10-1-2015

Science on a Shoestring: Building Nursing Knowledge With Limited Funding

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Accepted version. *Western Journal of Nursing Research*, Vol 37, No. 10 (October 2015): 1256-1268. DOI.

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Abstract: Building the science for nursing practice has never been more important. However, shrunken federal and state research budgets mean that investigators must find alternative sources of financial support and develop projects that are less costly to carry out. New investigators often build beginning programs of research with limited funding. This article provides an overview of some cost-effective research approaches and gives suggestions for finding other sources of funding. Examples of more cost-effective research approaches include adding complementary questions to existing funded research projects; conducting primary analysis of electronic patient records and social media content; conducting secondary analysis of data from completed studies; reviewing and synthesizing previously completed research; implementing community-based participatory research; participating in collaborative research efforts such as inter-campus team research, practice-based research networks (PBRNs), and involving undergraduate and doctoral students in research efforts. Instead of relying on funding from the *National Institutes of Health* (NIH) and other government agencies, nurse researchers may be able to find support for research from local sources such as businesses, organizations, or clinical agencies. Investigators will increasingly have to rely on these and other creative approaches to fund and implement their research programs if granting agency budgets do not significantly expand.

Keywords: nursing research, research design, research personnel

Nursing scientific inquiry had its origins in Florence Nightingale's efforts to reduce mortality rates during the Crimean War by analyzing patient conditions in military hospitals. Nurses are uniquely suited to conduct health care research because of their expertise in the organization and delivery of care to patients. In the last half century, nurses have enthusiastically embraced this responsibility and taken advantage of opportunities to conduct research and its practical application in clinical settings. Research by nurses has grown substantially in the United States, thanks to both an expanding pool of well-qualified PhD-level nurses and increased funding to support nursing research through the *National Institutes of Health* (NIH).

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Nursing research has been further facilitated by the establishment of the National Center for Nursing Research and subsequently the National Institute for Nursing Research. These agencies not only provide funding for research but also for training of nurse scientists.

The financial crisis of 2008 had a significant and lasting negative impact on funds available for research. The 2012 and 2013 Moody reports on the outlook for higher education, including academic health centers, predicted persistent fiscal limitations (Bogarty, 2013; Steingart & Tuby, 2012). Mandatory cuts to the NIH budget have reduced the size, number, and duration of federal grants awarded. Research productivity at academic institutions has also been affected by state budget cuts due to the 2008 crisis along with weakened public commitment to higher education (Hebel, 2014). Shrinking institutional operating budgets have decreased or eliminated internal funding for pilot projects and bridge funding for faculty between grants. In the absence of funds to hire teaching faculty and instructors and to support graduate teaching assistants, research faculty have had to shoulder increased teaching loads, decreasing time that can be devoted to research. Research progress has also been hindered by budget-related reductions in administrative and research support staff.

While the funding available for nursing research has declined, the need for research has continued to increase. The large demographic shift in the percentage of the population above the age of 65 due to the aging of the Baby Boomer generation means that there must correspondingly be an increased focus on gerontology and management of chronic illnesses associated with aging. The abundant evidence linking chronic diseases to unhealthy behaviors highlights the importance of investigations aimed at promoting healthier lifestyles as well as teaching patients already afflicted how to self-manage their illnesses and symptoms. Nurses are uniquely situated to conduct research in these areas. They are well-prepared to test interventions for managing chronic illness symptoms and initiating behavior change. And because they provide care to a diversity of patients in a variety of health care settings, nurses are the ideal researchers to address the efficiency, effectiveness, and safety of that care.

For nurses to continue to be productive researchers in the face of increasing budget constraints, nurses must discover new funding

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mechanisms, rethink existing research processes, and devise new approaches. This article provides an overview of strategies that can be used to conduct research at limited cost as well as identifies alternative sources of funding. Most of these strategies are more fully developed in the articles in this special issue of *Western Journal of Nursing Research* (*WJNR*).

The strategies summarized below will be helpful to new investigators beginning development of their research trajectory and nurses at research-intensive institutions who have not been successful in obtaining funding from conventional sources as well as nurses at teaching-intensive institutions who have some research responsibilities. Established researchers who have secured NIH grants or other public funding may also find some of these approaches useful for carrying out research not directly related to their funded projects.

Add Complementary Questions to Existing Research Projects

Complementary research questions can be added in the preliminary phases of projects before participants have been enrolled. Investigators can network with colleagues to identify research questions that could be addressed at the same time the parent study is being implemented. In many cases, the variables in the parent project can be linked to the new variables associated with the complementary research questions. For example, sibling health outcome variables could be added to a study examining the impact of parent caregiving support on chronically ill child outcomes.

This piggy-backing of research questions is predicated on researchers developing good connections with colleagues within the same department, on the same campus, or across institutions. The associations created when conducting the complementary project may in turn set the stage for additional collaborations down the line, including multi-center studies.

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Expand Team Research

The trend in biomedical research has increasingly moved away from the lone investigator toward a team-oriented approach. Team research permits a more cost-effective and efficient way of tackling complex, more expensive research questions. In nursing, the current team research model typically includes a principal investigator and several co-investigators who are nurses or in other associated health care disciplines; co-investigators might be located on the same campus or at different universities. In the latter situation, the project is considered to be centrally located at the principal investigator's home university, with co-investigators playing a much lesser role in project administration and management. In the past, this made sense from a practical standpoint because of barriers related to communicating in real time across geographic distance. In the present, web conferencing has facilitated communication to permit investigators to take a more equal and active role in project management.

Restructuring the team approach by expanding the composition and roles of specific team members is a strategy that can have a synergistic effect on knowledge acquisition and also potentially increase funding opportunities. The investigators invited to participate in a team project can be expanded to disciplines beyond the health care field. For example, family studies researchers could be logical collaborators for nursing research projects because many behavioral phenomena involve family dynamics. Child health nurse researchers may find valuable allies in colleges of education. Faculty in parks and recreation departments may be interested in research aimed at increasing physical activity. Nurses may even find collaborators in engineering or computer science; such faculty may be interested in designing devices or programs that would solve practice problems. It is important to note that the most successful inter-disciplinary collaborations require exploration of potential colleagues' expertise and interests during the design phase of a project rather than asking them to join the team after the fact.

Another way to encourage team research within schools of nursing is through strategic hiring of faculty who could contribute on team projects. For example, a school might want to develop a team

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emphasis on nursing home care and so would focus on hiring faculty who specialize in various aspects of gerontology.

To encourage faculty to participate in this more collaborative, active form of team research, universities will have to dispense with the entrenched notion of the lesser status of co-investigators compared with the principal investigator when evaluating faculty for tenure and promotion. University expectations for faculty will need to change for this kind of team science to take root and flourish.

Participate in PBRNs

Participation in practice-based research networks (PBRN) is another way that nursing investigators can conduct research more effectively and get access to additional funding. The PBRN is a unique type of collaborative research in which health care providers situated in multiple practices study health care problems in actual practice settings to generate knowledge generalizable to the practice arena (Strayer et al., 2013). Participation by nurses in PBRNs has the potential to facilitate more rapid translation of effective interventions into nursing practice (Baldwin et al., 2012). PBRN-based research projects are eligible for grant support from the Agency for Healthcare and Research Quality (Mold, Lipman, & Durako, 2012), and Clinical and Translational Science Award–funded academic health centers will often work in collaboration with community clinicians associated with PBRNs (Hayes & Burge, 2012).

Effective PBRNs rely on close communication to conduct studies across settings. To be successful working in a PBRN setting, research nurses must be prepared to work collaboratively with health care providers who may have limited research experience, and they must be skilled at managing the logistic and administrative complexities associated with conducting research at multiple clinical sites.

Conduct Secondary Analyses of Existing Data Sets

The proliferation of primary research has resulted in numerous data sets that can be analyzed to explore research questions not posed by the original investigators. Data sets are often difficult to replicate

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due to cost and participant availability, so data sharing can save researchers considerable time and money.

Although current NIH rules require investigators retain data for only a few years after completing the project, most investigators retain data for an extended time. At least two forces will make data sets more widely available to researchers. The NIH actively encourages sharing of data from grant-funded projects and currently mandates data sharing for high-budget projects (https://grants.nih.gov/grants/policy/data_sharing/data_sharing_guidance.htm). This mandate could be expanded to all NIH-funded studies at some future point (Piwowar & Chapman, 2008). Some health sciences journals request that authors make data available to readers and other researchers. Part of the original impetus for this policy was to allow other researchers to conduct their own analyses to validate findings in published research, but this requirement creates an opportunity to use the data to address new research questions. As more data sets become available, data use agreements to permit secondary analyses on these data may become more common.

Conducting secondary data analysis is not without its challenges. Quality of data sets may vary widely with regard to content, accuracy, and usability. Inadequate accompanying documentation about data set content and structure can hinder analysis and interpretation. If these challenges can be overcome, secondary analysis can be a valuable mechanism for building knowledge.

Utilize Patient Data in Existing Electronic Health Records

Electronic patient health records are another rich source of data for developing nursing knowledge. The conversion to electronic health records has permitted description and analysis of patient populations in a manner never before possible. Links between patient characteristics and clinical outcomes can be examined, and cost-effectiveness of care can be assessed because information is available on the types and costs of care provided to achieve outcomes. Sample

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sizes are large, so statistical analyses of comparisons of the effects of interventions on clinical outcomes will be adequately powered.

Some electronic health record data may be immediately analyzable from fixed-entry format information; other data will require extensive management. For example, text data may provide information not available in a fixed format. The process of creating an ontology to group and analyze such data is complex. Even in fixed-entry data, inconsistencies in data entry across settings make analysis of data from multi-site studies challenging.

Analysis and data management will simplify as information contained within electronic health records becomes more integrated and as data-mining methods are developed specifically for these types of databases (Raghupathi & Raghupathi, 2014). Research using electronic health records requires specialized skills not yet common among nurses. Moreover, nurses will need to be involved in developing systems to ensure they capture data about nursing care and patient outcomes related to that care.

Review and Synthesize Completed Research

Findings from individual primary research studies may have a limited impact on practice, and sometimes those findings seem to contradict one another, which leaves health care providers with unclear evidence for practice. Rigorous reviews that provide a comprehensive and critical summation of primary study findings therefore are another valuable research approach that can contribute substantially to knowledge development.

Narrative, integrated, and systematic reviews are all useful for summarizing findings from primary studies. However, meta-analyses and qualitative syntheses, such as meta-synthesis, are more useful for synthesizing data and explaining apparent inconsistencies in primary study findings. Given the vast number of primary studies on some topics, multiple reviews may have been published. In those cases, umbrella reviews—reviews of reviews—are an appropriate strategy for moving knowledge forward.

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Not only can reviews provide evidence for nursing practice, but they can also identify areas for future research to improve the efficiency of knowledge development. Research syntheses are the highest forms of the scholarship of integration (Boyer, 1996). Reviewing extant research requires advanced research skills. Although doctoral educational programs often require students to conduct reviews of the literature, the most useful reviews will be those conducted by faculty possessing an appropriate depth and breadth of expertise.

Use Online Communities and Social Media for Research

Use of social media has exploded in the last decade. Social media websites such as Facebook, Twitter, and YouTube can provide data for multiple kinds of research projects. Online communities with chats and discussion boards for different interests provide opportunities for innovative observational research on human behaviors and belief systems. The potential for health care-related studies is great due to the high number of online social networks that focus on specific health topics or diseases.

Data sets generated from social media sites and online networks pose special challenges from both an analytical and ethical standpoint. Data sets have the potential to be very large, and free text must be coded in a systematic manner to permit meaningful assessment. Fortunately, there is a growing literature concerning the management and analysis of social media data sets (Kim et al., 2013).

As with any kind of research, risks to participants as well as issues of privacy and confidentiality must be considered, and these will vary with the type of social media from which data are obtained. For example, an analysis of YouTube videos involves publicly available content and no interaction with participants. By contrast, data from Facebook profiles may not be publicly available and require the investigator to interact with participants. Information from Facebook pages or Twitter feeds may make it possible for participants to be identified. Strategies and practices for protection of human participants will need to evolve to take into account the social media

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environment. Researchers and institutional review boards for the protection of human subjects will have to carefully weigh the risks and benefits to ensure participants are protected from harm (Moreno, Goniu, Moreno, & Diekema, 2013).

Conduct Community-Based Participatory Research

Investigators have increasingly recognized the importance of involving community members in designing and implementing research projects. Community-based participatory research can investigate real-world problems in natural settings. Because community members have a greater personal involvement in projects, they are more likely to enroll as participants. In projects involving difficult-to-recruit participants, this can increase the likelihood of achieving an adequate sample size and can also cut down on the costs associated with the recruitment process.

Like participant recruitment, the process of data acquisition can be quite costly. The costs associated with data collection are reduced in those projects in which community members are also actively involved in the data collection phase. Although not all community-based participatory research is less expensive than traditional research, fiscally conservative designs are feasible in many cases. A high level of community involvement in research project design and implementation is generally only possible when investigators have previously established long-term relationships within the target community.

Execute Research With Local Entities

Researchers typically think of entities outside the university as potential sources of funding for the projects the investigator designs or as a location for recruiting participants. However, they can also be partners for research collaborations. For example, nearly all businesses are concerned about the health of employees. Many nurses investigate health problems that are common among employed adults such as hypertension, diabetes, and arthritis. Nurse scientists could team with local businesses to design studies that answer research

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questions while improving employee health. Other potential collaborators are self-help and support groups. Aggregate living arrangements for older adults and senior community centers also present opportunities for collaborative projects.

These types of collaborations will require investigators to create and sustain long-term relationships with local entities. Researchers used to conducting tightly controlled experiments will need to develop new skills in designing, conducting, and analyzing research conducted in realistic field settings.

Secure Funding From Local Businesses and Agencies

Most researchers look to national public and private institutes, foundations, and organizations to secure major funding for research projects. Extensive publicity about these sources fosters massive submissions. Competition for these awards is high, decreasing the likelihood of receiving funding. Investigators therefore may be well served by looking to more local sources to support their research projects.

Universities and colleges often have small pools of money sufficient to fund pilot studies or smaller projects, but off-campus resources should also be considered. A largely untapped source of research funding is the local business community. Many businesses prefer supporting local causes, and the high level of trust in nurses may facilitate that support. To determine what sorts of projects businesses might fund may require examining their pattern of donations to local causes. The necessary networking skills to develop financial relationships with business leaders are rarely taught in graduate school. Faculty may find university development staff to be especially helpful when packaging funding requests for local businesses.

Other possible sources of local funding are city, county, and state clinical agencies. Nursing faculty members often have existing relationships with these agencies, so they may be able to provide input to ensure that funding requests are tailored to match agency interests.

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Another possibility is to collaborate with agency personnel on research projects in areas for which the agency has budgeted funds.

Activate Collaborative Research Learning Opportunities

Currently, most nursing PhD programs require students to name a topic of study on entry, and early didactic work encourages students to pursue individual interests that may be completely independent from faculty projects. Modifications to nursing doctoral programs to increase collaborative research between students and faculty would facilitate faculty research productivity while better preparing students to conduct team-oriented research. In this regard, nursing PhD programs would become more like doctoral programs in the basic sciences in which students are encouraged or required to participate more fully in faculty research projects. Working on faculty projects allows students to understand the realities of planning, designing, conducting, analyzing, interpreting, and disseminating research beyond their individual dissertation work.

In programs in which students work on a faculty member's project, the requirement of independent research for dissertation projects is interpreted in various ways. Some schools require students to collect entirely new data while others recognize the value in asking new questions of existing data sets. As such, the definition of what constitutes independent dissertation research is much broader than is currently held by many nursing faculty.

Doctorate of nursing practice programs (DNP) are more flexible regarding final projects, possibly because these are newer programs with fewer established traditions. Possible group projects that teach both collaborative efforts and the field examination of phenomena of interest to nursing can move knowledge forward. Faculty designed group student projects may better prepare these graduates for their role in knowledge development and application in practice. With the relatively recent advent of the DNP degree, an exciting opportunity now exists for PhD and DNP students to collaborate on the same faculty research project, with the PhD student focusing on knowledge

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development and the DNP student concentrating on application of knowledge into practice.

Unlike in the basic sciences, undergraduate research experiences in nursing are uncommon. The Institute of Medicine Future of Nursing report asserts that practicing nurses should possess the skills necessary to analyze data from patient populations to improve care outcomes (Conn, 2012). However, these skills are often crowded out of undergraduate curricula by requirements for students to have clinical experiences in every specialty. Given the critical need to encourage more nurses to pursue graduate education, efforts to increase matriculation into PhD programs can be enhanced by getting undergraduates involved in the research process. For instance, undergraduates may be asked to assist with research study interventions and data collection as part of required clinical or research practica. Alternatively, they may be hired as research assistants and participate, under the guidance of a faculty mentor, as part of the research team in all aspects of the research process. Fundamental shifts in long traditions for undergraduate education, such as clinical experiences in every specialty, may be necessary to prepare them to meet Institute of Medicine standards, including having foundational research knowledge, skills in statistical analysis, and hands-on collaborative research experiences.

Implications of Alternative Research Strategies for Doctoral Education

Strong PhD programs have been remarkably successful in preparing nurse scientists to conduct research essential for improving practice. However, as the availability of major external research funding diminishes and emphasis on team-oriented collaborative projects increases, changes in doctoral program curricula will be necessary to ensure continued success.

Most importantly, the message—subtle or overt—that only NIH-funded research is of value needs to change. Many PhD programs specifically prepare students to compete for NIH funding, but as NIH funding becomes more difficult to obtain, students will need to have skills in designing projects that require less money. Many PhD

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programs focus on grant-writing skills; that focus must be expanded to include learning about strategies to conduct research on less or even no money. Programs of study could be developed that specifically emphasize fiscally conservative research strategies.

Currently, most dissertation projects reinforce in students the importance of autonomy when conducting research. Working on collaborative projects during doctoral education would better prepare graduates for current realities. Doctoral students could be provided the opportunity to collaborate with undergraduate students working on the same research project, preparing them for the role of mentoring and collaborating with undergraduate students in the future. Just as PhD programs of study are individualized based on dissertation topics, some programs of study could be tailored based on students' intended career paths. For example, in the past several decades, research on nursing education has been devalued to enhance patient-focused research. That was an important change given the early research over emphasis on nursing students. A more balanced approach with some valuing of nursing education research could ultimately improve patient care outcomes by better preparing nurses.

Other curriculum changes will be necessary to better prepare graduates to use the alternative research strategies described above. Students could gain experience in secondary analysis of existing data sets by working with faculty who possess data collected from previous studies. Courses could be offered that provide students opportunities to develop the skills necessary to work with electronic health records and other large data sets. Although many PhD programs require students to conduct a review of the literature, adding didactic content about review methods could better prepare graduates to write integrative and narrative reviews and conduct meta-analyses.

Conclusion

The need for research to inform nursing practice continues to grow even as the amount of public money allocated for that research continues to be inadequate to meet public health goals. Faced with an arid funding landscape, nurse scientists will need to find new and creative methods for cultivating their research programs. Embracing the opportunities in the midst of challenge is important as nurses

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strive to do what they have always done—find ways to improve care for their patients.

Article Notes

Declaration of Conflicting Interests The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Western Journal of Nursing Research, Vol 37, No. 10 (October 2015): pg. 1256-1268. DOI.