

Measuring Knowledge Utilization in Health Care*

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Abstract

In this paper we address the need for methodological advances in the research utilization field focusing on the area of measurement. Unresolved measurement challenges present an important and practical problem. An inability to adequately measure research utilization calls into question studies that claim to demonstrate either its causes or its effects. In this paper we: (1) briefly review the concept of research utilization and its meanings, (2) review the requirements of good measurement instruments, (3) review existing research utilization instruments in nursing (the field with which we are most familiar), and (4) discuss implications and future requirements for scholarship in this field.

Key words: research utilization, measurement, good measurement instruments, nursing

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1. Introduction

A significant attribute of the post-modern world is the reliance on science and research-based knowledge. In an economy increasingly viewed as knowledge based, knowledge is seen as an important social and organizational asset (Blackler, 1995; Brown and Duguid, 1991; David and Foray, 2002; Nahapiet and Ghoshal, 1998). Explaining knowledge use becomes a central question of contemporary scholars from a variety of disciplines.

The tradition of knowledge utilization¹ and related research in the health sciences is among recent efforts to root policy and practice decisions in science. The evidence-based medicine movement (Evidence-Based Medicine Working Group, 1992) emerged in its current form in the early 1990s, although its roots were put down much earlier² and quickly evolved into more general calls for the adoption of an evidence-based decision-making culture at all levels of the health care system (Gray, 1995; Evidence-Based Decision Making Working Group, 1997; National Forum on Health, 1997). In the Canadian context, these efforts eventually contributed to pressures to downsize the welfare state and increase the efficiency and effectiveness of those components that were not eliminated or privatized. Since the creation of the Canadian Health Services Research Foundation in 1997 (<http://www.chsrf.ca/>) and the Canadian Institutes for Health Research in 2000 (<http://www.cihr-irsc.gc.ca/>) the knowledge utilization agenda has accelerated at an ever increasing rate in Canada.

Under the broad umbrella of knowledge utilization, research utilization is related to evidence-based decision-making in the health professions, as well as, to similar concepts in sociology, agriculture and business, such as innovation diffusion (Rogers, 1995). It is also closely connected to the field of evaluation utilization that deals with the performance and outcomes of program evaluation (Johnson, 1998). Knowledge, in our case science, is however not translated to usefulness by itself – complex processes and deliberate efforts are required. We define research utilization as that process by which specific research-

based knowledge (science) is implemented in practice.

Research utilization is commonly assumed to have a positive impact on patient outcomes by assisting with eliminating ineffective practices and implementing more effective procedures (Sackett et al., 1998; Grol, 2000). However, this process is not straightforward. Many studies point to our uncertainty about the effect of medical and nursing research on clinical practice (Bero et al., 1998; Oxman et al., 1995; Estabrooks, 1998; Rycroft-Malone et al., 2002). Over the past three decades investigators in nursing have studied research utilization and proposed several factors thought to influence the uptake of research. However, similar to the literature on evaluation utilization (Johnson, 1998), we find a number of weaknesses in this literature. For example, the identification of factors that influence the research utilization process has not been followed by the development of theoretical models that specify relationships among factors or offer clear guidance for the development of implementation strategies. Of concern to us in *this* paper is the lack of development in the area of measuring research utilization, both generally and in nursing in particular. Whether research utilization is conceived as product (resulting from particular sets of factors) or process (resulting in particular health outcomes) our inability to measure it satisfactorily raises questions about claims of its importance.

Our purpose in this paper is to address the need for methodological advances in the research utilization field focusing on the area of measurement. Unresolved measurement challenges present an important and practical problem. An inability to adequately measure the construct of interest (research utilization) calls into question studies that claim to demonstrate either its causes or its effects. In this paper we: (1) briefly review the concept of research utilization and its meanings, (2) review the requirements of good measurement instruments, (3) review existing research utilization instruments in nursing (the field with which we are most familiar), and (4) discuss implications and future requirements for scholarship in this field.

2. Research Utilization in Health Care

The objective of increasing the use of research in health care is to improve patient outcomes. A society's values and its financial resources constitute obvious and basic elements of a health care system's capacity to meet patient needs. There is evidence to suggest that several additional

¹ Many terms are used in this field, for example, knowledge utilization, knowledge translation, knowledge mobilization, innovation diffusion, etc. While they are often used interchangeably they are not necessarily completely synonymous. In this paper we use the terms knowledge utilization, research utilization and research use.

² At least as early as the publication of the influential Flexner report (Flexner, 1910)

ctors within the health care system effect outcomes. These include health professionals' educational level, organizational climate, leadership, nurse-patient relationships, staff well-being and quality improvement strategies (Shortell, Bennett, and Byck, 1998; Shortell et al., 2000; Aiken et al., 2002; Aiken et al., 2001; Aiken et al., 2003; Arnetz, 1999). We hypothesize that research utilization is one indicator of an optimum practice environment, an environment that leads to improved patient outcomes. The relative importance of that indicator remains to be evaluated, but we believe it is a factor whose importance will be more apparent as the body of research examining it grows.

At the same time that it is relevant to consider research utilization as one of many factors influencing health outcomes it is also important to identify the constituent elements of the research utilization process itself. Evidence-based medicine has been described as having five steps: (1) converting information needs into answerable questions, (2) tracking down the best evidence for answering the questions, (3) critically appraising that evidence, (4) implementing the results of this appraisal in clinical practice, and (5) evaluating care performance (Sackett et al 1998). This general model reflects the commonly accepted ingredients of knowledge utilization as it is generally understood among health care providers. Although it can be challenged on, for example, its assumption of linearity in the change process, the model has evolved to where it is the cornerstone of the evidence-based movement in modern health care. The literature on evidence based care, as well as, research utilization focuses heavily on the critical appraisal phase, with the implementation phase being less well understood. Despite the need for expertise and resources in the appraisal process, we and others argue that the major stumbling block to achieving more research based clinical practice lies in the research *implementation* phase (Bero et al., 1998; Rycroft-Malone et al., 2002; Grimshaw and Russel, 1994; Feder et al., 1999; Thomas et al., 1998). Our knowledge of what constitutes successful research implementation strategies in practice is sparse. In effect, we treat this phase like a *black box* phenomenon where research implementation is viewed as more art than science – when the opposite is most urgently needed.

3. Types of Research Use

Several conceptualizations of research utilization have been proposed. Larsen (Larsen, 1980, p. 424) proposed that knowledge utilization be classified as instrumental and conceptual. Rich (Rich 1975; Rich 1977) and Weiss (Weiss 1979) also discussed these two kinds of knowledge utilization. Symbolic utilization was added by Beyer and Trice (Beyer and Trice 1982). Stetler (1985) introduced instrumental and conceptual use into the nursing literature. Estabrooks (1999b) empirically verified instrumental, conceptual and symbolic research use by nurses.

Instrumental research utilization is that concrete application of research either in making a specific decisions or specific interventions such that the research is translated into a material and useable form (e.g., a protocol or guideline). Instrumental use is a direct type of research use. In *conceptual research utilization*, the research may change one's opinion or mind set about a specific practice area but not necessarily one's particular action. It is a more cognitive application of research and is believed to occur more often in practice than instrumental applications of research. *Symbolic research utilization* is the use of research knowledge as a political tool in order to influence policies and decisions.

Currently, there is no unified theory of research utilization in nursing or elsewhere. Nor are there established competing research utilization theories suited to local contexts. The relative lack of research utilization theory and the failure of investigators to incorporate theory when it is available into instrument construction has hampered development of good research utilization measures. For example, in nursing while there are many *models* of research utilization, among them, CURN (Horsley, Crane, and Bingle, 1978), Goode (Goode et al., 1987) Ottawa (Logan and Graham, 1998), Stetler (Stetler, 1994), NCAST (Nursing Child Assessment Satellite Training) (Barnard and Hoehn, 1978), Horn (Goode and Bulechek, 1992), Iowa (Titler et al., 1994), PARIHS (Kitson, Harvey, and McCormack, 1998; Kitson et al., 1996), when we examined research utilization instruments, we found that they draw either on Roger's (Rogers 1995) work or do not identify a theoretical underpinning

4. Rogers' Innovation Diffusion Theory

Rogers' theory of innovation diffusion is widely used in the nursing

literature as a basis for measuring research utilization. Brett (1987), Winter (1990), Kirchoff (1982) and Lia-Hoagberg et al. (1999) developed instruments based on this work. Rogers' model describes a sequence of five stages an individual undergoes in adopting an innovation. He stipulated that an individual would pass through the stages of awareness, persuasion, decision, implementation, and finally confirmation in the adoption process. According to Rogers (1995), in the awareness stage the individual comes to know about the innovation. In the persuasion stage the individual is either favorably or unfavorably disposed to the innovation. Based on this disposition she engages in activities leading to a choice at the decision stage. The implementation stage follows a decision in favor of the innovation. Implementation involves a change in behavior as the innovation is put into practice. At the confirmation stage the individual reinforces beliefs about the innovation and the decision. Though Roger's model is widely used as a basis for measuring research utilization in nursing, Estabrooks (1998) has previously argued that a drawback in using Roger's model is the untested assumption that the innovation in classical diffusion theory is equivalent to research findings in the context of clinical nursing practice. That is, is innovation as product equivalent to knowledge as product?

5. Measurement Theory

A defensible theoretical basis is foundational to the development of measurement tools and to their validity assessment, providing clarity for the construct being measured. There are many theories available to those undertaking instrument development for psychological and social constructs. Among them, the three most commonly implemented are *classical test score* theory, *item response* theory, and *generalizability* theory. Each theory carries its own set of assumptions upon which the measure is premised. Classical test theory (Hambleton and Jones, 1993; Ellis and Mean, 2002) maintains that every measurement is an additive composite of two components – true ability of the respondent on that construct and random error. Classical test theory forms the foundation of reliability theory. Item response theory (Hambleton, 1991; van der Linden and Hambleton, 1997) is a model-based theory that assumes that a response to item is functionally related to a latent (unobservable) trait, presumably measured by the item. The theory postulates that as an individual's standing on the latent trait increases, the probability of a

correct response increases. This is often used when there is a correct, or more desirable answer. Generalizability theory (Brennan, 1983, 2000; Shavelson and Webb, 1991) is an extension of classical test theory as well as an application of some analysis of variance procedures to measurement models involving multiple error sources. It was designed with the intent to remedy what is often considered a major drawback of classical test theory, the assumption of a single source of random error. Additionally, there are a number of other criteria for good measures with which researchers must come to terms, among them:

Minimal Self-Report and Social Desirability Effects. A reliable and valid measure should be able to capture the intended "truth" about the measurement object. To achieve minimal effects of self-report and social desirability it is necessary that test questions are constructed in such a way that they are minimally "value laden". The instrument should have in-built mechanism to determine levels of social desirability, as well as handling other effects such as acquiescence and a tendency to choose the center of the scale.

Unequivocal Scale. The scale of measurement should not be ambiguous to either respondents and users. The scale should be easily understandable to stakeholders, and the types of inferences made about the results of measurement should be logical and understandable to all.

Acceptability within the research field. The ideal instrument would be reusable and generalizable across settings. The theory of the construct and the way in which the construct is operationalized by the instrument should be widely accepted by the researchers in the field. Ideally, other researchers would adopt the tool so that generalization and cross-study comparison of results across projects would be more compelling

6. Existing Research Utilization Measures

The need to better understand the problems of implementing research triggers requirements for measuring this implementation or *research use*. Most investigations in the area have described characteristics that facilitate research use and modeled these as predictors of research use. In the nursing field several instruments attempting to measure research use have resulted from these efforts.

We created a set of rules for inclusion of studies that narrowed our focus to the *actual use* of research in practice. Articles that reported the use or development of an instrument in which words or phrases such as

"use", "implement", "utilize" or "change practice" were used in conjunction with "research findings" in survey items or questions were included. We identified the papers from a recently published systematic review (Estabrooks et al., 2003) and review of the reference lists of the papers in that review. We also updated this review with a new literature search. We searched CINAHL, Medline, and PubMed using the keywords research utilization, knowledge utilization, evidence-based practice, and evidence-based medicine. Only published literature were included.

<Table 1> is a descriptive summary of existing instruments in the research utilization field in nursing. As it was necessary to restrict the inclusion of articles, we have not included reports on guideline implementation or the use of systematic reviews (Cliska et al., 1999; Dobbins, Cockerill, and Bamsley, 2001; Lia-Hoagberg, Schaffer, and Strömschein, 1999; Wallin et al., 2000).

<Table 1> Measures of Research Utilization*

Citation	Sample Size	Subjects	Framework	Specific RU Measurement	Scoring	Reliability	Validity
Nurse Practice Questionnaire (NPQ) [n=2]							
1. Irem, J. L. 1987. Use of nursing practice research findings. <i>Nursing Research</i> 36(6): 344-349.	216	Registered nurses	Rogers' Theory of Diffusion	NPQ Using Roger's stages of innovation adoption as a guide for 7 questions on 14 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Test-retest = 0.81 Sub-scales $\alpha = 0.68 - 0.95$ Overall $\alpha = 0.95$	Not reported on instrument Appropriateness of the nursing practices described as content validity
2. Irem, J. L. 1989. Organizational integrative mechanisms and adoption of innovations by nurses. <i>Nursing Research</i> 38(2): 105-110.	216	Registered nurses	Rogers' Theory of Diffusion	NPQ Using Roger's stages of innovation adoption as a guide for 7 questions on 14 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Refer to Irem 1987	Refer to Irem 1987
3. Coyle, J. A., & Sokop, A. G. 1990. Innovation adoption behavior among nurses. <i>Nursing Research</i> 39(3): 176-180.	115	Registered nurses	Rogers' Theory of Diffusion (modified)	NPQ Using Roger's stages of innovation adoption as a guide for 7 questions on 14 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Refer to Irem 1987	Refer to Irem 1987
Modified Nurse Practice Questionnaire (NPQ) [n=6]							
4. Datta, K. M. 1995. Information-seeking, research utilization, and barriers to research utilization of pediatric nurse educators. <i>Journal of Professional Nursing</i> 11(1): 49-57.	213	Registered nurses (Pediatric nurse educators)	Rogers' Theory of Diffusion	NPQ (Education) Using Roger's stages of innovation adoption as a guide for 7 questions on 8 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Overall $\alpha = 0.74$	Appropriateness of the nursing practices described as content validity
5. Michel, Y., & Sneed, N. V. 1995. Documentation and use of research findings in nursing practice. <i>Journal of Professional Nursing</i> 11(5): 306-311.	157	Registered nurses	Rogers' Theory of Diffusion	NPQ (modification of practices) Using Roger's stages of innovation adoption as a guide for 7 questions on 5 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Sub-scale $\alpha = 0.73 - 0.84$ Overall $\alpha = 0.85$	Appropriateness of the nursing practices described as content validity
6. Heggren, A. C. 1996. Swedish midwives' awareness of, attitudes to and use of selected research findings. <i>Journal of Advanced Nursing</i> 21: 407-430.	118	Midwives	Rogers' Theory of Diffusion	MidwifeNPQ (MPQ) Using Roger's stages of innovation adoption as a guide for 7 questions on 14 specific midwifery practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Pilot study $\alpha = 0.79$ Sub-scales $\alpha = 0.59 - 0.76$ Overall $\alpha = 0.68$	Appropriateness of the nursing practices described as content validity
7. Rutledge, et al. 1996. Use of Research-Based Practices by Oncology Staff Nurses. <i>Oncology Nursing Forum</i> 23(8): 1235-1244.	1100	Registered nurses	Rogers' Theory of Diffusion	NPQ (modification of practices) Using Roger's stages of innovation adoption as a guide for 7 questions on 8 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Overall $\alpha = 0.75$	Refer to Irem 1997 and Coyle 1990 Appropriateness of the nursing practices described as content validity

* The measurement table contains articles we have found in the research utilization literature with contents relating to research utilization measurement. Articles included in the table are those that report the use or development of instruments in which words or phrases such as "use", "implement", "utilize", or "change practice" are used in conjunction with "research findings" in survey items or questions. About half of the papers describe instruments with multi-item or scales measurement of research utilization, while the other half has single item(s) relating to research use measure. Papers on multi-item instruments are as chronological order, while

Citation	Sample Size	Subjects	Framework	Specific RI Measurement	Scoring	Reliability	Validity
8 Rodgers, S.I. 2000. A study of the utilization of research in practice and the influence of education. <i>Nurse Education Today</i> , 20: 279-287	600	Registered nurses	Rogers' Theory of Diffusion	NPI (modification of practices) Using Roger's stages of innovation adoption as a guide for 7 questions on 14 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Overall $\alpha = 0.63$	Validity by pilot study Validity of self-reports by follow-up interviews
9 Rodgers, S.I. 2000. The extent of nursing research utilization in general medical and surgical wards. <i>Issues and Innovations in Nursing Practice</i> 12(1): 182-193	600	Registered nurses	Rogers' Theory of Diffusion	NPI (modification of practices) Using Roger's stages of innovation adoption as a guide for 7 questions on 14 specific nursing practices	Dichotomous yes/no for most questions and sometimes/always for the question on use	Overall $\alpha = 0.63$	Validity by pilot study Validity of self-reports by follow-up interviews
Research Utilization Questionnaire (RUQ) [n=7]							
10 Champion, V.L. & Leach, A. 1989. Variables related to research utilization in nursing. An empirical investigation. <i>Journal of Advanced Nursing</i> 14: 703-710	99	Registered nurses	Not specified	Four indices of which one measured research utilization, consisting of 10 items. Other indices included attitudes, availability and support	5 pt Likert scale: strongly disagree - strongly agree	Sub-scales $\alpha = 0.84 - 0.94$ Overall $\alpha = 0.92$	Content validity by expert panel
11 Lacey, T.A. 1994. Research utilization in nursing practice—a pilot study. <i>Journal of Advanced Nursing</i> 19(5): 987-995	20	Registered nurses	Not specified	Four indices of which one measured research utilization, consisting of 10 items. Other indices included attitudes, availability and support	5 pt Likert scale: strongly disagree - strongly agree	Not reported	Validity of self-reports assessed by follow-up interviews
12 Hatcher, S., & Tramer, J. 1997. A survey of variables related to research utilization in nursing practice in the acute care setting. <i>Canadian Journal of Nursing Administration</i> Sept/Oct: 31-53	174	Registered nurses, 161, registered practical nurses 13	Not specified	Four indices of which one measured research utilization, consisting of 10 items. Other indices included attitudes, availability and support	5 pt Likert scale: strongly disagree - strongly agree	Refer to Champion & Leach 1989	Not reported
13 Humphrey, D., Hamilton, S., O'Halloran, P., Fisher, S., & Lathaphis, P. 1999. Do diabetes nurse specialists utilize research evidence. <i>Practical Diabetes International</i> 14(2): 47-50	432	Registered nurses	Not specified	Two indices of which one measured research utilization, number of items not specified. Other indices included attitudes, availability and support. Additional item from Pettengill et al 1994 - implementing specific research findings in practice	5 pt Likert scale: strongly disagree - strongly agree Dichotomous outcome yes/no on additional item	Not reported	Not reported
14 Humphrey, D., et al. 2000. Implementing Evidence-Based Practice: Factors that Influence the Use of Research Evidence by Occupational Therapists. <i>British Journal of Occupational Therapy</i> 63(11): 516-22	479	Occupational therapists	Not specified	Four indices of which one measured research utilization, consisting of 8 items. Other indices included attitudes, availability and support. Additional item from Pettengill et al 1994 - implementing specific research findings in practice	5 pt Likert scale: strongly disagree - strongly agree Dichotomous outcome yes/no on additional item	Not reported	Content validity - professional opinion

Citation	Sample Size	Subjects	Framework	Specific RI Measurement	Scoring	Reliability	Validity
15 Tramer, J., Leinhos-Gerlich, J., & Lam, M. 2002. The Effect of Staff Nurse Participation in a Clinical Nursing Research Program: Attitudes Towards, Access to, Support of and Use of Research in the Acute Care Setting. <i>Canadian Journal of Nursing Leadership</i> 15(1): 18-26	190	Registered nurses	Not specified	Four indices of which one measured research utilization, consisting of 10 items. Other indices included attitudes, availability and support	5 pt Likert scale: strongly disagree - strongly agree	Sub-scales $\alpha = 0.85 - 0.94$	Not reported
16 Waller, J., Houston, A.M., Wikblad, K., and Ewald, D. 2001. Sustainability in changing clinical practice: promoters of evidence based nursing care. <i>Journal of Advanced Nursing</i> 41: 509-518	119	Registered nurses	Not specified	Three indices of which one measured research utilization, consisting of 9 items. Other indices included attitudes, availability/support. Additional item from Pettengill et al 1994 - implementing specific research findings in practice	5 pt Likert scale: strongly disagree - strongly agree Dichotomous outcome yes/no on additional item	RI index $\alpha = 0.81$	Not reported
Edmonton Research Orientation Survey (EROS) [n=3]							
17 Pan, K., Hagler, P., & Warren, S. 1996. Development of an Instrument to Evaluate the Research Orientation of Clinical Professionals. <i>Canadian Journal of Rehabilitation</i> 9(2): 93-100	172	All clinical staff	Not specified	Four subscales using research, valuing research, research involvement, being on the leading edge. Ten items in research use sub-scale	5 pt Likert scale: strongly disagree - strongly agree	Overall $\alpha = 0.91$	Construct validity by contrasted groups
18 Wain, M., Magill-Evans, J., & Pan, K. 1997. Alberta Occupational Therapists' Perspectives On and Participation in Research. <i>Canadian Journal of Occupational Therapy</i> 64(2): 82-88	293	Occupational therapists	Not specified	Four subscales using research, valuing research, research involvement, being on the leading edge. Additional sub-scale on barriers to research use was added. Ten items in research use sub-scale	5 pt Likert scale: strongly disagree - strongly agree	Refer to Pan 1996	Refer to Pan 1996
19 McCreary, L., & Brown, G.I. 2002. Research utilization among pediatric health professionals. <i>Nursing and Health Sciences</i> 4: 163-171	281	Nurses and allied health professionals	Not Specified	Four subscales using research, valuing research, research involvement, being on the leading edge. Additional sub-scale on a sense of calling to the field was added. Ten items in research use sub-scale	5 pt Likert scale: strongly disagree - strongly agree	Research use sub-scale $\alpha = 0.81$	Refer to Pan 1996
Other multi-item instruments [n=3]							
20 Petz, D.C., & Horsley, J.A. 1981. Measuring utilization of nursing research. In J.A. Carlo Edlow. <i>Using evaluation: Concepts and measurement techniques</i> (pp. 325-49). Beverly Hills, CA: Sage	12	Registered nurses	Not specified	One index and ten items on direct and indirect use of research	4 pt frequency scale on direct measures, 0-5 times in the past year 5 pt scale on indirect measures from none to complete 5 pt scale from no extent to very great extent	RI index $\alpha = 0.87$	Not reported

Citation	Sample Size	Subjects	Framework	Specific RU Measurement	Scoring	Reliability	Validity
21. Baxster, C.A., et al. 1994. Medical-Surgical Nurses' Utilization of Research Methods and Products. <i>MedSurg Nursing</i> 3(2): 113-141.	212	Registered nurses	Not Specified	Research Utilization Questionnaire (69 items) Five subscales: difficulty, attitudes, use of sources, use of research methods and products, research competencies.	Likert-type scale and dichotomous outcome (agree/disagree)	Pilot tested but details not reported	Not reported
22. Varcoe, C., & Hiltun, A. 1995. Factors affecting acute care nurses' use of research findings. <i>Canadian Journal of Nursing Research</i> 27(4): 51-71.	450	Registered nurses	Unpublished dissertation by Crane 1989	The Research Use in Nursing Practice Instrument (Alosk 1990) 10 general statements on research use and use of 10 specific research practices (from Blich 1987).	General use: 4-point scale (not at all - always) Specific practices: 3-point scale (never-always)	Overall $\alpha = 0.87$	Content validity by pilot testing and peer review
Single Item(s) in Questionnaire (n=19)							
23. Bostrom, J., & Suter, W.N. 1991. Research utilization: Making the link to practice. <i>Journal of Nursing Staff Development</i> 9(1): 28-34.	1588	Registered nurses	Not specified	Item in Research Involvement Survey (RIS) For past (> 6mths ago) and present (most recent 6mths) - use of research findings in clinical practice - made a research based practice change	Dichotomous, probably yes/no	Overall $\alpha = 0.88$	Not reported
24. Brown, D.S. 1997. Nursing education and nursing research utilization: is there a connection in clinical settings? <i>The Journal of Continuing Education in Nursing</i> 28(6): 258-262, 284.	753	Registered nurses	American Nurses Association 1989 Nursing Research model	Item in questionnaire - used research findings for a particular patient's care - used research findings to change practice on their unit	Number of times participated in activity	Not reported	Not reported
25. Butler, J. 1995. Valuing research in clinical practice: a basis for developing a strategic plan for nursing research. <i>Canadian Journal of Nursing Research</i> 27(4): 33-39.	348	Registered nurses	Not specified	Item added to "Research Survey" (Wells & Briggs 1991) on the use of research (in the context of level of research involvement)	Dichotomous, yes/no	Not reported	Not reported
26. Dystart, A.M., & Tomlin, G.S. 2002. Factors related to evidence-based practice among US occupational therapy clinicians. <i>American Journal of Occupational Therapy</i> 56: 275-284.	209	Occupational therapists	Not specified	Item in questionnaire on the frequency of using research information to develop or alter therapeutic treatment plans in the past year	Not stated specifically - indicates frequency of use	Not reported	Not reported
27. Estabrook, C.A. 1998. The Conceptual Structure of Research Utilization. <i>Research in Nursing & Health</i> 22: 203-216.	600	Registered nurses	Not specified	Items in questionnaire: one question each for direct, indirect and persuasive RU - how often have you used research in this way 4 questions on overall use - overall in the past year have you used research in some aspect of your nursing practice	7 pt frequency scale (never - nearly every shift)	Not reported	Content validity by expert panel and pilot study. Construct validity by Structural Equation Modeling $R^2 = 0.79$

Citation	Sample Size	Subjects	Framework	Specific RU Measurement	Scoring	Reliability	Validity
28. Loughton, C., Wanders, D., Hawkins, H., Parker, B., & Peden, A. 1998. Factors related to research utilization by registered nurses in Kentucky. <i>Armed Forces Nurses</i> 14(3): 23-6.	196	Registered nurses	Not Specified	Item in "Registered Nurses' Views of Research" - utilize research findings to change practice at least once a year	Not clearly stated	Not reported	Not reported
29. Nelson, D. 1995. Research into research practice. <i>Accident and Emergency Nursing</i> 3: 184-189.	17	Registered nurses	Not specified	Item in questionnaire on implementation of research based action plan	Not clearly stated	Not reported	Not reported
30. Parahoo, K. 1998. Research utilization and research related activities in Northern Ireland. <i>International Journal of Nursing Studies</i> 35: 283-291.	1368	All grades of hospital nurses (UK)	Not specified	Two items in questionnaire One on indicating the use of research in clinical practice One on implementation of new research findings in own practice in the last two years	5 pt frequency scale (never - all the time) Dichotomous, yes/no	Not reported	Content validity by expert panel and pilot study
31. Parahoo, K. 1999a. A Comparison of pre-Project 2000 and Project 2000 nurses' perceptions of their research training, research needs and of their use of research in clinical areas. <i>Journal of Advanced Nursing</i> 29(1): 237-245.	1368	All grades of hospital nurses (UK)	Not specified	Two items in questionnaire One on indicating the use of research in clinical practice One on implementation of new research findings in own practice in the last two years	5 pt frequency scale (never - all the time) Dichotomous, yes/no	Not reported	Content validity by expert panel and pilot study
32. Parahoo, K. 1999b. Research utilization and attitudes towards research among psychiatric nurses in Northern Ireland. <i>Journal of Psychiatric & Mental Health Nursing</i> 6(2): 125-135.	230	All grades of hospital nurses (UK)	Not specified	Two items in questionnaire One on indicating the use of research in clinical practice One on implementation of new research findings in own practice in the last two years	5 pt frequency scale (never - all the time) Dichotomous, yes/no	Not reported	Content validity by expert panel and pilot study
33. Parahoo, K. 2000. Research utilization and attitudes towards research among learning disability nurses in Northern Ireland. <i>Journal of Advanced Nursing</i> 31(1): 607-13.	87	All grades of hospital nurses (UK)	Not specified	Two items in questionnaire One on indicating the use of research in clinical practice One on implementation of new research findings in own practice in the last two years	5 pt frequency scale (never - all the time) Dichotomous, yes/no	Not reported	Content validity by expert panel and pilot study
34. Parahoo, K. 2001. Research utilization among medical and surgical nurses: A comparison of their self-reports and perceptions of barriers and facilitators. <i>Journal of Nursing Management</i> 9: 21-30.	1368	All grades of hospital nurses (UK)	Not specified	Two items in questionnaire One on indicating the use of research in clinical practice One on implementation of new research findings in own practice in the last two years	5 pt frequency scale (never - all the time) Dichotomous, yes/no	Not reported	Content validity by expert panel and pilot study

Study	Author	Sample Size	Subjects	Instrument	Specific, BII Measurement	Scoring	Reliability	Validity
16	Huzzain, C. et al. 1994. Predictors of Nurses' Involvement in Research Activities. <i>British Journal of Nursing Research</i> 10(2): 193-204	1111	Registered nurses	Bandura's social cognitive theory	- implement by self - implement with assistant Items on Research Involvement Survey (RIS) for physiotherapists (most recent) and general practitioners (most recent) - use of research findings in clinical practice - made a research based practice change	In histograms, probably yes/no	Pickler = 0.89 Present $\alpha = 0.86$	Content validity by expert panel
17	Swerdlow, J. & Cook, C. 2001. The Use of Evidence-Based Practice by Occupational Therapists who Treat Adult Stroke Patients. <i>British Journal of Occupational Therapy</i> 64(3): 236-60	125	Occupational therapists	Sackett's definition of evidence based practice	Item on questionnaire on the use of evidence based practice according to Sackett's definition	4 pt frequency scale (always-never)	Not reported	Not reported
18	Tan, S. L. 2000. Nurses' participation and utilization of research in the Republic of China. <i>International Journal of Nursing Studies</i> 37: 435-444	182	Registered nurses	Not specified	Single item in questionnaire (adapted from Funk 1991 and Pothoff 1995) on research findings used for practice in previous three years	In histograms, yes/no	Not reported	Content validity by expert panel and pilot test
19	Veeramah, V. 1995. A study to identify the attitudes and needs of qualified staff concerning the use of research findings in clinical practice within mental health care settings. <i>Journal of Advanced Nursing</i> 22: 855-861	118	Registered nurses	Not specified	Single item in questionnaire (based on Campion & Leath 1989 and Lacey 1994) - are nursing research findings used in the area to improve patient/care?*	4 pt Likert scale (not at all - to a great extent)	Not reported	Content validity by pilot test
20	Wojcik, J. B. et al. 1994. A Survey of Research-Related Activities and Perceived Barriers to Research Utilization Among Professional Oncology Nurses. <i>Oncology Nursing Forum</i> 21(4): 210-215	81	Registered nurses	Not specified	Single item in questionnaire (adapted from Sletten 1984) - utilizing research findings to a great extent	4 pt Likert scale (none - high)	Test-retest = 0.88 Cronbach's $\alpha = 0.88$	Content validity by pilot test
21	Wright, J. C. 1993. Brief Relationship between sources of knowledge and use of research findings. <i>The Journal of Continuing Education in Nursing</i> 21(1): 13-16	186	Registered nurses	Roger's theory of Diffusion	Item on "Innovation Source and Use Questionnaire" on the specific research based nursing practice	In histograms, probably yes/no	Not reported	Content validity by pilot test
22	Wright, A., Brown, P., & Simons, R. 1996. Nurses' perceptions of the value of nursing research for practice. <i>Australian Journal of Advanced Nursing</i> 13(4): 15-18	410	Registered nurses	Not specified	Item in questionnaire on the application of research findings to patient care	In histograms, probably yes/no	Not reported	Content validity by expert panel

Although we risk missing interesting work on the direct use of research by excluding such papers, we rationalized this decision based on the complexity and scope of nursing guidelines, the significant variance in the rigor with which they are developed, and the evidence base that supports them. We also excluded a number of papers that one might anticipate being included where multi-item instruments were used to measure several factors related to research use, but not research use in itself. These included such factors as individual and organizational determinants, and barriers to research use (Camiletti and Huffman, 1998; Ehrenfeld and Eckerling, 1991; Funk et al., 1991; Adamsen et al., 2003; Carroll et al., 1997; Griffiths et al., 2001; Kamwendo, 2002). Other papers were excluded due to lack of clarity in the method or result sections specifically regarding if and how research use was measured (Curtin and Jaramazovic, 2001; Davies, 1999; Ketefian, 1975; Kirchoff, 1982).

We located three commonly used multi-item instruments published in 20 papers and three multi-item instruments cited in one paper each. Another 20 published papers used single-item questions to measure actual research use. A more detailed description is presented below.

Nurses Practice Questionnaire (NPQ)

Brett (1987) developed the Nurses Practice Questionnaire (NPQ) based on Roger's (1983) innovation diffusion theory. The NPQ consists of brief description of 14 specific nursing practice innovations and it is the most widely used research utilization instrument in the nursing literature. Based on Roger's (1983) stages of innovation adoption, seven questions³ measuring the nurse's stage of innovation adoption are posed for each of the nursing practice innovations. The questions attempt to examine Roger's five stages in the adoption of a specific practice innovation - level of awareness, persuasion, decision, implementation, and confirmation.

The NPQ and its modifications have been used in ten studies (see Table 1). The reliability assessments reported in all these studies are limited to Cronbach's alpha test of internal consistency and little is reported that suggests validity has been established. A number of assumptions underpin the NPQ. The NPQ assumes research use has a

³ Have you read about this nursing practice? Have you heard about this nursing practice? Have you observed this practice in use? Have you learned about this practice from any other source? If appropriate to the practice setting, do you believe a nurse should use this nursing practice? How often do you use this nursing practice? Are you aware of any policies concerning this nursing practice in your workplace?

linear progression through the identified stages and that awareness of the innovation (the research finding) and a positive attitude (persuasion) towards innovation reflect use. The term 'use' is not clearly operationalized in the NPQ. In fact, with few exceptions in this body of literature (e.g., Estabrooks, 1999b; Rodgers, 2000), an operational definition of the term research use was not given in the studies.

Finally, the NPQ (as do all instruments we assessed) assumes that implementing research is good despite the fact that many research findings are decontextualized and in some cases impractical in the face of existing resources and particular patient populations.

The Research Utilization Questionnaire (RUQ)

Champion and Leach (1989) developed the Research Utilization Questionnaire (RUQ). This instrument is made up of 42 self-descriptive statements comprising four subscales of which research utilization is one. Research utilization was measured using a summated 5-point Likert scale. The scale comprises 10 items measuring the degree to which a nurse felt she incorporated research findings into practice. Sample items in the instrument include: *I base my practice on research, I apply research results to my own practice, I use research to supply my nursing practice.*

This instrument and its modifications have been used in seven research utilization studies (see Table 1). Similar to the NPQ, psychometric assessment has been limited to Cronbach's alpha test of internal consistency and some limited assessments of content validity. "Use" is not well defined and the instrument does not discriminate different forms of research use. We found no evidence that the development of this instrument was based on an established theoretical framework making it difficult to understand how the research utilization process was conceptualized. The items included in this instrument contain value laden phrasing making it prone to social desirability biases.

Edmonton Research Orientation Survey (EROS)

The Edmonton Research Orientation Survey (EROS) developed by Pain, Hagler, and Warren (1996) is a self-report questionnaire measuring practicing clinicians' participation in and orientation toward research. It was developed in the context of rehabilitation medicine specialties (e.g., physiotherapy, occupational therapy). We included it because researchers have included nurses in their samples. This instrument has four subscales of which the 'Using Research/Evidence Based Practice' is one and is composed of 10 items using a 5-point Likert scale. Examples of items that measure research use from the EROS include: *reading the research*

literature has changed the way I practice, and hearing research presentations has changed the way I practice.

The instrument has been used in three studies. As with the other instruments a drawback of the EROS is the vagueness of the term *use*. No theoretical framework or operational definitions are reported. While the instrument was tested for construct validity and reports acceptable reliability ratings for the research use subscale, it assumes that involvement in and understanding of research implies a higher level of research use. The influence of social desirability through self-report is again potentially present. Additionally, the questions ask respondents to reflect on their use of research over the past five years, raising questions of recall accuracy. As with the NPQ and RUQ, the EROS does not explicitly integrate measurement theory in its development.

Other Multi-Item Instruments

We located three other multi-item instruments developed to measure research use. We found one report describing each instrument. Baessler et al (1994) developed an instrument and called it the Research Utilization Questionnaire (RUQ) based on a critical review of the literature. The instrument was composed of statements and open-ended questions with regard to use of products and methods in relation to research use. Products included searching the literature, engaging others to use research findings, critique of research studies, and the creation of clinical action plans from findings. The underlying assumption is that these products infer research use, which the authors did not define or conceptualize in the study. The instrument also examined the frequency of use of knowledge sources as an indicator of research use, assuming that this variable predicts use without empirical evidence to support such claims. The authors provided no report of validity or reliability testing of this instrument.

Pelz and Horsley (1981) reported results from an intervention study measuring direct and indirect research utilization as part of the Conduct and Utilization of Research in Nursing (CURN) research development project. The instrument was specifically developed for the project where an intervention team was placed in experimental hospitals to determine their effect on the research utilization process. Sample questions (5 items in total) related to frequency of instrumental research use. Examples include: *you evaluated a research study to determine its value for practice, and you discontinued or rejected a practice activity because of knowledge included in the results of research studies.* Questions that measured research use less directly included the extent to which the respondent did

a series of activities in their own job such as: evaluating their practice, altering nursing practice based on new ideas, and influencing others to alter their nursing practice based on new ideas. The instrument lacked explicit theoretical and measurement frameworks, although the authors referenced Havelock's linkage model (1969). In contrast to many of the other studies, this instrument was used to evaluate an intervention.

Varcoe and Hilton (1995) used a modified version of *Research Use in Nursing Practice* instrument developed by Alcock (1990). This instrument included 10 items that measured general research activity on a 4-point Likert scale and 10 items that rated frequency of use of specific research findings on a 3-point scale. Although Varcoe and Hilton referred to Crane's (1985) theoretical framework for building their study, the instrument they used had no such theoretical underpinnings. As with the other instruments, no explicit measurement theory was used in the development and the potential impact of social desirability was not addressed. The conceptualization of use was not reported.

Single Items Measures

Several instruments designed to measure a wide array of concepts included a single item (or items) question(s) relating to the respondent's research utilization behavior. In some cases these instruments were multi-item surveys that focused on the research utilization process but had only one question specifically addressing research use. Examples of these items in the literature include – how often do you use research in your clinical practice? How often have you utilized research findings to change practice? Are nursing research findings used in your area to improve patient/client care? We excluded single item questions that asked about participation in research, support for research use or attitudes toward research.

Several concerns associated with the use of single item questions similar to those previously cited include poor operationalization of research use, lack of theoretical underpinning (either measurement or research utilization), and social desirability. Looking at the single items together, many different terms are used when asking questions about research use such as frequency and extent of use, application of findings, implementation of findings, and changing nursing practice. Different questions make it very difficult to draw conclusions or extrapolate findings from one study to another. Single item questions also used an array of scoring methods and differing sets of scaling assumptions. Finally, in these single item questions, as well as with the instruments previously discussed, respondents were often asked to remember as far

back as three years prior to the study, raising questions of recall accuracy.

Common attributes of measures

Across all reviewed studies there was a focus on the measurement of the individual nurses' use of research. Organizational dimensions of research utilization were not commonly studied. If organizational variables were examined the unit of analysis was the individual suggesting serious *unit of analysis errors* exist. Also common were retrospective survey designs, heavily dependant on self reporting and recall. We located few experimental designs and no longitudinal designs. The conceptualization of research use was almost always unclear. Respondents were not given descriptions of the various kinds of research use (i.e., instrumental, conceptual, symbolic), leading to uncertainty in interpreting study outcomes.

A number of assumptions were apparent in these instruments – that research utilization is always good (all research is applicable to practice), that research utilization is linear (a sequential process of dissemination – critical appraisal – implementation), that evidence-based practice is an individual responsibility, and that research utilization is a valuable outcome in and of itself. Perhaps the most striking assumption in these studies and embedded in the instruments was that of *rationality*, i.e., the assumption that decisions to use research are the decisions of rational actors in rational environments.

6. Discussion

Our review of research utilization measurement in nursing has revealed that both single item measures and more widely used instruments reflect a common set of problems. First, there are general problems that include: lack of research utilization or appropriate other theory, lack of construct clarity, lack of explicit measurement theory, lack of advanced psychometric assessment, a presumption of linearity, an absence of longitudinal work (neither repeated measurement in studies or frequent use of any instrument) and potentially influential but unacknowledged assumptions. Second, these instruments were also commonly susceptible to a number of other problems, including self-report and recall biases, social desirability biases, under-developed scaling approaches, and lack of clarity regarding the unit of analysis (and resultant ecology fallacies).

Lack of research utilization or appropriate other theory

We have established that little in the way of research utilization or other related theory has guided the development of research utilization measures to date in nursing. A more interesting avenue may be to pursue what sorts of 'models' should guide us. In 1986 Van de Ven (van de Ven, 1986) argued against the emergence of a unified model, suggesting that competing theories would emerge that would serve us better. Potentially useful theory and theoretical models include those in the field of clinical decision making (Tavakoli, Davies, and Thomson, 2000; Dowding and Thompson, 2003), decision making (Groen and Patel, 1985; Kahneman, Slovic and Tversky, 1982; Patel, Arocha, and Kaufman, 1999), critical thinking (Facione, 1992), information processing theory (Newell and Simon, 1972), self-efficacy (Bandura, 1977), behavioral change (Prochaska and DiClemente, 1986; Prochaska and DiClemente, 1992; Oldenburg, Glanz, and French, 1999), organizational theory (Brown and Duguid, 2001; Czarniawska and Sevón, 1996; Denis et al., 2002; Orlikowski, 2002) and evaluation utilization models (Greene, 1988a; Greene, 1988b; Cousins and Leithwood, 1993; Patton, 1997; Johnson, 1998). Finally a group of models less commonly associated with research or knowledge utilization, but which we believe are of significant importance to this area are policy analysis frameworks (e.g., Stone, 1999; Hogwood and Gunn, 1984; Lomas, 2000, Jenkins-Smith and Sabatier, 1993).

Lack of construct clarity

Construct validity is premised on a well-grounded theoretical conceptualization of research utilization. In addition to theorizing, there are additional methodological approaches to achieving it. Cronbach and Meehl's nomological network (1955) is one well accepted approach. However it carries strenuous demands for strong theory. Kane's (1992) constructed arguments (sets of logical, testable postulates that are used to fill in gaps in theory) approach is less demanding of strong theory and consequently may be more suitable in the research utilization field.

Lack of explicit measurement theory.

We have identified a consistent absence of measurement theory in the development of reviewed instruments. We argue that using an appropriate theory (or theories) would benefit the development of any research utilization instrument and is strongly needed for guidance in future development. Choosing which theory to use depends on many factors, all stemming from the inferences that one wishes to make about research

utilization once it has been measured. The hypothesized inferences will drive how a study is designed and the way in which data are collected and analyzed. The measurement model must fit with the construct (in line with the desired inferences), and will inform the way in which the instrument development data are collected.

Lack of psychometric assessment.

All of the current studies lack significant psychometric assessment of used instruments. The use of the multi-item instruments has commonly been accompanied by testing homogeneity using Cronbach alpha, while most of the single-item instruments have no measure of reliability. Validity in some cases was assumed because investigators drew on original instrument development and in fewer cases by actually assessing it. In Lacey's pilot study (1994) validity was strengthened by semi structured interviews and in Pain's EROS study (Pain, Hagler, and Warren, 1996) evidence of construct validity was reported. However, over half of the studies did not mention validity. As there is frequent use of various types of scales it is surprising that psychometric testing is rarely reported. This is, however, in line with an ill-defined construct of interest and emphasizes Dunn's (1983) claim of two decades ago that construct validity is a serious and unresolved problem in the field.

Presumption of linearity.

The presumption that research utilization is a linear process is most obvious in the NPQ instrument, but is present in the other instruments and single-item questions. This presumption is closely linked to the idea of rationality and presumes that the use of research follows a planned course – identification, critical appraisal, and implementation. This understanding may be analytically useful but in practice, does not occur. Further the least attention has been devoted to the most complex part of the process, implementation. Recognized guidelines frequently need adaptation to local conditions. Further, the complexity of most health settings and the intensity of care needs contribute to change being a circuitous not a linear route. Such conditions need to be factored into the measurement of research utilization.

Unacknowledged assumptions.

A number of unacknowledged assumptions adversely influence the measurement of research utilization. They do so by creating conditions where respondents may understand questionnaires as idealistic and artificial, rather than as an organic part of a practice requiring many forms

of knowledge in addition to science. In particular, assumptions of linearity and rationality run counter to the complex and often messy conditions replete with competitive interests and influences prevailing in most health care facilities today (Kitson, Harvey, and McCormack, 1998; Rycroft-Malone et al., 2002).

Estabrooks (2001), Norman (1999), and Rich & Oh (2000) have argued persuasively that a rationality bias is one of the most serious impediments to successful advances in the field. We have observed that this particular bias persists through much of the historical and contemporary literature in the broad field of knowledge utilization, although alternative approaches are emerging in fields such as organizational studies.

We located three published papers expressly addressing the measurement issue in this field (Dunn, 1983; Rich, 1997; Weiss, 1981). These authors have each offered guidance on approaches to move this field forward. Their arguments illustrate the complexity and wide range of possibilities required to conceptualize and measure research utilization. Each calls unmistakably for conceptual clarity. Commonly they also address the necessity of pluralism in procedures and methods of measurement. Separately, Dunn (1983) emphasizes the need for strengthening reliability and validity given the subjective properties inherent in knowledge utilization. Weiss (1981) argues for the need for specific foci, that is, on studies, people, issues or organizations and that these foci determine method. Rich (1997) provides a comprehensive overview of issues influencing research utilization.

7. Future Directions

Rich (1997) examining the knowledge utilization field broadly across many disciplines, claimed that little new empirical work had been reported in the knowledge utilization field in the last decade and that a bias toward measuring what was easy to measure persisted. We found little to refute Rich's claims. Although there has been a measurable increase in empirical work on research utilization in nursing in the past fifteen years, little new information has been reported and few methodological advances are apparent – the picture regarding the measurement of research utilization is perhaps bleakest of all. Further, in our review of knowledge utilization literature across many fields and disciplines we found little to distinguish those fields from nursing when

searching for methodological advances.

In aiming for the development of a research utilization measurement instrument in nursing we suggest the following be re-examined. First, Dunn's (1983) overview of instruments for measuring knowledge (or information) use, in which he presents instrument used in other fields, e.g., the information utilization scale (Larsen, 1982); the stages of concern scale (Hall et al, 1979); the evaluation utilization scale (Johnson, 1980), and the overall policy impact scale (van de Vall and Bolas, 1982). These scales and indices, as well as, newer instruments may offer productive ideas on problems in the measurement of research utilization in our field of interest –nursing. Another valuable contribution that could inform development of an instrument for measuring research in nursing may be Knott & Wildavsky's (1980) "seven standards of utilization" – reception, cognition, reference, effort, adoption, implementation and impact. The thorough work done by Johnson (1998) in examining implicit and explicit theoretical models for evaluation utilization may also have bearing for such efforts in our field.

We advocate the study of research utilization as both process and product because both are necessary to assess its impact on health outcomes. However, the most fruitful courses of study probably lies in the examination of research utilization as process. Whether one is examining knowledge (or research) utilization as product or process, however, the most pressing issue ahead of us lies in establishing construct clarity in order that defensible measurement can follow. Partitioning the research utilization process into manageable components and clearly delineating the focus of attention will ensure the appropriate measurement approach and selection.

Meaningful advancement in this field requires that intervention studies aimed at the implementation phase of research be mounted to test strategies believed to enhance research utilization. These studies need to incorporate longitudinal designs in order to evaluate sustainability and they need to be embedded in sound theorizing. The clarion call for good theory in this field remains unanswered. If we are to measure research utilization –we are going to have to answer it.

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Reference

- Adamsen, L., L. K. Bjerregaard, and J.K. Madsen. (2003). Danish research-active clinical nurses overcome barriers in research utilization. *Scandinavian Journal of Caring Sciences* 17(1): 57-66.
- Aiken, L. H., S. P. Clarke, D. M. Sloane, J. A. Sochalski, and J. H. Silber. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *Journal of the American Medical Association* 288(16): 1987-93.
- Aiken, L. H., S. P. Clarke, R. B. Cheung, D. M. Sloane, and J. H. Silber. (2003). Educational levels of hospital nurses and surgical mortality. *Journal of the American Medical Association* 290(12): 1617-23.
- Aiken, L.H., S. P. Clarke, D. M. Sloane, J. A. Sochalski, and others. (2001). Nurses' reports on hospital care in five countries. *Health Affairs* 20(3): 43-53.
- Alcock, D., G. Carroll, and M. Goodman. (1990). Staff nurses' perceptions of factors influencing their role in research. *The Canadian Journal of Nursing Research* 22(4): 7-18.
- American Nurses' Association. (1989). *Education for Participation in Nursing Research*. Kansas City, MO: Author.
- Arnetz, B. B. 1999. Staff perception of the impact of health care transformation on quality of care. *International Journal for Quality in Health Care* 11(4): 345-51.
- Baessler, C. A., M. Blumbert, J. S. Cunningham, J. A. Curran, A. G. Fennessey, J. M. Jacobs, P. McGrath, M. T. Perrong, and Z. R. Wolf. (1994). Medical-surgical nurses' utilization of research methods and products. *MEDSurg Nursing*, 3(2): 113-17, 120-121, 141.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 84(2): 191-215.
- Barnard, K., and R. Hoehn. (1978). *Nursing Child Assessment Satellite Training: Final Report*. DHEW, Division of Nursing, Hyattsville, MD.
- Barta, K. M. (1995). Information-seeking, research utilization, and barriers to research utilization of pediatric nurse educators. *Journal of Professional Nursing* 11(1): 49-57.
- Berggren, A. C. (1996). Swedish midwives' awareness of, attitudes to and use of selected research findings. *Journal of Advanced Nursing* 23: 462-70.
- Bero, L., R. Grilli, M. Grimshaw, E. Harvey, A. Oxman, and M. A. Thomson. (1998). Closing the gap between research and practice: An overview of systematic reviews of interventions to promote implementation of research findings. *BMJ* 317: 465-68.
- Beyer, J. and H. Trice. (1982). The utilization process: A conceptual framework and synthesis of empirical findings. *Administrative Science Quarterly* 27: 591-622.
- Blackler, F. (1995). Knowledge, knowledge work and organizations: An overview and interpretation. *Organization Studies* 16(6): 1021-46.
- Bostrom, J., and W. N. Suter. 1993. Research utilization: Making the link to practice. *Journal of Nursing Staff Development* 9(1): 28-34.
- Brennan, R.L. (1983). *Elements of Generalizability Theory*. Iowa City, Iowa: American College Testing Program.
- Brett, J. L. L. (1987). Use of nursing practice research findings. *Nursing Research* 36(6): 344-49.
- Brown, D. S. (1997). Nursing education and nursing research utilization: is there a connection in clinical settings? *The Journal of Continuing Education in Nursing* 28(6): 258-62, 284.
- Brown, J. S., and P. Duguid. (1991). Organizational learning and communities of practice: Toward a unified view of working, learning, and innovation. *Organization Science* 2(1): 40-57.
- _____ (2001). Knowledge and organization: A social-practice perspective. *Organization Science* 12(2): 198-213.
- Butler, L. (1995). Valuing research in clinical practice: a basis for developing a strategic plan for nursing research. *Canadian Journal of Nursing Research* 27(4): 33-39.
- Camiletti, Y. A., and M. C. Huffman. (1998). Research utilization: evaluation of initiatives in a public health nursing division. *Canadian Journal of Nursing Administration* 11(2): 59-77.
- Carroll, D., R. Greenwood, K. Lynch, J. Sullivan, C. Ready, and J. Fitzmaurice. (1997). Barriers and facilitators to the utilization of nursing research. *Clinical Nurse Specialist* 11(5): 207-12.
- Champion, V. L., and A. Leach. (1989). Variables related to research utilization in nursing: An empirical investigation. *Journal of Advanced Nursing* 14: 705-10.
- Ciliska, D., S. Hayward, M. Dobbins, G. Brunton, and J. Underwood. (1999). Transferring public-health nursing research to health-system planning: Assessing the relevance and accessibility of systematic reviews. *Canadian Journal of Nursing Research* 31(1): 23-36.
- Cousins, J. B., and K. A. Leithwood. (1993). Enhancing knowledge

- utilization as a strategy for school improvement. *Knowledge: Creation, Diffusion, Utilization* 14(3): 305-33.
- Coyle, L. A., and A. G. Sokop. (1990). Innovation adoption behavior among nurses. *Nursing Research* 39(3): 176-80.
- Crane, J. (1985). Using research in practice: Research utilization--Theoretical perspectives. *Western Journal of Nursing Research* 7(2): 261-68.
- Cronbach, L. J., and P. E. Meehl. (1955). Construct validity in psychological tests. *Psychological Bulletin* 52: 281-302.
- Curtin, M., and E. Jaramazovic. (2001). Occupational therapists' views and perceptions of evidence-based practice. *British Journal of Occupational Therapy* 64(5): 215-22.
- Czarniawska, B., and G. Sevón, Eds. (1996). *Translating Organizational Change*. New York: Walter de Gruyter.
- David, P., and D. Foray. (2002). An introduction to the economy of the knowledge society. *International Social Science Journal* 171: 9-23.
- Davies, S. (1999). Practice nurses' use of evidence-based research. *Nursing Times* 95(4): 57-60.
- Denis, J.L., Y. Hébert, A. Langley, D. Lozeau, and L.H. Trottier. (2002). Explaining diffusion patterns for complex health care innovations. *Health Care Management Review* 27(3): 60-73.
- Dobbins, M., R. Cockerill, and J. Barnsley. (2001). Factors affecting the utilization of systematic reviews. A study of public health decision makers. *International Journal of Technology Assessment in Health Care* 17(2): 203-14.
- Dowding, D., and C. Thompson. (2003). Measuring the quality of judgement and decision-making in nursing. *Journal of Advanced Nursing* 44(1): 49-57.
- Dunn, W. N. (1983). Measuring knowledge use. *Knowledge: Creation, Diffusion, Utilization* 5(1): 120-133.
- Dysart, A. M., and G. S. Tomlin. (2002). Factors related to evidence-based practice among U.S. occupational therapy clinicians. *American Journal of Occupational Therapy* 56: 275-84.
- Ehrenfeld, M., and S. Eckerling. (1991). Perceptions and attitudes of registered nurses to research: A comparison with a previous study. *Journal of Advanced Nursing* 16: 224-32.
- Ellis, B.B. and A.D. Mead. (2002). Item analysis: Theory and practice using classical and modern test theory. In Rogelberg, S.G, editor. *Handbook of Research Methods in Industrial and Organizational Psychology*. Blackwell Handouts of Research Methods in Psychology. Malden, MA, Blackwell Publishers. : 324-343.
- Estabrooks, C. A. (1998). Will evidence-based nursing practice make practice perfect? *Canadian Journal of Nursing Research* 30(4): 273-94.
- _____ (1999a). Mapping the research utilization field in nursing. *Canadian Journal of Nursing Research* 31(1): 53-72.
- _____ (1999b). The conceptual structure of research utilization. *Research in Nursing & Health* 22(3): 203-16.
- _____ (2001). Research utilization and qualitative research. In *The Nature of Qualitative Evidence*. J. M. Morse, J. Swanson, and A. Kuzel, editors. Thousand Oaks, CA: Sage: 275-98
- Estabrooks, C. A., J. A. Floyd, S. Scott-Findlay, K. A. O'Leary, and M. Gushta. (2003). Individual determinants of research utilization: A systematic review. *Journal of Advanced Nursing* 43(5): 506-20.
- Evidence-Based Decision Making Working Group. (1997). *Creating a Culture of Evidence-Based Decision Making in Health*, H21-126/5-2-1997E. National Forum on Health, Ottawa.
- Evidence-Based Medicine Working Group. (1992). Evidence-based medicine. A new approach to teaching the practice of medicine. *JAMA: the Journal of the American Medical Association* 268(17): 2420-2425.
- Facione, P. (1993). *Critical Thinking: What it is and why it counts*. Milbrae, CA: California Academic press.
- Feder, G., M. Eccles, R. Grol, C. Griffiths, and J. Grimshaw. (1999). Using Clinical Guidelines. *BMJ* 318: 728-30.
- Flexner, A. (1910). *Medical Education in the United States and Canada: A Report to the Carnegie Foundation for the Advancement of Teaching*. New York: Carnegie Foundation for the Advancement of Teaching.
- Funk, S. G., M. T. Champagne, R. A. Wiese, and E. M. Tornquist. (1991). BARRIERS: The barriers to research utilization scale. *Applied Nursing Research* 4(1): 39-45.
- Goode, C., and G. M. Bulechek. (1992). Research utilization: An organizational process that enhances quality of care. *Journal of Nursing Care Quality Supply*: 27-35.
- Goode, C. J., M. K. Lovett, J. E. Hayes, and L. A. Butcher. (1987). Use of research based knowledge in clinical practice. *Journal of Nursing Administration* 17(12): 11-18.
- Gray, M. (1995). Scientific truths: Weighing the evidence. *JWOCN* 22: 203-5.
- Greene, J. C. (1988a). Communication of results and utilization in

- participatory program evaluation. *Evaluation and Program Planning* 11: 341-51.
- _____ (1988b). Stakeholder participation and utilization in program evaluation. *Evaluation Review* 12(2): 91-116.
- Griffiths, J. M., R. M. Bryar, S. J. Closs, J. Cooke, T. Hostick, S. Kelly, and K. Marshall. (2001). Barriers to research implementation by community nurses. *British Journal of Community Nursing* 6(10): 501-10.
- Grimshaw, J. M., and I. T. Russel. (1994). Achieving health gain through clinical guidelines: II: Ensuring guidelines change medical practice. *Quality in Health Care* 3: 45-52.
- Groen, G., J. and Vimla Patel, (1985). Medical problem solving: Some questionable assumptions. *Medical Education* 19: 95-100.
- Grol, R. (2000). Between evidence-based practice and total quality management: The implementation of cost-effective care. *International Journal for Quality in Health Care* 12(4): 297-304.
- Hall, G.A. and W. Rutherford (1979). *Measuring Stages of Concern About the Innovation: A Manual for Use of the SoC Questionnaire*. Austin: Research and Development Center for Teacher Education, University of Texas.
- Hambleton, R. K., H. Swaminathan, and H. Jane Rogers. (1991). *Fundamentals of Item Response Theory*. Newbury Park, CA: Sage.
- Hambleton, R.K. and R.W. Jones (1993). Comparison of classical test theory and item response theory and their applications to test development. *Educational Measurement: Issues & Practice*, 12(3): 38-47.
- Hatcher, S., and J. Tranmer. (1997). A survey of variables related to research utilization in nursing practice in the acute care setting. *Canadian Journal of Nursing Administration*, Sept-Oct: 31-53.
- Havelock, R. G. (1969). *Planning for Innovation through Dissemination and Utilization of Knowledge*. Ann Arbor: Centre for Research on Utilization of Scientific Knowledge: University of Michigan.
- Hogwood, B., and L. Gunn. (1984). *Policy Analysis for the Real World*. Oxford, U.K.: Oxford University Press.
- Horsley, J.A., Joyce C., and J. D. Bingle. (1978). Research utilization as an organizational process. *Journal of Nursing Administration* July: 4-6.
- Humphris, D., S. Hamilton, P. O. O'Halloran, S. Fisher, and P. Littlejohns. (1999). Do diabetes nurse specialists utilise research evidence? *Practical Diabetes International* 16 (2): 47-50.
- Humphris, D., P. Littlejohns, C. Victor, P. O'Halloran, and J. Peacock. (2000). Implementing evidence-based practice: factors that influence the use of research evidence by occupational therapists. *British Journal of Occupational Therapy* 63(11): 516-22.
- Jenkins-Smith, Hank C., and Paul A. Sabatier. (1993). *Policy Change and Learning: An Advocacy Coalition Approach*. San Francisco, CA: Westview Press.
- Johnson, K. W. (1980). Stimulating evaluation use by integrating academia and practice. *Knowledge: Creation, Diffusion, Utilization* 2(2): 237-62.
- Johnson, R. Burke. (1998). Toward a theoretical model of evaluation utilization. *Evaluation and Program Planning* 21: 93-110.
- Kahneman, D., P. Slovic and A. Tversky. (Eds.). (1982). *Judgment under Uncertainty: Heuristics and biases*. New York: Cambridge University Press.
- Kamwendo, K. (2002). What do Swedish physiotherapists feel about research? A survey of perceptions, attitudes, intentions and engagement. *Physiotherapy Research International* 7(1): 23-34.
- Kane, M. T. (1992). An argument based approach to validity. *Psychological Bulletin* 112(3): 527-35.
- Ketefian, S. (1975). Application of selected nursing research findings into nursing practice. *Nursing Research* 24(2): 89-92.
- Kirchoff, K T. (1982). A diffusion survey of coronary precautions. *Nursing Research* 31(4): 196-201.
- Kitson, A., L. B. Ahmed, G. Harvey, K. Seers, and D. R. Thompson. (1996). From research to practice: one organizational model for promoting research-based practice. *Journal of Advanced Nursing* 23(3): 430-40.
- Kitson, A., G. Harvey, and B. McCormack. (1998). Enabling the implementation of evidence based practice: A conceptual framework. *Quality in Health Care* 7: 149-58.
- Knott, J., and A. Wildavsky. (1980). If dissemination is the solution, what is the problem? *Knowledge: Creation, Diffusion, Utilization* 1(4): 537-78.
- Lacey, E. Anne. (1994). Research utilization in nursing practice--a pilot study. *Journal of Advanced Nursing* 19(5): 987-95.
- Larsen, J. K. (1982). *Information Utilization and Non-utilization*. Palo Alto, CA: American Institutes for Research in the Behavioral Sciences.
- _____ (1980). Knowledge utilization. What is it? *Knowledge: Creation, Diffusion, Utilization* 1(3): 421-42.

- Lia-Hoagberg, B., M. Schaffer, and S. Strohschein. (1999). Public health nursing practice guidelines: An evaluation of dissemination and use. *Public Health Nursing* 16(6): 397-404.
- Logan, J., and I. D. Graham. (1998). Toward a comprehensive interdisciplinary model of health care research use. *Science Communication* 20(2): 227-46.
- Logsdon, C., D. Winders, B. Hawkins, B. Parker, and A. Peden. (1998). Factors related to research utilization by registered nurses in Kentucky. *Kentucky Nurse* January/February: 24-27.
- Lomas, J. (2000). Connecting research and policy. *Isma* 1(1): 140-144.
- McCleary, L., and G.T. Brown. (2002). Research utilization among pediatric health professionals. *Nursing & Health Sciences* 4(4): 163-72.
- Michel, Y., and N. V. Sneed. (1995). Dissemination and use of research findings in nursing practice. *Journal of Professional Nursing* 11(5): 306-11.
- Nahapiet, J., and S. Ghoshal. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review* 23(2): 242-66.
- National Forum on Health. (1997). *Canada Health Action: Building on the Legacy*. National Forum on Health, Ottawa, ON.
- Nelson, D. (1995). Research into research practice. *Accident and Emergency Nursing* 3: 184-189.
- Newell, A. and H. Simon. (1972). *Human Problem Solving*. Englewood Cliffs, NJ: Prentice Hall.
- Norman, G. (1999). Examining the assumptions of evidence-based medicine. *Journal of Evaluation in Clinical Practice* 5(2): 139-47.
- Oldenburg, B., K. Glanz, and M. French. (1999). The application of staging models to the understanding of health behaviour change and the promotion of health. *Psychology and Health* 14: 503-16.
- Orlikowski, W. (2002). Knowing in practice: Enacting a collective capability in distributed organizing. *Organization Science* 13(3): 249-73.
- Oxman, A. D., M. A. Thomson, D. A. Davis, and R. B. Haynes. (1995). No magic bullets: A systematic review of 102 trials of interventions to help health care professionals deliver services more effectively or efficiently. *CMAJ: Canadian Medical Association Journal* 153(10): 1423-31.
- Pain, K., P. Hagler, and S. Warren. (1996). Development of an instrument to evaluate the research orientation of clinical professionals. *Canadian Journal of Rehabilitation* 9(2): 93-100.
- Parahoo, K. (1998). Research utilization and research related activities of nurses in Northern Ireland. *International Journal of Nursing Studies* 35(5): 283-91.
- (1999a). Research utilization and attitudes towards research among psychiatric nurses in Northern Ireland. *Journal of Psychiatric and Mental Health Nursing* 6(2): 125-35.
- (2001). Research utilization among medical and surgical nurses: A comparison of their self reports and perceptions of barriers and facilitators. *Journal of Nursing Management* 9: 21-30.
- (1999b). A comparison of pre-Project 2000 and Project 2000 nurses' perceptions of their research training, research needs and of their use of research in clinical areas. *Journal of Advanced Nursing* 29(1): 237-45.
- Parahoo, K., O. Barr, and E. McCaughan. (2000). Research utilization and attitudes towards research among learning disability nurses in Northern Ireland. *Journal of Advanced Nursing* 31(3): 607-13.
- Patel, V. L., J. F. Arocha, and D. R. Kaufman. (1999). Expertise and tacit knowledge in medicine. In *Tacit Knowledge in Professional Practice: Researcher and Practitioner Perspectives*. Editors Robert J. Sternberg, and Joseph A. Horvath. Mahwah, NJ: Lawrence Erlbaum Associates: 75-99.
- Patton, M. Q. (1997). *Utilization-focused Evaluation*. Beverly Hills, CA: Sage.
- Pelz, D. C., and J.A. Horsley. (1981). Measuring utilization of nursing research. In *Utilizing Evaluation: Concepts and measurement techniques*. Ed. James A. Ciario. Beverly Hills, CA: Sage: 125-49.
- Pettengill, M.M., D.A. Gillies and C.C. Clark. (1994). Factors encouraging and discouraging the use of nursing research findings. *Image. The Journal of Nursing Scholarship* 26(2): 143-147.
- Prochaska, J.O., and C.C. DiClemente. (1986). Towards a comprehensive model of change. In *Treating Addictive Behaviours: Processes of change*. Editors. W. R. Miller, and N. Heather. New York: Plenum Press: 3-27.
- Prochaska, J.O. (1992). Stages of change and the modification of problem behaviours. In *Progress in Behaviour Modification*. Editors. M. Hersen, R. M. Eisler, and P. M. Miller. Sycamore: Sycamore Press.
- Rich, R. F. (1975). Selective utilization of social science related

- information by federal policy-makers. *Inquiry* 12(3): 239-45.
- (1977). Uses of social science information by federal bureaucrats: Knowledge for action versus knowledge for understanding. In *Using Social Research in Public Policy Making*. Edited by Carol H. Weiss. Lexington, MA: DC. Heath.: 199-211.
- (1997). Measuring knowledge utilization processes and outcomes. *Knowledge and Policy: International Journal of Knowledge Transfer and Utilization* 3: 11-24.
- Rich, R. F., and C.H. Oh. (2000). Rationality and use of information in policy decisions. *Science Communication* 22(2): 173-211.
- Rizzuto, C., J. Bostrom, W.N. Suter, and W.C. Chenitz. (1994). Predictors of nurses' involvement in research activities. *Western Journal of Nursing Research* 16(2): 193-204.
- Rodgers, S. (2000a). A study of the utilization of research in practice and the influence of education. *Nurse Education Today* 20: 279-87.
- (2000b). The extent of nursing research utilization in general medical and surgical wards. *Journal of Advanced Nursing* 32(1): 182-93.
- Rogers, E. (1995). *Diffusion of Innovations*. 4th ed. New York, NY: The Free Press.
- (1983). *Diffusion of Innovations*. 3rd ed. New York: The Free Press.
- Rogers, P. L. (2000). Barriers to adopting emerging technologies in education. *Journal of Educational Computing Research* 22(4): 455-72.
- Rutledge, D. N., P. Greene, K. Mooney, Lillian M. Nail, and Mary Ropka. (1996). Use of research-based practices by oncology staff nurses. *Oncology Nursing Forum* 23(8): 1235-44.
- Rycroft-Malone, J., A. Kitson, G. Harvey, B. McCormack, K. Seers, A. Titchen, and C. Estabrooks. (2002). Ingredients for change: Revisiting a conceptual framework. *Quality & Safety in Health Care* 11(2): 174-80.
- Sackett, D. L., W. S. Richardson, W. Rosenberg, and R. B. Haynes. (1998). *Evidence Based Medicine. How to Practice and Teach EBM*. Edinburgh: Churchill Livingstone.
- Shavelson, R. J. and N. M. Webb. (1991). *Generalizability Theory: A Primer*. Newbury Park, CA: Sage.
- Shortell, S. M., C. L. Bennett, and G. R. Byck. (1998). Assessing the impact of continuous quality improvement on clinical practice: What it will take to accelerate progress. *Milbank Quarterly* 76(4): 593-624, 510.
- Shortell, S. M., R. H. Jones, A. W. Rademaker, R. R. Gillies, D. S. Dranove, E. F. Hughes, P. P. Budetti, K. S. Reynolds, and C. F. Huang. (2000). Assessing the impact of total quality management and organizational culture on multiple outcomes of care for coronary artery bypass graft surgery patients. *Medical Care* 38(2): 207-17.
- Stetler, C.B. (1984). *Nursing Research in a Service Setting*. Reston, VA: Reston Publishing.
- (1985). Research utilization: Defining the concept. *IMAGE: The Journal of Nursing Scholarship* 17(2): 40-44.
- (1994). Refinement of the Stetler/Marram model for application of research findings to practice. *Nursing Outlook* 42(1): 15-25.
- Stone, D.A. (1999). *Policy Paradox*. New York: W.W. Norton & Company.
- Sweetland, J., and C. Craik. (2001). The use of evidence-based practice by occupational therapists who treat adult stroke patients. *British Journal of Occupational Therapy* 64(5): 256-60.
- Tavakoli, M., H.T.O. Davies, and R. Thomson. (2000). Decision analysis in evidence-based decision making. *Journal of Evaluation in Clinical Practice* 6(2): 111-20.
- Thomas, L. H., E. McColl, N. Cullum, N. Rousseau, J. Soutter, and N. Steen. (1998). Effect of clinical guidelines in nursing, midwifery and the therapies: A systematic review of evaluations. *Quality in Health Care* 7: 183-91.
- Titler, M.G., C. Kleiber, V. Steelman, C. Goode, B. Rakel, J. Barry-Walker, S. Small, and K. Buckwalter. (1994). Infusing research into practice to promote quality care. *Nursing Research* 43(5): 307-13.
- Tranmer, J. E., J. Lochhaus-Gerlach, and M. Lam. (2002). The effect of staff nurse participation in a clinical nursing research project on attitude towards, access to, support of and use of research in the acute care setting. *Canadian Journal of Nursing Leadership* 15(1): 18-26.
- Tsai, S.L. (2000). Nurses' participation and utilization of research in the Republic of China. *International Journal of Nursing Studies* 37: 435-44.
- van de Vall, M., and C. Bolas. (1982). Using social policy research for reducing social problems: An empirical analysis of structure and functions. *The Journal of Applied Behavioral Science* 18(1): 49-67.