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The Language of Data

Tools to Translate Evidence for Nurses in Clinical Practice

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In clinical practice, nurses are expected to understand and implement the science that supports patient care, yet they fall short of goals to implement evidence in practice. One reason is difficulty in interpreting research results. Interpretation requires an ability to read and speak a language that many nurses have never mastered—the language of data. This article presents a skill-based solution for use in nursing professional development to improve nurses' understanding of statistics as a language.

An early epidemiologist and statistician, Florence Nightingale used numbers to demonstrate the effect of simple interventions like hand washing on important clinical outcomes such as death (Nightingale, 1863). As nursing science developed, however, recognition of the need for nurses to use research-based evidence for frontline clinical problem solving faded. The "nurse scientist," prepared in formal graduate education programs, grew to be seen as the sole proprietor of the scientific underpinnings of nursing interventions (Dickoff, James, & Wiedenbach, 1968). Clinical activities carried out by bedside nurses and focused on caring were seen as set apart from the science undergirding them (Watson, 1985). Thus, it should come as no surprise that staff nurses today do not routinely base clinical decisions on evidence (Pravikoff, Tanner, & Pierce, 2005).

Changes in health care have brought attention to the need to prepare and support nurses to interpret research findings and to appropriately translate evidence into practice. For example, the increased complexity of patient care, the expanded use of devices and technology, shortened lengths of stay, and increased need to connect patients with outpatient and community-based services require that nurses have the skills required to translate evidence to support decisions and provide safe, high-quality care. The growing expectation for nurses to develop and implement policies that are evidence based calls for a closer look at how well nurses understand the basic language that describes completed research. The purpose of this article was to present a toolbox for nurses in nursing professional development to use to facilitate (1) learning the language of data, (2) using data symbols, and (3) speaking the language of data in clinical settings.

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EXPECTATIONS FOR USE OF EVIDENCE IN PRACTICE

Increasing Expectations to Apply Evidence in Clinical Practice

The knowledge that underpins nursing practice defines the professional discipline and is central to nurses' unique contribution to patient care (Bottorff, 1991; Paley, 2001). Knowing how to interpret scientific findings strengthens clinical decision making and allows for more confident patient advocacy (Granger, 2001). However, integration of scientific findings into daily nursing care has been difficult to achieve and sustain (Melnyk, Fineout-Overholt, Gallagher-Ford, & Stillwell, 2011). Identifying and solving the barriers to using research in practice have long been the topic of nursing research (Fink, Thompson, & Bonnes, 2005; Funk, Tornquist, & Champagne, 1995). Work by Thompson, McCaughan, Cullum, Sheldon, and Raynor (2005) identified three reasons for nurses' failure to use research in practice: (1) gaps remain between skills and knowledge, creating barriers to successful knowledge transfer; (2) opportunities for consumption of new research-based knowledge are limited; and (3) access to findings in a

timely manner is difficult in the patient care milieu. Each of these, but particularly the latter two, reflects the reality of time constraints in the clinical setting. Time will always be a limitation, and high-quality patient care comes first. However, there is a need for data at the point of care as a means of improving the quality of what nurses do best (Pravikoff et al., 2005). While studies of how nurses translate research into practice have shown that nurses fail to translate for many reasons, primary among these is lack of knowledge of how to interpret scientific findings in the busy context of clinical care (Fineout-Overholt, Melnyk, Stillwell, & Williamson, 2010).

Despite participation and, in many cases, leadership of data-dependent forums, nurses in most clinical settings are not comfortable reading or interpreting research data. For example, nurses collect and monitor patient data in many forms, such as vital signs, response to pain medications, staging and progress of wound healing, and many other data points regarding patients' physiologic status, care delivery processes, and clinical and safety outcomes. Nurses are subsequently responsible for communicating these data to each other and to other team members in patient report. Nurses document and report patient care outcomes in many other forums as well, including quality assessment and evaluation forums, safety and process improvement initiatives, clinical practice committee reports, career ladder projects, Magnet applications, and others. However, despite being facile with data collection, documentation, and monitoring, nurses lack confidence when it comes to interpreting and integrating research data into patient care processes (Brown, Kim, Stichler, & Fields, 2010).

Mastery of the fundamental language required to communicate key information about data is not a requirement of most undergraduate nursing programs. As a result, nurses in clinical settings come into these positions unprepared to perform their best, not because they cannot recognize and use appropriate information but because they have not mastered the language required to communicate data related to patient outcomes. That is, what is taught in academic settings is not commensurate with what is expected from nurses in clinical settings.

When it comes to using evidence in practice, nursing professional development specialists have an opportunity to bridge the chasm between the academic and practice setting. In many academic settings, nurses are exposed to the information necessary to communicate clinical outcomes but are not expected to integrate the information. Most baccalaureate programs require some statistics, usually beginning with the theory of probabilities, exercises in coin flipping, and some application to clinical scenarios. Although curricula are now being revised to better integrate evidence-based practice courses, most nurses' educational preparation includes little more than exposure to statistical symbols and examples of how these symbols are applied in a research paper. Curricula fall short on two important counts. First, the rapid, compulsory interpretation of statistical symbols is not mastered, and as a result, data in a research report cannot be translated for application to the clinical setting in a timely or meaningful way. Second, clinical rotations in which students are expected to demonstrate applied clinical knowledge neglect to require or evaluate the ability to apply statistical knowledge in practical patient care situations. For evidence-based practice to become integrated into clinical practice, nurses need to be dependent on professional development in the clinical setting to master statistical "speaking" skills. These skills must be adopted and used in the clinical setting, reinforced by health system incentives, recognized by clinical education departments, and rewarded by peers and managers.

THE TOOLBOX

Being able to talk about the scientific basis or the rationale for recommended interventions requires an understanding of the meaning behind statistical symbols, or the language of data. Like the English language, the language of data is a simple system of word–symbol associations. Speaking the language requires learning these symbols and becoming familiar with their meaning. For example, *probability* is represented as p and means "the likelihood that an event will occur" or that a difference or association is not simply due to chance. Knowing what p means is important for communicating the significance of a specific finding in a study, although knowing how the *p value* was mathematically derived is less important. Nurses who care for patients may not use the symbol p regularly and often forget the meaning of simple symbols such as α, p, t, χ^2, or β. Learning to speak meaningfully about data can be considered analogous to learning any new language.

Similarly, statistics is a collection of letters and symbols that hold contextual meaning. Reading and speaking statistics begin, like any other language, as little more than word–symbol association. When nurses hear or see symbols such as p, they must learn the associated meaning, *probability* or *the likelihood that an event will occur.* If nurses think differently and consider statistical symbols as words, the symbol p is a "lexeme" or word in a "data lexicon" or data word dictionary. Symbols in this lexicon have meaning in the context of a statistical sentence.

Typically, a didactic approach to statistics begins by describing the characteristics that the data elements and the equations required to compute the "odds" or probabilities of an outcome. Formulas for the basic equations to derive statistical solutions or "answers" are often memorized. Although mathematically accurate, these equations lack meaning for many nurses and are difficult to apply in clinical practice.

In contrast, teaching the language of data using a comprehensive literacy instruction approach is less about grammar,

or the equivalent of the mathematical derivations of the statistics, and more about the meaning of the symbols for informing and improving patient care.

A short list of statistical symbols commonly used in research is shown in Table 1. If learning the language of data bears resemblance to learning the English language, it is logical that teaching the language of data in nursing professional development requires tools that mimic those used for English-language instruction. To follow this analogy, comprehensive literacy instruction encompasses a balanced

TABLE 1 Letters in the Data Language Alphabet

Symbol or Letter	Word and Phonetic Pronunciation	Meaning	Example in Context
H0	H null, ''Null hypothesis''	A hypothesis that the effect of the intervention to the desired outcome is zero (no effect).	''Hand washing has no effect on patient death rate.''
α	Alpha, ''alfa''	The level of significance; the threshold level on *p*, under which effect of intervention will be considered statistically significant, is set before the study begins.	''Since the risk of rejecting the true H0 described above is minimal, the conventional significance level of 5% is chosen for this study.''
β	Beta, ''bAta''	In a multivariable regression model, the ''weight'' or contribution that a single variable makes to the overall model	''With a *β* of −1.5 for average hand-washing time, we conclude that hand-washing time has the most significant effect on death rate reduction. Holding other variables constant, with every 1-minute increase in hand-washing time, the death rate is expected to decrease by 1.5%.''
p	Probability	The probability or likelihood, under the assumption of H0, that the collected data are observed	''Reported *p* value of .04 of the *t* statistic means there is only 4% chance obtaining the observed result if no real effect exists. Given the significant level of .05, we reject the null hypothesis of there is no difference on death rate between the hand-washing and non-hand-washing groups.''
r	Correlation ''*R*''	The correlation or ''sameness'' of two things	''The correlation *r* = .85 between average hand-washing time and hand-washing frequency of a nurse indicates that nurses who wash their hands more frequently tend to wash longer each time and vice versa.''
t	*t* test, ''tee'' test	A test of the difference between two groups or sets of data. These data must be continuously measured (e.g., 0–10) and able to be averaged (or have a mean).	''Telemetry systems were swabbed before and after cleaning with sodium hypochlorite wipes to evaluate organism colonization. Each randomly selected telemetry system was its own control (preintervention) and case (postintervention). Organism presence was analyzed before and after intervention using *t* test to determine if there is significant difference in organism counts between precleaning and postcleaning.''
χ^2	Chi-square, ''kI square''	(1) A test of the difference between two groups or sets of data. These data must be dichotomous or in categories (or able to have a median). (2) In a multivariable model, the ''weight'' or contribution that a single variable makes to the overall model	''Nursing scientists in a large urban hospital take a random sample of 6,000 patients and compare the days-before-readmission levels (within or beyond 30 days) of those who took antidepressants and those who did not. If levels of readmission days are independent of taking antidepressant, then the proportions at each level (within 30 days, beyond 30 days) should be equal. The chi-square test is used to determine if there is an association between taking antidepressants and levels of readmission days.''

emphasis on skill development and meaning-making activities. Skills required for the major reading processes include decoding, vocabulary comprehension, and skills to stimulate and motivate learners to engage in reading (Kruidenier, 2002). Making "meaning" of new words or statistical symbols is achieved through engaging learners in activities that build on prior knowledge, integrating tasks that require critical thinking, and presenting opportunities for real-world application of statistical word-use skills. Integrating skills-building and meaning-making strategies in a professional development program may improve the adoption of evidence-based practices. Ultimately, the constellation of strategies to develop skills and meaning must integrate evidence-based best practices to meet the needs of all learners.

Although nurses in professional development are not English-language educators, the opportunity and need to facilitate and support the development of staff in the use of evidence in patient care are high institutional and professional priorities. Professional development strategies to teach adults include the use of (1) implicit and explicit instruction techniques, (2) learning-style-based customization, (3) application of concepts in multiple contexts, (4) repetition, (5) multimedia methods, and (6) memory devices such as mnemonics (Kruidenier, 2002; National Reading Panel, 2000; see Table 2).

First, didactic content is provided in an online or live lecture format, with traditional, implicit opportunities for discussion and question-and-answer sessions. Short presentations featuring small segments of new information ensure early success and enthusiasm for the material and are more feasible to achieve in the time-constrained everyday life of patient care delivery. In addition, nontraditional, explicit

TABLE 2 Integration of Literacy Strategies in a Clinical-Practice-Based Data Language Program

Skill(s)	Integration Strategy	Rationale
Learning lexemes of the language of data		
Symbol recognition	1. Devise flashcards for each statistical symbol. Offer incentives for flashcard-based games in staff meetings or rounds; give small incentive or prize as a weekly drawing.	Memorization of new word–symbol association requires simple recognition and repetition.
	2. Find symbols in a scavenger hunt through articles.	Creative approaches add incentive and fun to repetitive exercises.
Lexicon	1. Use web-based tools to practice vocabulary (e.g., Quizlet; wordly wise).	Adult language learners benefit from structured repetition.
	2. Develop a standard line of postreading questioning using the "What? So What? Now what?" strategy to encourage critical thinking, reflection on personal integration of statistics language, and opportunities for further study.	The Experiential Learning Cycle emphasizes experiencing, reflecting, generalizing, and applying.
Speaking the language of data		
Reading fluency	1. Incorporate job aids, such as mnemonics, into active presentation and debriefing. For example, devise a statistical mnemonic and use it as a unit password for coupon-based incentives.	Mnemonic devices facilitate long-term recall.
	2. Use a mind-map drawing contest to stimulate staff diagrams of the statistical associations of symbols-words-meanings in context.	Reflection and debriefing serve to assist clinicians' integration of evidence in practice.
Application in practice	1. Collaborate in groups to design research studies with an emphasis on experimental design.	Students in study identified "applying the statistics in a research project" to be one of the three most effective learning tools.
	2. Interpret and present high-interest, real-world, nursing-related studies to or within small groups.	Students preferred working on real-world problems when learning to interpret data. Adult learners benefit from repetition in multiple contexts.
Begin each unit of study in the Language Series with live introduction, lecture, and question-and-answer format. Follow up with online or audio MP3 options and iPad applications where available.		

methods such as mind mapping (Kruidenier, 2002) may be used to individualize content, account for unique learning styles, and reinforce new content. For instance, the majority of nurses identify with a visual learning style. Mind mapping, a strategy that is popular among visual learners (Bradshaw & Lowenstein, 2010), incorporates the use of a diagram to represent associated concepts, words, or ideas. A mind map for the language of data might show a central box with a key word or idea, such as a directional hypothesis, and the related key words, ideas, or terms would be "mapped" or linked to and arranged around the central idea using lines and smaller boxes. Drawing links and associations on a map allows the learner to practice thinking and talking about ideas that are related to central statistical concepts.

Another, more traditional example of graphic representation is the use of flashcards displaying each of the symbols in Table 1. These cards may be on an electronic interactive screen, in PowerPoint, or on actual laminated cards. Using a gaming strategy and flashcards encourages healthy competition and can be a way to infuse fun and enthusiasm into learning the new language.

Auditory learners might benefit from listening devices such as a headset connected to the computer to allow staff to listen to a voiceover recording of the pronunciation of the symbol. Along with the meaning or definition of the symbol, the listener also hears the sound for that symbol when spoken. Recitations of the symbols themselves, such as taped audio or karaoke-style games, are then used with research study teams to practice recitation of the presented material (see Table 2). Using such a model incorporates simplicity and repetition strategies for learning the statistical symbols and their meaning.

Because adult learners are more likely to respond to learning new symbols and vocabulary in a meaningful context, teaching these skills is most successful when the symbols and words are identified with "why we need to know." For example, knowing how the symbols and words are practically useful in everyday patient care may best be presented using case examples (Thompson et al., 2005). To start creating a meaning-association link and reinforce the skill of symbol recognition, staff can be asked to find the symbols in nursing research articles so that they begin to recognize them in print and associate them with specific case scenarios. Such an exercise is a low-pressure and fun method for establishing symbol recognition and building on that to establish a meaning-association in context.

In the clinical setting, each of these strategies can be used in a multipronged approach to teach nurses word recognition, vocabulary, and reading fluency for mastery of a new language—the language of data. By applying a literacy model to statistics and incorporating principles of adult learning theory, evidence-based strategies can be used to teach statistics as a language that can be understood and spoken.

Speaking the Language: Implications for Practice

Dexterous use of the language of data helps strengthen the ability of staff nurses to discuss and use the evidence that supports nursing practice. Therefore, the clinical setting is a natural place to apply and exercise language skills. To begin application of skills, as shown in Figure 1, the professional development nurse uses strategies to facilitate staff learning of the symbol-associations. Next, staff are given an opportunity to think, practice, and demonstrate "speaking the language" by using or applying statistical symbols in the clinical setting. Practical support for using the language skills might begin with a patient-focused hypothesis or clinical question. Case studies of recent patient examples are also a good starting point.

Speaking a foreign language for the first time in a group setting can be intimidating because of the fear of using the vocabulary incorrectly. To increase nurses' comfort with this new skill, this new language can be practiced in safe environments with a mentor to confirm that the "language" is being spoken correctly. An example of this could be a unit-based research committee where the staff can find the symbols in a research article and then interpret them using a picture or diagram, such as the graph or table, and present this to the group. Allowing the staff to practice their learning in small-group activities both validates and directs their learning.

The clinical experience in patient care rounds presents an opportunity for "speaking" the relevant scientific findings and incorporating the symbols associated with meaningful, patient-specific data (see Figure 1). To follow this thought process with skills acquisition, the mentor or

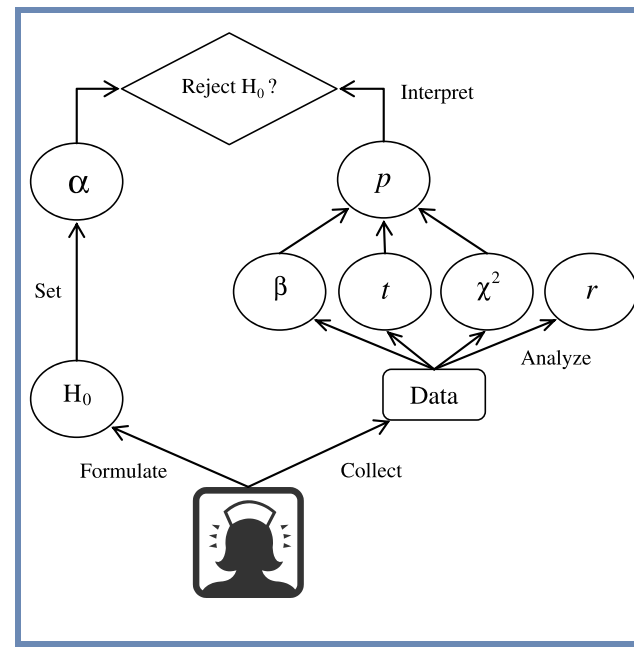

FIGURE 1 Visual representation of relationships among elements of the language of data.

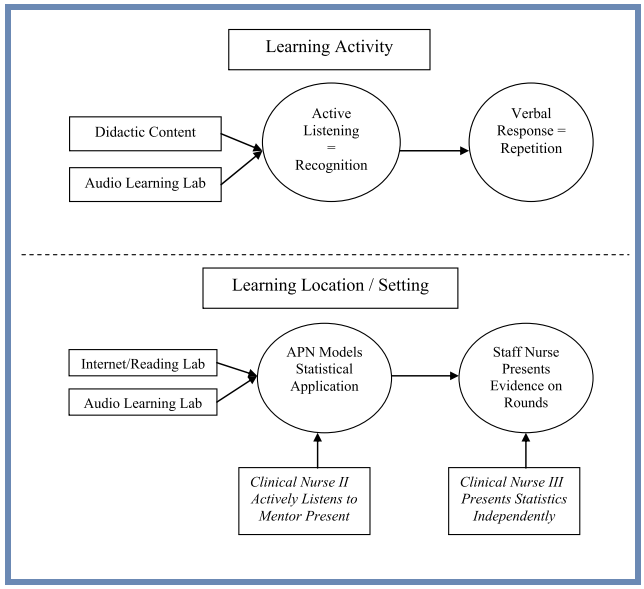

FIGURE 2 Applied learning of statistics in a professional practice model.

professional development nurse may select a strategy and activity for a new nurse to use to learn to "speak the data language" from Table 1. The mentor may practice applying the symbolic associations to the patient scenario with the new nurse, using these same statistical symbols in clinical practice (see Figure 2). For example, during the course of a patient presentation on morning rounds, the advanced practice nurse or research mentor may "present" the patient data on the status of the peripheral IV by describing the insertion date and key features of site assessment, as well as any changes over time, using reference guidelines from the Centers for Disease Control and Prevention for the recommended frequency of dressing change, and the statistical significance of increased risk of infection if dressing change lapsed. Repeated opportunities to demonstrate the application of statistical knowledge allow the nurse to speak in a meaningful way about the results of research or specific, real-time data related to the patient.

Opportunities for repeatedly using the language of data occur every day across numerous clinical settings (see Figure 3). For example, a staff nurse might practice evaluating and presenting the interpretation of selected articles in committee work, such as unit-based clinical practice committees or practice policy committees. By understanding the evidence behind nursing practice, the staff nurse can articulate more clearly why evidence may or may not support changes in policy that will improve patient outcomes. With practice, nurses learn the common themes of symbol–word associations and the patient contexts in which they apply, making the responsibility to speak meaningfully and clearly easier with each opportunity. Additional opportunities for integrating the language of data skills into professional practice or clinical ladder models are shown in Figure 3. These include (1) encouraging nurses to present patient scenarios to one another, using the statistical components of evidence that support nursing practice for the patient (e.g., journal club, research mentoring); (2) using small-group forums to present the statistical evidence in support of a generic patient care scenario, with a mentor or nurse educator in the clinical setting (e.g., clinical practice council); and (3) using multidisciplinary rounds as an ongoing, working stage for nurses to

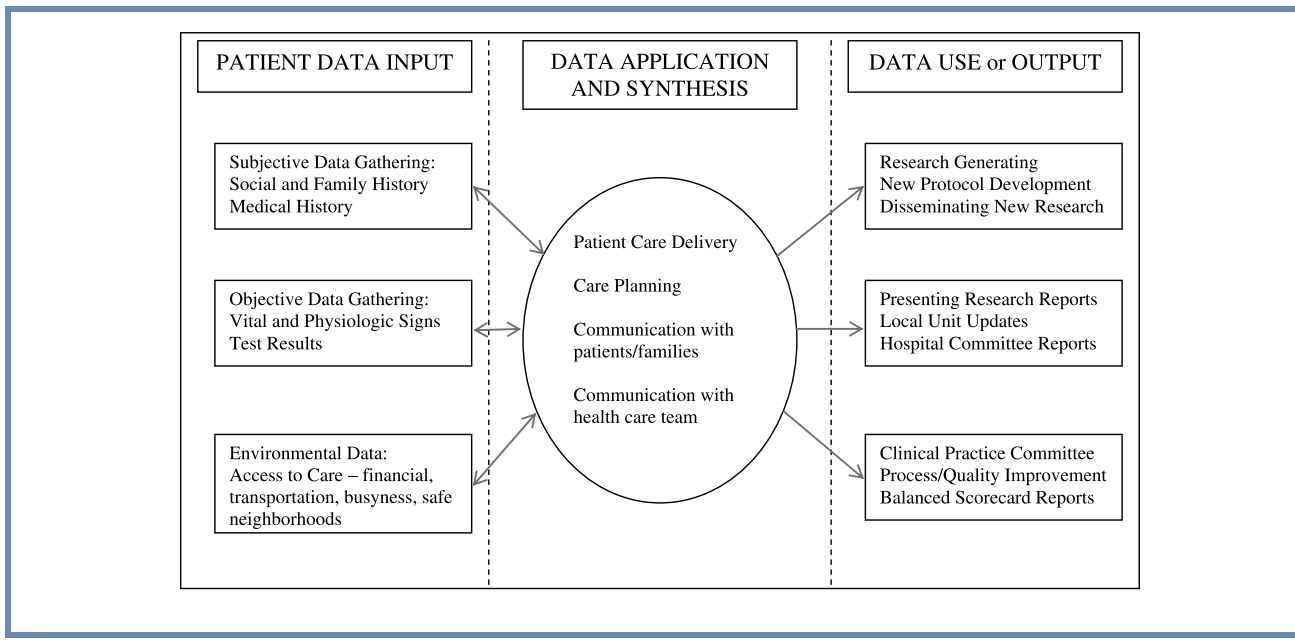

FIGURE 3 Communication paths in the clinical setting that require the data language.

present the existing evidence for nursing interventions and to communicate the nature and strength of the evidence using statistically meaningful terms.

With each of these approaches, nurses have an opportunity to present the patient problem and the suggested treatment plan in the context of research that supports that treatment plan. Opportunities such as these are a required component of the process of applied learning theory and, similarly, comprehensive literacy instruction. However, integration of these strategies and the many creative ways they might be applied in practice has not yet become a staple component of most nursing professional development programs.

CONCLUSIONS

For most clinicians, including nurses, statistics has been taught as a didactic rather than an applied science. If clinicians are expected to evaluate scientific evidence critically and apply that evidence in patient care, the symbols and words must be taught to make that evaluation possible and must have contextual meaning. Using a comprehensive literacy instruction approach to teaching the statistical language is a step toward better translation of science in nursing and may result in improved translation of science to patients and families.

References

Bottorff, J. L. (1991). Nursing: A practical science of caring. *Advances in Nursing Science, 14*(1), 26–39.

Bradshaw, M., & Lowenstein, A. (2010). *Innovative teaching strategies in nursing and related health professions* (5th ed.). Burlington, MA: Jones and Bartlett Publishers.

Brown, C. E., Kim, S. C., Stichler, J. F., & Fields, W. (2010). Predictors of knowledge, attitudes, use and future use of evidence-based practice among baccalaureate nursing students at two universities. *Nurse Education Today, 30*(6), 521–527. doi:10.1016/j.nedt.2009.10.021

Dickoff, J., James, P., & Wiedenbach, E. (1968). Theory in a practice discipline. II. Practice oriented research. *Nursing Research, 17*(6), 545–554.

Fineout-Overholt, E., Melnyk, B. M., Stillwell, S. B., & Williamson, K. M. (2010). Evidence-based practice step by step: Critical appraisal of the evidence: Part I. *American Journal of Nursing, 110*(7), 47–52. doi:10.1097/01.NAJ.0000383935.22721.9c

Fink, R., Thompson, C. J., & Bonnes, D. (2005). Overcoming barriers and promoting the use of research in practice. *Journal of Nursing Administration, 35*(3), 121–129.

Funk, S. G., Tornquist, E. M., & Champagne, M. T. (1995). Barriers and facilitators of research utilization. An integrative review. *Nursing Clinics of North America, 30*(3), 395–407.

Granger, B. B. (2001). Research strategies for clinicians. *Critical Care Nursing Clinics of North America, 13*(4), 605–615.

Kruidenier, J. R. (2002). *Research-based principles for adult basic education reading instruction*. Washington, DC: National Institute for Literacy.

Melnyk, B. M., Fineout-Overholt, E., Gallagher-Ford, L., & Stillwell, S. B. (2011). Evidence-based practice, step by step: Sustaining evidence-based practice through organizational policies and an innovative model. *American Journal of Nursing, 111*(9), 57–60. doi:10.1097/01.NAJ.0000405063.97774.0e

National Reading Panel. (2000). *Report of the National Reading Panel: Teaching children to read*. Washington, DC: National Institution of Child Health and Human Development.

Nightingale, F. (1863). *Notes on hospitals* (3rd ed.). Covent-Garden, London: Savill and Edwards Printers.

Paley, J. (2001). An archaeology of caring knowledge [Review]. *Journal of Advanced Nursing, 36*(2), 188–198.

Pravikoff, D. S., Tanner, A. B., & Pierce, S. T. (2005). Readiness of U.S. nurses for evidence-based practice. *American Journal of Nursing, 105*(9), 40–51.

Thompson, C., McCaughan, D., Cullum, N., Sheldon, T., & Raynor, P. (2005). Barriers to evidence-based practice in primary care nursing–why viewing decision-making as context is helpful. *Journal of Advanced Nursing, 52*, 432–444.

Watson, J. (1985). *Nursing: Human science and human care, a theory of nursing*. Norwalk, CT: Appleton-Century-Crofts.