Asian Nursing Research 10 (2016) 89–93

Contents lists available at ScienceDirect

Asian Nursing Research

journal homepage: www.asian-nursingresearch.com

Review Article

Synthesizing Quantitative Evidence for Evidence-based Nursing: Systematic Review

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ARTICLE INFO

Article history:
Received 6 May 2016
Accepted 9 May 2016

Keywords:
evidence-based practice
meta-analysis
systematic review

SUMMARY

As evidence-based practice has become an important issue in healthcare settings, the educational needs for knowledge and skills for the generation and utilization of healthcare evidence are increasing. Systematic review (SR), a way of evidence generation, is a synthesis of primary scientific evidence, which summarizes the best evidence on a specific clinical question using a transparent, a priori protocol driven approach. SR methodology requires a critical appraisal of primary studies, data extraction in a reliable and repeatable way, and examination for validity of the results. SRs are considered hierarchically as the highest form of evidence as they are a systematic search, identification, and summarization of the available evidence to answer a focused clinical question with particular attention to the methodological quality of studies or the credibility of opinion and text. The purpose of this paper is to introduce an overview of the fundamental knowledge, principals and processes in SR. The focus of this paper is on SR especially for the synthesis of quantitative data from primary research studies that examines the effectiveness of healthcare interventions. To activate evidence-based nursing care in various healthcare settings, the best and available scientific evidence are essential components. This paper will include some examples to promote understandings.

Introduction

Evidence-based practice (EBP) is an important element in patient safety and quality of healthcare. The landmark report from the Institute of Medicine, *Crossing the Quality Chasm: A New Health System for the 21st Century*, described a healthcare system that is highly disintegrated and lacking care coordination [1]. The Roundtable on Evidence-Based Medicine from the Institute of Medicine has been called to help transform the way evidence on clinical effectiveness is generated and used to improve health and healthcare. Participants have set a goal that, by the year 2020, 90.0% of clinical decisions will be supported by accurate, timely, and up-to-date clinical information, and will reflect the best available evidence [2]. Quickly following these reports, recommendations were made in the *Quality Chasm* series that underscored the centrality of EBP as a solution in redesigning care that is effective and safe [1–3]. The EBP movement was significantly accelerated by these reports, and key recommendations were made, which were (a) to provide services based on scientific knowledge to all who could benefit [1], (b) to educate all healthcare professionals to deliver evidence-based care [3] and (c) to assess effectiveness of clinical services to provide unbiased information about what really works in healthcare [2].

EBP is a problem-solving approach to patient care that incorporates the conscientious use of current best evidence available from well-designed research studies, clinical expertise and assessment. Patient values and preferences are also incorporated within a caring context [4–7]. According to Joanna Briggs Institute (JBI) model of EBP, evidence-based healthcare is a cyclical process. Global healthcare needs, as identified by clinicians or patients/consumers, are addressed through the generation of research evidence that is effective, feasible, appropriate and meaningful to specific populations, cultures and settings. This evidence is collected and the results are appraised, synthesized and transferred to service delivery settings and health professionals who utilize it and evaluate its impact on health outcomes, health systems and professional practice. Therefore, in order to work in and use healthcare systems globally, one should consider evidence generation, different forms of evidence in a formal assessment called a

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http://dx.doi.org/10.1016/j.anr.2016.05.001

systematic review (evidence synthesis), dissemination of information in appropriate, relevant formats to inform health systems, health professionals and consumers (evidence transfer), and effective implementation of evidence and evaluation of its impact on healthcare practice (evidence utilization) [8].

As implementation of EBP has become a core competency among healthcare professional in promoting high-quality, patient-centered healthcare, the need for acquisition of skills in evidence generation and utilization has increased. Several organizations have contributed to the preparation of systematic reviews, including the National Institute of Health and Clinical Excellence in the UK, the Evidence-based Practice Center Program, funded by the Agency for Healthcare Research and Quality in the United States, the JBI, and the International Campbell and Cochrane Collaborations, with the latter being the largest single producer of systematic reviews in healthcare, with more than 5,200 published by the end of 2015 (Cochrane Collaboration). Often, healthcare providers and policy makers are overwhelmed with an unmanageable amount of information, including evidence from healthcare research. There is a need for time, skills and resources to find, appraise and interpret this evidence and to incorporate it into healthcare decisions.

Therefore, the purposes of this paper are to introduce concept and characteristics of SR, and to explain major steps in synthesizing quantitative evidences suggested by the JBI and Cochrane methodology in conducting SR.

Definition and characteristic of SR

SR, which is also called "research synthesis" is an attempt to integrate empirical data for the purpose of uncovering international evidence and producing statements about that evidence to guide decision making. SR requires explicit and exhaustive reporting of the methods used in synthesis [9,10]. The characteristics of SR are (a) protocol-driven process, (b) clearly stated set of objectives with predefined eligibility criteria for studies, (c) explicit and reproducible methodology, (d) systematic search that attempts to identify all studies that would meet the eligibility criteria, (e) assessment of the validity of the findings of the included studies, and (f) systematic presentation, and synthesis, of the characteristics and findings of the included studies [11]. SRs have become the "gold standard" in the synthesis of literature at each evidential level, as they enable rigorous, transparent and replicable analysis of all relevant study results [12]. The most common type of clinical questions for SR is the treatment effectiveness and the synthesis of data from randomized controlled trials in quantitative studies [10]. However, other types of quantitative research such as quasiexperimental, cohort, and cross-sectional studies can be valuable for SR in nursing care.

SRs provide a reliable estimate because they are required to follow strict scientific design based on explicit, prespecified and reproducible methods. They can also provide insights as to where knowledge is lacking which provides guidance for future research [13].

Methodological process for conducting SR

Review title of SR

The title of the SR protocol should be as descriptive as is reasonable and reflect relevant information. If the review aims to examine clinical effectiveness, this should be stated in the title. If specific interventions and/or patient outcomes are to be examined, these should also be included. If possible, the setting and target population should also be stated [14], for example, "A systematic review of the effectiveness of lifestyle interventions for improving bone health in women at high risk of osteoporosis" [15]. This example provides readers with an indication of the population, "women at high risk of osteoporosis", the interventions, "lifestyle interventions", and the outcome of interest, "bone health", as well as the fact that it is a SR. Ensuring the relevant fields of the Population, Intervention, Comparison intervention, Outcomes (PICO) reminder are incorporated in the title assists peer reviewers as well as end users to identify the scope and relevance of the review.

Developing a review question

Sackett et al [7] stated that a good clinical question should have four essential factors: (a) the patient or problem in question; (b) the intervention, test, or exposure of interest; (c) comparison interventions (if relevant); (d) the outcome, or outcomes, of interest. It should be clear, directly focused on the problem at hand, and answerable by searching the medical literature [16]. The clinical question in PICO format aims to clarify its purpose and is used to define the properties of studies to be considered for inclusion in the review. PICO is used to construct a clear and meaningful question when searching for quantitative evidence [17].

Population within a specific setting within a specific time frame should be described in the clinical questions for SR [17]. There are no subgroups or exclusions described, thus all patients meeting the described criteria would be included in the analysis for each outcome. Specific reference to population characteristics, either for inclusion or exclusion should be based on a clear, scientific justification rather than based on unsubstantiated clinical, theoretical or personal reasoning [17].

Interventions of interest are nursing care, treatment, or exposure. The intervention should be described in detail, particularly if it is complicated. Consideration should also be given to whether there is a risk of exposure to the intervention in comparator groups in the included primary studies [17].

Comparison is being made with the intervention of interest. For JBI reviews of effectiveness, the comparator is the one element of the PICO mnemonic that can be either left out of the questions, or posited as a generalized statement. SR of effectiveness based on the inclusive definition of evidence adopted by JBI often seeks to answer broader questions about complex interventions [17]. Usually there are active and passive comparators. Active comparators are specific comparators of one's interest. For example, if one is interested in comparing clinical effectiveness of different types of exercise such as aerobic exercise versus nonaerobic exercise in metabolic syndrome, the nonaerobic exercise group can be an active comparator. Otherwise, passive comparator is a current status or placebo comparator. For example, if one is interested in knowing the effectiveness of exercise, the types of passive comparator can be a group with no exercise or maintaining usual daily activities of life.

Outcomes are the measures of effectiveness of the intervention. The protocol should list all the outcome measures presented in the study. The relevance of each outcome to the review objective should be apparent from the background section. Outcomes should be measurable and appropriate to the objective of the SR. It is useful to list outcomes and identify them as primary or secondary, short-term or absolute and discuss which ones will be included. It is also important to consider and include nursing outcomes for both clients' perspectives such as functional status and/or quality of life, and those of the nursing professionals such as nurses' satisfaction.

Developing a search strategy: a guide to evidence-based information retrieval

After formulating the clinical question with the format of PICO, the next step is to search for the relevant evidence that will help