations, but also build on the spirit of the project and progress made towards better managerial decision making. This paper proposes a pragmatic framework to move beyond the impasse, refocusing the discussion on variety of knowledge while respecting the meaningful critiques by each side.

By arguing from variety, this paper suggests that the "best available evidence" can be generated by ensuring that a broad range of knowledge types is elicited from and reconciled across individuals. Maintaining knowledge regulation states allows the organization to manage attention and balance the valuation and legitimization from mechanism, implementation, and policy knowledge.

For practitioners, this paper appreciates that organizational "decision-makers generally don't seek evidence, they seek an answer to their question" (Martelli, 2012). As a result, EBMgt can be a disappointingly loose guide for decision makers, because it "does not prescribe the kind of evidence, how to obtain it, or what decisions should be made" (Rundall and Kovner, 2009). Under the best of circumstances, when parameters are known and fixed, finding and applying the "best" evidence is elusive. However, under turbulent or otherwise nebulous conditions, expecting practitioners to well-specify the characteristics of their particular decision process is untenable. Additionally, it highlights the tension inherent in the role of EBMgt in the complex service organizations of healthcare, where the technical decision processes of healthcare management are distinct from technical decision processes governing the delivery of the healthcare product.

The benefits to decision making should accrue when a diverse team reconciles evidence for or against a course of action across each knowledge type. A simple managerial intervention might be to distribute a structured evidence collection form, which would be completed by all attendees prior to an administrative meeting. The form requires each attendee to compile and arrange evidence about a given decision on the agenda within each type (e.g. know what, know why). For example, the CMO and CNO of a hospital each presents evidence for a safety culture intervention, justifying their perspective by reconciling evidence gathered within each of the knowledge types. Where evidence is lacking in a type, attendees could critically examine the reasons for the deficiency; where it is unusually abundant, attendees could consider whether it is confirmatory or deceptive.

This is not duplication; it is a critical way to leverage the power of diversity to reduce epistemic uncertainty by eliciting tacit information, giving voice to individuals and viewpoints that are less precise, technical, or aligned with the powerful, and preventing drift of organizational attention away from weak signals. Potentially, a Chief Evidence Officer could be responsible for supporting the collection and reconciliation of evidence to that end.

For researchers, this paper argues that EBMgt is not merely a managerial tool, but rather a technology "situated in culture and embedded in history" (Jasanoff, 2012). Consequent to the relationship between uncertainty, complexity, and diversity, the "bestness" of evidence is not determined through either rank or fit, but rather through variety. As social systems are open and dynamic, the best evidence is likely to vary as the problems specified and

solutions desired themselves vary. This analysis places EBMgt in the tradition of the cybernetic regulation of social systems and the rational decision logic of appropriateness.

Further research might make better use of existing cognitive diversity measures, such as interpretive ambiguity (Kilduff *et al.*, 2000) and knowledge heterogeneity (Rodan and Galunic, 2004), to examine variety in EBMgt. In this way, it may be possible to explore how an organization's attention is misdirected to one or another type of evidence, leading to potential strategic errors. One such concept is a Type III error, or the probability of resolving at the expense of solving a problem, or of "solving the 'wrong' problem precisely" (Mitroff and Featheringham, 1976). A second is the overadoption of innovation, or the assumption that "to adopt innovations is desirable behavior and to reject innovations is less desirable […] [which] may not be true. Overadoption often results from insufficient knowledge; overadopters perceive the innovation as a panacea" (Rogers, 1962). Overadoption could stem from the implementation of "best practices" without social and contextual knowledge – a process observed in healthcare management (Arndt and Bigelow, 1992; Denis *et al.*, 2002; Kaissi and Begun, 2008).

A critical goal of the EBMgt movement should be to help organizations develop and maintain a common, or at least commonly understood, mental model for strategic decision making. This is especially true with respect to strategic improvement initiatives in healthcare, where prior research has shown the significance of knowledge intermediaries, particularly consulting groups such as The Advisory Board and Sg2, in "compiling evidence, developing alternatives, or managing implementation" (Martelli, 2012). Under a bevy of constraints to assessing contingency factors, organizations adopting these standardized "management bundles" risk falling into overadoption and innovation failures, as the diffusion of surgical checklists attests (e.g. Dixon-Woods *et al.*, 2011). Considering the "best available evidence" as variety offers a promising resolution, both practically and theoretically.

The field of EBMgt has made great strides both in convincing practitioners to use evidence and in tempering that drive with warnings about potential misapplications. Resolving the impasse, rather than repeating it, will require developing new foundations and strategies for the project.

References

Ahlemeyer, H.W. (2001), "Management by complexity: redundancy and variety in organizations", in Geyer, R.F. and van der Zouwen, J. (Eds), *Sociocybernetics*, Greenwood Press, Westport, CT, pp. 59-71.

Anderson, P. (1999), "Complexity theory and organization science", *Organization Science*, Vol. 10 No. 3, pp. 216-232.

Argote, L., McEvily, B. and Reagans, R. (2003), "Managing knowledge in organizations: an integrative framework and review of emerging themes", *Management Science*, Vol. 49 No. 4, pp. 571-582.

Arndt, M. and Bigelow, B. (1992), "Vertical integration in hospitals: a framework for analysis", *Medical Care Review*, Vol. 49 No. 1, pp. 93-115.

Arndt, M. and Bigelow, B. (2009), "Evidence-based management in health care organizations: a cautionary note", *Health Care Management Review*, Vol. 34 No. 3, pp. 206-213.

Ashby, W.R. (1956), *An Introduction to Cybernetics*, Chapman & Hall, London.

Baba, V.V. and HakemZadeh, F. (2012), "Toward a theory of evidence based decision making", *Management Decision*, Vol. 50 No. 5, pp. 832-867.

Balsiger, J. (2016), "Logic of appropriateness", *Encyclopædia Britannica*.

Barends, E., Rousseau, D.M. and Briner, R.B. (2014), "Evidence-based management: the basic principles", Center for Evidence-Based Management, Amsterdam.

Begun, J.W., Zimmerman, B. and Dooley, K. (2003), "Health care organizations as complex adaptive systems", in Mick, S.S. and Wyttenbach, M.E. (Eds), *Advances in Health Care Organization Theory*, Jossey-Bass, San Francisco, CA, pp. 253-288.

Bennett, R.H. III (1998), "The importance of tacit knowledge in strategic deliberations and decisions", *Management Decision*, Vol. 36 No. 9, pp. 589-597.

Boulding, K.E. (1956), "General systems theory: the skeleton of science", *Management Science*, Vol. 2 No. 3, pp. 197-208.

Briner, R.B., Denyer, D. and Rousseau, D.M. (2009), "Evidence-based management: concept cleanup time?", *Academy of Management Perspectives*, Vol. 23 No. 4, pp. 19-32.

Brint, S. (2001), "Professionals and the knowledge economy: rethinking the theory of postindustrial society", *Current Sociology*, Vol. 49 No. 4, pp. 101-132.

Buckley, W. (1968/2008), "Society as a complex adaptive system", *Emergence: Complexity and Organization*, Vol. 10 No. 3, pp. 86-112.

Charon, R. and Wyer, P. (2008), "Narrative evidence based medicine", *The Lancet*, Vol. 371 No. 9609, pp. 296-297.

Chisholm, D. (1995), "Problem solving and institutional design", *Journal of Public Administration Research and Theory*, Vol. 5 No. 4, pp. 451-492.

Cunliffe, A.L. (2003), "Reflexive inquiry in organizational research: questions and possibilities", *Human Relations*, Vol. 56 No. 8, pp. 983-1003.

Cunliffe, A.L. and Jun, J.S. (2005), "The need for reflexivity in public administration", *Administration & Society*, Vol. 37 No. 2, pp. 225-242.

Denis, J.L., Hebert, Y., Langley, A., Lozeau, D. and Trottier, L.H. (2002), "Explaining diffusion patterns for complex health care innovations", *Health Care Management Review*, Vol. 27 No. 3, pp. 60-73.

Dixon-Woods, M., Bosk, C.L., Aveling, E.L., Goeschel, C.A. and Pronovost, P.J. (2011), "Explaining Michigan: developing an ex post theory of a quality improvement program", *Milbank Quarterly*, Vol. 89 No. 2, pp. 167-205.

Donaldson, S.I. (2009), "In search of the blueprint for an evidence-based global society", in Donaldson, S.I., Christie, C.A. and Mark, M.M. (Eds), *What Counts as Credible Evidence in Applied Research and Evaluation Practice?*, Sage Publications, Los Angeles, CA, pp. 2-18.

Dörner, D. (1996), *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations*, Metropolitan Books, New York, NY.

Dupuy, J.-P. (2000), *The Mechanization of the Mind*, Princeton University Press, Princeton, NJ.

Edmondson, A.C. (2010), "Mapping the failure landscape: process deviations, system breakdowns and unsuccessful trials as sources of improvement, problem solving and innovation in teams", paper presented at the 3rd International HRO Conference, New Orleans, LA, January 9–10.

Ekblom, P. (2002), "From the source to the mainstream is uphill: the challenge of transferring knowledge of crime prevention through replication, innovation and anticipation", in Tilley, N. (Ed.), *Analysis for Crime Prevention, Crime Prevention Studies*, Vol. XIII, Criminal Justice Press, Monsey, NY, pp. 131-203.

Food & Drug Administration (2018), "Real world evidence", available at: www.fda.gov/ScienceResearch/SpecialTopics/RealWorldEvidence/default.htm (accessed February 25, 2018).

Frederickson, H.G. and Smith, K.B. (2003), *The Public Administration Theory Primer*, Westview Press, Boulder, CO.

Garman, A.N., Leach, D.C. and Spector, N. (2006), "Worldviews in collision: conflict and collaboration across professional lines", *Journal of Organizational Behavior*, Vol. 27 No. 7, pp. 829-849.

Gasson, S. (2005), "The dynamics of sensemaking, knowledge, and expertise in collaborative, boundary-spanning design", *Journal of Computer-Mediated Communication*, Vol. 10 No. 4, available at: https://academic.oup.com/jcmc/article/10/4/JCMC1049/4614479#

Gigerenzer, G. and Goldstein, D.G. (1996), "Reasoning the fast and frugal way: models of bounded rationality", *Psychological Review*, Vol. 103 No. 4, pp. 650-669.

Gore, J., Banks, A., Millward, L. and Kyriakidou, O. (2006), "Naturalistic decision making and organizations: reviewing pragmatic science", *Organization Studies*, Vol. 27 No. 7, pp. 925-942.

Jasanoff, S. (2012), "Genealogies of STS", *Social Studies of Science*, Vol. 43 No. 3, pp. 435-441.

Kahneman, D. and Klein, G. (2009), "Conditions for intuitive expertise: a failure to disagree", *American Psychologist*, Vol. 64 No. 6, pp. 515-526.

Kaissi, A.A. and Begun, J.W. (2008), "Fads, fashions, and bandwagons in healthcare strategy", *Health Care Management Review*, Vol. 33 No. 2, pp. 94-102.

Keller, A.C. (2009), "Credibility and relevance in environmental policy: measuring strategies and performance among science assessment organizations", *Journal of Public Administration Research and Theory*, Vol. 20 No. 2, pp. 357-386.

Kilduff, M., Angelmar, R. and Mehra, A. (2000), "Top management team diversity and firm performance: examining the role of cognitions", *Organization Science*, Vol. 11 No. 1, pp. 21-34.

Klimoski, R. and Mohammed, S. (1994), "Team mental model: construct or metaphor?", *Journal of Management*, Vol. 20 No. 2, pp. 403-437.

Kovner, A.R. and Rundall, T.G. (2006), "Evidence-based management reconsidered", *Frontiers of Health Services Management*, Vol. 22 No. 3, pp. 3-22.

Kovner, A.R., Elton, J.J. and Billings, J. (2000), "Evidence-based management", *Frontiers of Health Services Management*, Vol. 16 No. 4, pp. 3-24.

Kuhn, T. (1962), *The Structure of Scientific Revolutions*, Chicago University Press, Chicago, IL.

Laursen, K. and Salter, A. (2006), "Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms", *Strategic Management Journal*, Vol. 27 No. 2, pp. 131-150.

Learmonth, M. and Harding, N. (2006), "Evidence-based management: the very idea", *Public Administration*, Vol. 84 No. 2, pp. 245-266.

Mankelwicz, J. and Kitahara, R. (2008), "Propositions to guide evidence-based decision-making", *Journal of Business Economics & Research*, Vol. 6 No. 10, pp. 41-56.

Martelli, P.F. (2012), *An Argument for Knowledge Variety in Evidence-Based Management*, University of California Berkeley, Berkeley, CA.

Matheson, D. and Matheson, J. (1998), *The Smart Organization*, HBS Press, Cambridge, MA.

Mattesich, R. (1978), *Instrumental Reasoning and Systems Methodology*, Reidel Publishing, Boston, MA.

Meyer, M.A. and Booker, J.M. (2001), *Eliciting and Analyzing Expert Judgment*, Society for Industrial Mathematics, Philadelphia, PA.

Mitroff, I.I. and Featheringham, T.R. (1976), "Towards a behavioral theory of systemic hypothesis-testing and the error of the third kind", *Theory and Decision*, Vol. 7 No. 3, pp. 205-220.

Morrell, K. and Learmonth, M. (2015), "Against evidence-based management, for management learning", *Academy of Management Learning & Education*, Vol. 14 No. 4, pp. 520-533.

Mowles, C. (2011), *Rethinking Management: Radical Insights from the Complexity Sciences*, Gower Press, Burlington, VT, pp. 17-20.

Nutley, S.M., Walter, I. and Davies, H.T.O. (2003), "From knowing to doing: a framework for understanding the evidence-into-practice agenda", *Evaluation*, Vol. 9 No. 2, pp. 125-148.

Nutley, S.M., Walter, I. and Davies, H.T.O. (2007), *Using Evidence: How Research Can Inform Public Services*, The Policy Press, Bristol.

Ocasio, W. (1997), "Towards an attention-based view of the firm", *Strategic Management Journal*, Vol. 18 No. S1, pp. 187-206.

Oxford English Dictionary (1989), "evidence, n", 2nd ed., available at: www.oed.com/oed2/00079136 (accessed July 18, 2018).

Page, S.E. (2011), *Diversity and Complexity*, Princeton University Press, Princeton, NJ.

Page, S.E. (2017), *The Diversity Bonus*, Princeton University Press, Princeton, NJ.

Pfeffer, J. and Sutton, R.I. (1999), *The Knowing-Doing Gap: How Smart Companies Turn Knowledge Into Action*, HBS Press, Cambridge, MA.

Pfeffer, J. and Sutton, R.I. (2006), "Evidence-based management", *Harvard Business Review*, Vol. 84 No. 1, pp. 62-74.

Plsek, P.E. and Greenhalgh, T. (2001), "The challenge of complexity in health care", *British Medical Journal*, Vol. 323 No. 7314, pp. 625-628.

Polanyi, M. (1962), "Tacit knowing: its bearing on some problems in philosophy", *Reviews of Modern Physics*, Vol. 34 No. 4, pp. 601-616.

Potts, M., Prata, N., Walsh, N. and Grossman, A. (2006), "Parachute approach to evidence based medicine", *British Medical Journal*, Vol. 333 No. 7570, pp. 701-703.

Quiggin, J. (1993), *Generalized Expected Utility Theory: The rank-dependent model*, Kluwer Academic Publishers, Boston, MA.

Quiggin, J. (2004), "The precautionary principle and the theory of choice under uncertainty", working paper, University of Queensland, Brisbane, 11 January.

Rodan, S. and Galunic, D.C. (2004), "More than network structure: how knowledge heterogeneity influences managerial performance and innovativeness", *Strategic Management Journal*, Vol. 25 No. 6, pp. 541-562.

Rogers, E.M. (1962), *Diffusion of Innovations*, Free Press of Glencoe, New York, NY.

Rousseau, D. (2016), "Evidence-based management", available at: https://groups.google.com/forum/#!topic/evidence-based-management/t1G08LUIu7Y (accessed September 10, 2017).

Rousseau, D.M. (2006), "Is there such a thing as 'evidence-based management?'", *Academy of Management Review*, Vol. 31 No. 2, pp. 256-269.

Rundall, T.G. and Kovner, A.R. (2009), "Evidence-based management reconsidered: 18 months later", in Kovner, A.R., Fine, D. and D'Aquila, R. (Eds), *Evidence-based Management in Healthcare*, Health Administration Press, Chicago, IL, pp. 79-82.

Rundall, T.G., Martelli, P.F., McCurdy, R., Graetz, I., Arroyo, L., Neuwirth, E.B., Curtis, P., Schmittdiel, J., Gibson, M. and Hsu, J. (2009), "Using research evidence when making decisions: views of health services managers and policymakers", in Kovner, A., D'Aquila, R. and Fine, D. (Eds), *Evidence-based Management in Healthcare*, Health Administration Press, Chicago, IL, pp. 3-16.

Rynes, S.L. and Bartunek, J.M. (2017), "Evidence-based management: foundations, development, controversies and future", *Annual Review of Organizational Psychology and Organizational Behavior*, Vol. 4 No. 1, pp. 235-261.

Rynes, S.L., Rousseau, D.M. and Barends, E. (2014), "From the guest editors: change the world: teach evidence-based practice!", *Academy of Management Learning & Education*, Vol. 13 No. 3, pp. 305-321.

Sherman, R.E., Anderson, S.A., Dal Pan, G.J., Gray, G.W., Gross, T., Hunter, N.L., LaVange, L., Marinac-Dabic, D., Marks, P.W., Robb, M.A. and Shuren, J. (2016), "Real-world evidence – what is it and what can it tell us", *The New England Journal of Medicine*, Vol. 375 No. 23, pp. 2293-2297.

Tang, K.C., Ehsani, J.P. and McQueen, D.V. (2003), "Evidence-based health promotion: recollections, reflections, and reconsiderations", *Journal of Epidemiology and Community Health*, Vol. 57 No. 11, pp. 841-843.

Tetlock, P.E. (2017), *Expert Political Judgment*, Princeton University Press, Princeton, NJ.

Turner, S. (2004), "Quasi-science and the state", in Stehr, N. (Ed.), *Governing Science in Comparative Perspective*, Transaction Publications, New Brunswick, NJ, pp. 241-268.

Wallsten, T.S. and Budescu, D.V. (1995), "A review of human linguistic probability processing: general principles and empirical evidence", *Knowledge Engineering Review*, Vol. 10 No. 1, pp. 43-62.

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Walshe, K. and Rundall, T.G. (2001), "Evidence-based management: from theory to practice in health care", *Milbank Quarterly*, Vol. 79 No. 3, pp. 429-457.

Weick, K.E. (1979), *The Social Psychology of Organizing*, 2nd ed., Addison-Wesley, Reading, MA.

Weick, K.E. (2001), "Gapping the relevance bridge: fashions meet fundamentals in management research", *British Journal of Management*, Vol. 12 No. S1, pp. S71-S75.

Zaltman, G., Duncan, R. and Holbek, J. (1973), *Innovations and Organizations*, John Wiley & Sons, New York, NY.

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