Application and Development Trend of Evidence-based Research Methods in Research Management

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Abstract: The rise of evidence-based medicine and the development of evidence-based research methods in the field of social science have injected new vitality into the research and practice of traditional research. Evidence-based research management with evidence as the core continuously obtains the best research evidence through information collection, integration, analysis, and evaluation, and promotes the transformation of the empirical, professional, and scientific paradigm of research evaluation, knowledge service, intelligent publishing, scientific communication, and effect evaluation. While guiding scientific decision-making in research management and improving service effectiveness, it is also urgent to achieve the benign development trend of research management through multiple paths such as dynamic use of evidence-based research methods based on various intelligent algorithm technologies, evidence acquisition enabled by emerging technologies, and enhancement of research evidence evaluation skills by "magazine club".

Key words: Evidence-based research methods; Research management; Evidence evaluation; Development trend

"Human rationality is limited, and all decisions are based on the results of finite rationality". With the rise of Evidence-based Medicine (EBM), which supports clinical practice and decision-making based on "prudent, accurate and wise application of the best available research evidence", the trend of research evidence has brought tremendous energy to drive the practice of humanities and social sciences into the fast track of development[1]. Relying on rigorous scientific process and rigorous philosophical logic, it has spawned interdisciplinary disciplines such as evidence-based pedagogy, evidence-based economics, evidence-based management, evidence-based law, evidence-based historiography, evidence-based library management, etc. At the same time, it also guides the expansion of the scope of human rationality with the best evidence, thus boosting the quality of decision-making. Although research management in the context of evidence-based practice has achieved unprecedented acceleration in this development. However, the endless problems such as incomplete evidence, information noise, and data pollution also make evidence-based research management appear to be widespread insufficiency and imbalance. It is urgent to guide scientific decision-making, effective service, and satisfaction improvement based on the application and practice of evidence-based research methods in research management, so as to continuously optimize the future development trend of evidence-based research management.

1. Overview of research methods of evidence-based research management

The transformation of theoretical research has always been a difficult problem in the development of research management. Compared with traditional research, the emergence of evidence-based research methods as well as their application and development in the field of social sciences not only provides a new research paradigm for the research of research management but also stimulates the inexhaustible motivation for the in-depth exploration and wide application of research management.

1.1 Evidence-based research methods

Evidence-based research methods are used in the field of social sciences to profoundly reveal and explain the established regularity and scientific problems through the perfect combination of the research object group wishes, the best evidence, and the research methods, and then guide scientific decision-making and evidence-based practice. Therefore, effectively clarifying the concepts of evidence-based, best evidence, and evidence-based practice involved in the whole life cycle of evidence-based research methods is a prerequisite for evidence-based research and application.

The term "evidence-based medicine" originated from evidence-based medicine, which means "medicine that follows evidence". Its core idea is to systematically combine the best and most appropriate external clinical evidence to integrate various clinical expertise and to guide medical decisions based on objective research results. Specifically, evidence-based medicine provides information explanation and reference for clinical diagnosis and treatment, clinical scientific research, and health decision-making in the form of text and electronic journals by continuously searching for massive and diverse clinical experience data. Therefore, evidence-based means to find the most scientific data and evidence to solve the problem of the service object.

Evidence is the core of evidence-based, but the "evidence" is not simple data or information, but emphasizes the acquisition of decision-making basis through scientific research. That is, according to the idea of stratification of evidence and the need to solve the problem, the knowledge system with different rigor is obtained after summarizing and analyzing the relevant information. With the introduction of the evidence layer and "evidence pyramid", the evidence is drawn up at different levels, such as systematic review or Meta-analysis, randomized controlled trials, cohort studies, other controllable experimental studies, quasi-experimental studies, descriptive studies, single case studies, expert and object opinions, etc. Among them, the highest level of available evidence after rigorous rational analysis is regarded as the Best Available Evidence and helps the service object to solve specific problems, and this practice process is also called evidence-based practice.

Evidence-based practice (Evidence-Based Practice, EBP) refers to the practice that obtains the best research evidence through the collection, integration, and evaluation of evidence while taking into account the value and willingness of service objects and the practice standards established by managers. Successful evidence-based service practices in medicine and health not only highlight the best evidence to help managers make informed decisions but also enable clients to achieve higher quality and better results. Therefore, the infiltration and application of evidence-based practice in the early exploration of medicine and other fields of humanities and social sciences has successfully extended the "following evidence" research paradigm into the "evidence-based" research paradigm, and researchers can find the best evidence to serve managers or formulate practice guidelines according to the classification of evidence.

1.2 Evidence-based research and practice in scientific research management

As an important scientific research institution, how to manage a large number of scientific research information efficiently and safely, so as to make daily scientific research management more standardized and scientific, and establishing a scientific research management system for scientific research management is the only way for every university. Compared with other abstract theoretical research and social science, scientific research management is not only more practical, technical, and applied, but also takes actual needs as the logical starting point, and is in a unique position that is more convenient to manage, search, and evaluate evidence.[2] Therefore, at the beginning of the emergence of evidence-based medicine, scientific research management, which emphasizes the application and improvement of technology and methods, began to explore the potential possibility of introducing and testing evidence-based research methods. The purpose is to apply the rigorously evaluated research results to the practice of scientific research

management and to establish a scientific and efficient scientific research theoretical system on the basis of summarizing the experience of scientific research management.

As a combination of quantitative and qualitative empirical method, evidence-based research and practice will certainly bring a new research perspective and paradigm for scientific research management, and then promote the research and cause of scientific research management to a new stage of great-leap-forward development. The application of evidence-based thinking and methods in scientific research management decision-making is a process of obtaining experimental results by manipulating some variables under the support of theories and hypotheses. Relying on evidence stratification and result evaluation, the scientific evidence obtained by evidence-based methods can be better applied to the practice of scientific research management, which can effectively avoid subjective experience and promote the innovative transformation from traditional research management based on experience to modern research management based on science.[3] It can specifically quantify the manifestation of complex things and their movement processes, enrich the cognitive scope of research subjects and research management workers, and provide guidance and compliance for them to carry out services centered on research management objects. It can effectively ensure the professionalism of research management, optimize the effectiveness of research management theory and practice, and then bridge the gap between research and practice to improve the quality of decision-making.[4] Therefore, evidence-based research management can be defined as the method of "rigorously evaluating the research evidence in the whole process of research management by raising and discovering problems, applying the evidence to daily practice, promoting the career development of research managers, and encouraging managers to conduct high-quality and high-quantity research".[5] "This is a new concept", that is, research managers are required to engage in lifelong learning based on the new evidence-based research paradigm to continuously improve their evidence-based practice skills, so that they can conduct research and identify the best evidence in their relevant work; "This is an action research", that is, the introduction of the new paradigm of evidence-based research and practice provides a decision-making framework for research management, promotes the ability of research managers to improve information research, collaboration and problem solving, and promotes the continuous development of research management in the direction of empirical research and empirical science.

2. Typical application of evidence-based research management methods

Different from the dominant position of speculative research and normative research in traditional research management, the evidence-based method undoubtedly opens up a new perspective of research and practice of research management, that is the evidence-based empirical research paradigm.[6] At present, evidence-based research and practice methods in research management mainly involve journal publication, project management, reference consultation, resource management, information collection, and information retrieval.[7] In particular, with the application of "evidence" in the research and practice of research management and its increasing weight, the evidence-based methods based on the best evidence not only optimize the decision-making of research management but also continuously guide the practice of key modules such as research performance evaluation, publication recommendation, discipline development, and effect evaluation, so as to promote the transformation of research management into substantialization, specialization, and science.

In the terms of research performance evaluation module, the introduction of evidence-based research methods can meet the needs of the development of schools and disciplines as the first priority, rather than excessively pursuing the value of publications themselves. When funds permit, relying on the best evidence theory, based on the majority of

researchers' expertise, professional principles, and school planning, as well as the comprehensiveness of research content, the accuracy of research direction layout, and the timeliness novelty of research materials, to build multiple project recruitment and publication supplement resources channels to meet the complete and personalized research development and selection needs of researchers.[8]

In the terms of publication recommendation module, the introduction of an evidence-based research management method can alleviate the frequent confusion in the traditional publishing mode. Both the traditional experience recommendation and the new technology recommendation are based on the comprehensive analysis and result direction of the original inertia publication, which leads to the malpractice of the lack of macro guidance in the research management system. Therefore, the evidence-based research method is applied to the publication recommendation of research management, design of a classification model based on professional and professional titles, and publishing recommendations for different audience groups. On the one hand, the research management system of each university can combine the professional composition, discipline advantages, training progress, and other factors of the university to carry out highly targeted, personalized, and suitable academic materials and special recommendations of publishing institutions for researchers of different audiences; On the other hand, the research management system of each university can establish and enrich the diversified special publication and recommendation think tanks through inter-school and inter-school exchanges. Such evidence-based practice design in the publication recommendation module can not only shift the attention of audience researchers from massive publications to a small scope that is more effective for their professional development and the promotion of publication success rate but also reduce the confusion of audiences' searching for publishing institutions and improve the overall research publication rate. However, the evidence-based practice of the publication recommendation module is based on the search, comparison, evaluation, and integration of existing publishing institutions and publications by research managers and researchers, which also puts forward new requirements for their learning and research ability. In the process of evidence-based recommendation practice, research managers and researchers need to take the five steps of evidence-based practice as the guiding framework, combined with the specific realities of universities and publishing institutions, to transform experience into more effective research evidence, so as to construct a bridge between theory and practice on the basis of avoiding intuition and blindness. To enrich and improve the evidence elements in the field of publication recommendation with their own action research. And then realize the EBL transformation of publication recommendation.[9]

In terms of the subject development and effect evaluation module, the claims and concepts of evidence-based research methods are highly compatible with this module. The use of evidence-based research management research methods can provide a large number of objective conditions for the development of research disciplines, and then promote the effectiveness of discipline development. First of all, the study of discipline development has a long history and fruitful results, and many rigorously evaluated research results can be used as evidence sources for evidence-based research management practice. Secondly, traditional discipline development and effect evaluation activities are often accompanied by high cost expenditure, and the introduction of evidence-based research management methods can help research managers to find sufficient and credible evidence to determine the necessity of specific discipline development activities, so as to clarify the value and effectiveness of this activity. Thirdly, discipline development can be recognized as effective intervention and intervention behavior in the characteristics and prospects of the discipline. With the help of evidence collection, screening, and evaluation, it can effectively define the positive intervention factors (such as stimulating research interest) and negative intervention factors (such as inhibition of research interest) in discipline development activities, and promote the choice of the optimal path of development practice through evidence evaluation and effect

evaluation. In order to give new value to the development of traditional disciplines and constantly change to science, objectivity and practicality.

In addition, with the leapfrog development and application innovation of the research and practice of evidence-based research management, in addition to key modules such as research performance evaluation, publication recommendation, discipline development, and effect evaluation, evidence-based theories and methods are applied to the construction of new liberal arts is in full swing and in the direction of science and specialization.

3. Analysis of the advantages of evidence-based research management methods

EBL combines research with the urgent need to solve practical problems and uses the best available scientific evidence to solve practical problems in research management and assist scientific decision-making. The specific process includes formulating a clearly stated practical question for the professional field, searching for the evidence set required to answer the question in all published and unpublished literature, and systematically evaluating the authenticity and validity of the collected evidence to a more intuitive public expression that is "EBL= available evidence + research management experience + audience needs".[10] Therefore, EBL as a practical research method can guide research management practice by using the best available evidence and pragmatic perspectives derived from research management experience to help scientific decision-making and improve service effectiveness and satisfaction.

3.1 Scientific decision-making

"Science is cognitive, involving accurate observation and clear description, generation of hypothesis, collection, and interpretation of data, and creation of theory"[11]. As a research category, the evidence-based method optimizes the insufficient external validity of traditional empirical research to the maximum extent and improves research validity by collecting, evaluating, and selecting the best evidence. This increases the stability and replicability of social science findings. Therefore, evidence collection, integration, evaluation, and selection are the only ways for the scientific, objective, and practical transformation of situational social problems. It is an important optimization of traditional statistical analysis methods. and also the basic premise to promote the application of social sciences, an important measure to improve the reliability and validity of research, and the basic core of evidence-based research management.

The reason why scientific decision-making needs to be evidence-based is that, from a conceptual point of view, complex social problems often exist in specific situations, and it is difficult to obtain solid and simple evidence support like natural science. For example, research management is often questioned about the extensibility of findings, and the application of evidence-based research methods in the field of research management provides fundamental guidelines for solving this problem. From the perspective of research, evidence-based methods mainly rely on empirical research, supplemented by qualitative research, to avoid the simple subjective experience of research managers and researchers, so as to ensure the scientific research work. From the perspective of methodology, the core methods of evidence-based science, that is, the application of systematic review and meta-analysis, can produce and transform high-quality evidence, and provide support for solving and overcoming the disadvantages of passivity, symbolization, idealization, and stream of consciousness of traditional consultation, decision-making, and governance as far as possible, and then provide a reliable basis for decision-makers based on the actual situation, so as to improve the service quality of research management.

3.2 Service effectiveness

In the information age, with the vigorous development of various digital technology industries, the internet and mobile internet have become the mainstream ways of knowledge dissemination and acquisition, and become the first choice for researchers to acquire knowledge. The essence of evidence-based research management is to organize

information for retrieval to support evidence collection, integration, evaluation, and selection. On the one hand, evidence-based research management seeks the best evidence to support and serve researchers through layers of evidence-based methods, and collaborates in decision-making and practical guidance of research work; On the other hand, the huge demand for evidence acquisition in scientific practice promotes the continuous improvement of information organization and evidence evaluation capabilities of evidence-based research management, and provides more efficient information services to the audience researchers by relying on the best evidence. In other words, research management has a strong practicality and is in a unique position that is very convenient to manage, search, and evaluate evidence. Based on this, evidence-based research management can carry out more efficient scientific practice and research activities through evidence selection and evaluation. The concrete implementation path is as follows: firstly, the problem is proposed and defined, then the literature is searched according to the actual problem, and the alternate evidence is found to match the problem; then the spare evidence is evaluated and tested strictly, and the high-quality evidence is selected according to the correlation of evidence; finally, the high-quality evidence is evaluated and applied to the solution of specific practical problems. Therefore, evidence-based research management can effectively improve the quality of research services, promote the development of traditional experience-based research management to modern science-based research management, and thereby improve the professional research of research management.

3.3 Improve satisfaction

The research objects of research management mainly include research managers, researchers, and project publishing institutions. The introduction of evidence-based research methods can balance the different service needs of the three parties.

On the one hand, research managers can develop an optimal decision-making framework based on the best data selection. First of all, as evidence providers, research managers can participate in the whole process of information collection and evaluation. Secondly, as evidence evaluators, research managers can make a comprehensive assessment of the acquired data and cases. Thirdly, as evidence users, research managers can apply evidence correctly and objectively on the basis of rigorous evaluation, so as to formulate the best decision-making framework. On the other hand, research managers can continuously improve their awareness through lifelong learning. For research managers, it is necessary to constantly learn all kinds of new knowledge for the introduction and use of evidence-based research methods in research management practice. Another example is the need to constantly learn the latest cutting-edge technologies. The continuous iterative upgrading of research management and construction under the support of information, digital, and intelligent technology, as well as the digital service demands of decision-makers and audience researchers, have put forward new requirements for the learning of emerging technologies for research managers. It can be seen that research managers are the link between decision makers and best evidence, audience researchers and project publishers, and play an irreplaceable role in evidence-based research management.

4. Development trend of evidence-based research management methods

Compared with traditional research management, evidence-based research management not only means more scientific and practical decision-making and planning but also means more convenient, more accurate, and more efficient research work and practical revolution. The advantage of the evidence-based research method in the multiple modules of research management also fully proves that the evidence-based research method is the future development trend of research management. With the support and empowerment of various intelligent sciences and technology in the information age, evidence-based research methods will be continuously improved and will also promote the scientific, intelligent, and dynamic transition of research management.

4.1 Dynamic use of evidence-based research methods

Evidence-based research management is "a dynamic way of thinking and research, emphasizing rigorous methodological design, process research norms and the authenticity of research results". And relying on cutting-edge thinking concepts to scientific integration of traditional and modern research management, promote the organic collection of traditional research management, digital research management and compound research management. It broadens the research space of research management, promotes the social function of research management, optimizes the service function of research management, and shows the dynamics, times, and future of the development of research management in a new state[12].

In the process of future research and development, it is necessary to continue to adhere to the concept of dynamic, and continuously optimize the working mechanism of research management and the form of information service for researchers through the acquisition and evaluation of real-time dynamic best evidence. On the one hand, it is necessary to continue to adhere to the dynamic model of evidence-based practice in research management. First of all, research managers need to conduct research, production, and maintenance of valid data. Secondly, research managers need to coordinate the management, evaluation, and standardization of relevant evidence. Thirdly, research managers need to explore, cite evidence, and carry out practice according to actual problems. Finally, the audience researchers actively or passively participate in the practice and enjoy the information services brought by the research managers. In particular, it should be noted that the whole dynamic process of the evidence-based practice model of research management should be a real-time dynamic practice aimed at the different needs of researchers from different audiences, which requires three kinds of interrelated dynamic subjects, namely research institutions, research managers and researchers, to coordinate and communicate according to the different needs of researchers from different audiences. And dynamically search for the best evidence to guide decision-making and practice, so as to provide the best service experience for the audience of researchers. On the other hand, it is necessary to continue to maintain the dynamic formation of evidence. "New information can propose new directions or methods". In the future research and practice of evidence-based research management, it is still necessary to maintain the real-time and effective supplement and update of evidence database. Because any effective evidence acquisition can not be completed only through a literature interview, description survey, case study, and other work, it is necessary to constantly remove redundant content and supplement new content, so that the whole database is a dynamic and sufficient condition that the data in the database is the latest and best data, which can better assist the decision-making and practice of research institutions, research managers and researchers.

4.2 Evidence acquisition of emerging technology empowerment

At the beginning of the rise of evidence-based medicine, it de-emphasized intuition, unsystematic clinical experience, and pathophysiological principles as the sufficient basis for clinical decision-making, and emphasized the review of clinical research evidence and the application of formal rules of evidence to evaluate clinical literature.[13] With the widening and deepening of the practice and application of evidence-based research methods, higher requirements have been put forward for the collection, collation, analysis, and evaluation of evidence, especially the best evidence. "High-quality evidence should be used as a support point to eventually form an 'evidence chain', and through evidence-based practice, the theoretical research of research management and the practice of resource construction, service, technology application and management decision-making of research management can be more scientific, accurate and effective." Therefore, how to create the best evidence chain in evidence-based research management based on emerging technologies for the practical application of research institutions, research managers and researchers will become the focus and trend of future research.

The most important foundation of the evidence-based research method is that a large amount of accurate information needs to be collected and integrated into the process of establishing a metadata pool and stored in the data resource pool after classification. In the digital era, the data sources under the characteristics of 4V and 5V are diverse and complex, which brings new challenges to the consistency test and reasoning under the traditional evidence-based research, and will also lead to profound changes in the traditional evidence-based practice of finding the best evidence and reliable conclusions based on causality. Emerging technologies such as cloud computing, big data analysis, and intelligent algorithms can comprehensively mine the massive evidence data resource pool and deeply explore the relevance of discrete evidence sets, which can boost the accuracy and effectiveness of evidence-based evidence, and demonstrate with more tangible, measurable, and determined evidence in the process of evidence-based.

4.3 "Magazine Club" to improve the evidence evaluation skills of research managers

The "magazine club" in evidence-based research management refers to an effective way to develop evaluation techniques and propose rigorous evaluation topics, which can improve the ability of research managers to read and identify research problems. For example, libraries in the United Kingdom, Canada, and other countries have gradually adopted the establishment of "magazine clubs" to improve librarians' key evidence evaluation skills to assist in evidence-based research and practical application.[14] Specifically, it is through the establishment of several "magazine clubs" evidence-based research teams to carry out specific evidence-based research and practice. First of all, you need to determine the number of people in each magazine club or discussion group, with 6-8 people as the best choice, and brainstorming activities based on a full discussion of a specific issue. Secondly, it determines the composition of research managers based on their professional background, classifies them according to their different disciplines and functions, and then carries out wide-field, multi-angle and differentiated research on this specific problem in order to find the best literature and evidence. Thirdly, new members are added and included regularly, so that the "Magazine Club" can be constantly updated and adjusted to ensure the diversity, activity, and compatibility of the evidence-based research and practical knowledge composition system of research management. Thus, the construction of the "magazine club" can provide a good opportunity for the lifelong learning and self-adjustment of research managers, and provide a broader space for their career path and career development, so as to promote the cultivation of evidence-based research talents in the field of research management. It can find the best evidence for the research and practice of evidence-based research management to guide scientific decision-making, research direction, and development trends. In addition, the collaboration and common growth among research managers in "Magazine Club" changes the qualitative thinking and working mode of individual research managers, promotes the individual development of research managers, and promotes the orderly development of the overall cause of research management.

5. Conclusion

Information collection management, strict evidence evaluation, and best evidence selection are important processes for evidence-based research and practice in the intelligent age. The evidence-based research management strategy based on the best evidence theory can effectively avoid the subjective assumptions of research managers and researchers to promote the practical development of research management but also can provide a more accurate, efficient, and scientific service experience for the broad researchers, and promote research management to show the knowledge value to the whole society with unprecedented opportunities. However, the application of evidence-based research methods in research management also has some problems, such as short application time, immature development, and many research barriers. It needs to complete its future development trend based on the dynamic use of evidence-based research methods,

evidence acquisition enabled by emerging technologies, and the enhancement of research evidence evaluation skills by the "magazine club", to realize the sound development of research management.

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