

Melanie S. Sorrell. Comparing Physician and Nurse Site Search Behavior within the North Carolina AHEC Digital Library. A Master's Paper for the M.S. in Library Science degree. April, 2012. 52 pages. Advisor: Jaime Arguello

The North Carolina AHEC Digital Library (ADL) is an electronic network of resources for in-state health care providers to easily access select medical and pharmaceutical information. A quick retrieval of subscription-specific content is available through a site search tool on the ADL website. A cursory review of transaction logs for website searching revealed a large number of failed patron search attempts, which prompted a study to learn how the site search tool is being used and what the ADL can do to improve search effectiveness. A comparison between physician and nurse search behavior from 2010 will be performed to see which factors yield successful and unsuccessful results, the average number of queries per subject session, and which resource links are used by patrons. The study outcome will guide menu changes to the ADL website to improve the site search experience for patrons.

Headings:

Database searching

Information-seeking strategies

Querying (Computer science)

Digital libraries

Medical informatics

Content analysis (Communication)

COMPARING PHYSICIAN AND NURSE SITE SEARCH BEHAVIOR WITHIN THE
NORTH CAROLINA AHEC DIGITAL LIBRARY

by

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Introduction

The North Carolina AHEC Digital Library (ADL) site search is an effective mechanism by which to locate licensed content through query submission. The study presented here was undertaken to evaluate the effectiveness of searching by physicians and nurses, the two occupational groups that are the focus of ADL outreach efforts and constitute the largest percentage of ADL members (M.B. Schell, personal communication, November 29, 2011). Using a transaction log analysis, common behaviors were assessed and coded to form categories that could be addressed individually. The outcomes may assist in planning changes and updates for the ADL website menu construction and learning how to better educate patrons to achieve more productive searches.

North Carolina AHEC Digital Library Background and Format

The North Carolina Area Health Education Center (AHEC) Program was created in response to needs for uniform delivery of health care across the state. It partners with academic institutions, health care agencies, and other organizations to provide resources for the health care industry's workforce demands (Johnston, 2007; McDuffee, 2000; "North Carolina AHEC – Mission," 2011). A crucial part of this mission is the North Carolina AHEC Digital Library which provides biomedical information through an user friendly single portal. The ADL allows remote access outside of physical library space by

providing an electronic network of resources and services designed to assist North Carolina health specialists with their professional information needs (McDuffee, 2000; Schell, 2003). The website offers electronic books and journals and aggregates links to evidence-based medicine (EBM) databases, continuing education materials, drug formularies, and electronic bibliographic databases (See Appendix 1). Primary vendors are Ovid, Swets, EBSCO, and Elsevier (Flake, 2010; “North Carolina AHEC Library - Resources,” 2011). Many of these materials serve as key tools in the practice of EBM, choosing the best evidence to inform clinical decisions (Hersh, Stavri, and Detmer, 2006). Some may use ADL for clinical fact-finding and others find it valuable for research.

The titles for select materials may be quickly found by patrons through a site search, which functions as a navigational tool for the ADL website. The success rate for retrieved results for this tool is unknown, but a brief review of the ADL Structured Query Language (SQL) database transaction logs showed that many keyword submissions yielded no results (i.e. “0” hits) (M.B. Schell, personal communication, December 2, 2011). If a query is ineffective, then the patron might not acquire the desired results (M.B. Schell, personal communication, September 1, 2011). The reasons for these low outputs are the focus of this study and the conclusions will signify ways to improve the search process for ADL patrons.

The ADL began in September 2000 as a portal to licensed content for University of North Carolina (UNC) - Chapel Hill medical student trainers (i.e. preceptors), faculty, staff, medical residents, and community health practitioners (M.B. Schell, personal communication, September 1, 2011; Schell, 2011). Thirty-seven hospitals are paying

consortium members of the ADL and at least one even integrated the ADL into its electronic medical record system for more direct access for clinicians (Flake, 2010). Additionally, ADL sells individual memberships to health care workers unaffiliated with hospitals. The ADL has about 19,000 members with at least 4,061 physician and 7,607 nurses. These numbers exclude the non-members who use hospital computers without a log-in password and the patrons who have an institutional membership password. Counting those accessing content through institutional memberships, there are approximately 66,000 potential patrons. The number would be higher if the tally included anyone (e.g., non-members) using the ADL site through internet access (M.B. Schell, personal communication, September 1, 2011; November 29, 2011).

A privacy policy link, located at the bottom of the ADL homepage, explains that the ADL collects information on the user's web browser automatically. The patron IP address, computer browser type, and search terms are stored in the ADL SQL database, along with the time of day the patron logged into the ADL site and the linked content viewed on the site. The data is used by the ADL to facilitate collection development, promotion, and product development ("North Carolina AHEC Digital Library - Privacy," 2011). Session logins are classified as the time a session began (i.e. when the user name and password were entered) (Schell, 2009). When a member logs into the site, the ADL webpages present resources that are matched to a particular membership (Schell, 2011). Basic resources are available to those "guests" who visit the webpage without logging into the site.

Located at the top right-hand corner of the ADL home page is a dual function box for both federated (the ability to search across multiple sites simultaneously) and ADL

site searches. The site search box, a single repository search engine, was added in 2005. Site search is selected via a radio button and searches publisher names, ADL-assigned health categories, and names of resources (e.g., book titles, journal names, and database names, names of websites), and words in URL strings. Links to those items are provided, if found. When the search results display, they are listed alphabetically under their resource group (See Table 1), but are not ranked according to relevancy. The lists of the resource types remain static on the page.

Table 1

1	Databases
2	Journals
3	Books
4	Practice guidelines
5	Continuing Education
6	Websites
7	Mobile
8	Clinical Answers
9	Clinical Trials
10	Journal Collections
11	Libraries
12	Patient Education

If results (i.e. 0 “hits”) are not obtained, an explanation is automatically given as to how the search could be adjusted as in Figure 1. There is not a separate list of instructions for the site search box on the ADL homepage that a patron may read prior to beginning a search.

Figure 1

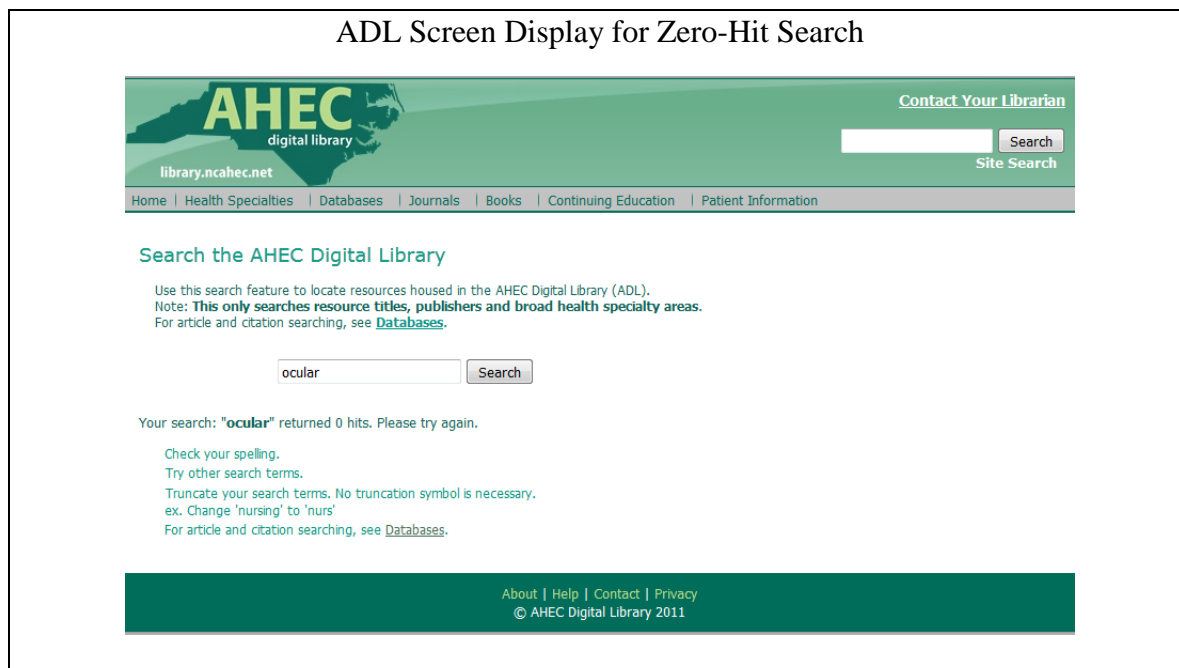


Figure 2 is an example of what the patron sees for a results list. The “note” reminds patron that the search involves journal titles, not article titles or author names. The resource links take the patron straight to the licensed content, such as, the *New England Journal of Medicine*.

In addition, Table 2 provides a clearer picture of how data are stored in the SQL transaction log. The nurse with the Name ID of #12415 attempted twice to find results related to “C-reactive proteins.” Both of these queries are too specific for the site search, as there is no journal title or text that is on ADL's book list with that exact text. The next nurse (#15042) was more successful when the search was broadened to “cancer,” which yielded 43 results. From those results, three links were clicked on, also known as link-


outs. Physician #332 reformulated the search term to a journal title recognized by the ADL database. As the associated LoginID #881123 is followed down the column, it shows that the link was clicked a second time after Physician #36468 logged-in and began searching.

Figure 2

ADL Screen Display For a Search Returning Nine Results

The screenshot shows the AHEC Digital Library search results page. The header includes the AHEC logo, the URL library.ncahec.net, and navigation links for Home, Health Specialties, Databases, Journals, Books, Continuing Education, Patient Information, and Logout. A search bar is present with the text 'TRALI' and a 'Search' button. Below the search bar, the results are organized by resource type: Journals, Practice Guidelines, and Websites. The Journals section lists five items: Australian & New Zealand Continence Journal, Australian Journal of Advanced Nursing, Australian Journal of Medical Herbalism, Australian Journal of Rural Health, and Australian Nursing Journal. The Practice Guidelines section lists one item: Providing Care to Patients from Culturally & Linguistically Diverse Backgrounds: Guidelines to Practice. The Websites section lists two items: Checklists for Cultural Assessment and Multilingual Mental Health Information. The footer contains links for About, Help, Contact, and Privacy, along with the copyright notice © AHEC Digital Library 2011.

ADL Screen Display For a Search Returning Nine Results



library.ncahec.net

Contact Your Librarian

Article Search Site Search

Home | Health Specialties | Databases | Journals | Books | Continuing Education | Patient Information | Logout

Search the AHEC Digital Library

Use this search feature to locate resources housed in the AHEC Digital Library (ADL).
 Note: **This only searches resource titles, publishers and broad health specialty areas.**
 For article and citation searching, see [Databases](#).

Your search: "TRALI", returned **9** hits. These are organized by the following resource types:

[Journals](#) | [Practice Guidelines](#) | [Websites](#)

Journals

[top](#)

- [Australian & New Zealand Continence Journal](#) Ebsco
- [Australian Journal of Advanced Nursing](#) Ebsco
- [Australian Journal of Medical Herbalism](#) Ebsco
- [Australian Journal of Rural Health](#) Ebsco 1
- [Australian Nursing Journal](#) Ebsco
- [Journal of the Australian Traditional-Medicine Society](#) Ebsco

Practice Guidelines

[top](#)

- [Providing Care to Patients from Culturally & Linguistically Diverse Backgrounds: Guidelines to Practice](#)
Queensland Health (Australia)

Websites

[top](#)

- [Checklists for Cultural Assessment](#) Queensland Health (Australia)
- [Multilingual Mental Health Information](#) Australian Government Department of Health & Aging; Multicultural Mental Health Australia

[About](#) | [Help](#) | [Contact](#) | [Privacy](#)
 © AHEC Digital Library 2011

Table 2

ADL Transaction Log							
SiteSearchId	LoginID	SiteSearchDate	Search Terms	Hits	NameID	Occupation	URLName
54912	880285	1/1/2010 2:36	C-Reactive Protein in neonates	0	12415	Nurse	
54913	880285	1/1/2010 2:36	C-Reactive Protein	0	12415	Nurse	
54914	880306	1/1/2010 8:46	prostate cancer	0	15042	Nurse	
54915	880306	1/1/2010 8:46	prostate	0	15042	Nurse	
54916	880306	1/1/2010 8:46	cancer	43	15042	Nurse	
54917	880306	1/1/2010 8:47	cancer prostate	0	15042	Nurse	
54918	880306	1/1/2010 8:47	cancer	43	15042	Nurse	
54918	880306	1/1/2010 8:48				Nurse	Cancer Fact Sheets
54918	880306	1/1/2010 8:48				Nurse	Cancer Topics
54918	880306	1/1/2010 8:48				Nurse	American Journal of Clinical Oncology (archival access only)
54950	881123	1/4/2010 11:37	the journal of trauma	0	332	Physician	
54951	881123	1/4/2010 11:38	Journal of Trauma	4	332	Physician	
54951	881123	1/4/2010 11:38				Physician	Journal of Trauma: Injury, Infection, and Critical Care
54953	881126	1/4/2010 11:42	journal womens health	0	36468	Physician	
54954	881126	1/4/2010 11:42	journal of womens health	0	36468	Physician	
54955	881126	1/4/2010 11:42	womens health	7	36468	Physician	
54951	881123	1/4/2010 11:44				Physician	Journal of Trauma: Injury, Infection, and Critical Care
54976	881473	1/4/2010 14:32	trali	11	33948	Physician	
54977	881516	1/4/2010 15:02	essential evidence plus	0	44723	Physician	

Key
Site search ID = Identification for each entered search term or query.
LogIn ID = Identification automatically assigned to member upon log-in. A different number will be assigned upon subsequent logins.
Site Search Date = Date and time of day (military time) for each action.
Search terms = Queries entered by patron to search ADL content.
Hits = Number of results acquired.
Name ID = Permanent identification of ADL member.
Occupation = Nurse or physician member.
URL Name = Title of link clicked by patron.

A federated search tool was added on January 1, 2010 to the ADL. Unlike the site search, which is equivalent to a website map, the federated search scans across the ADL and internet for text within journal articles and databases. Members may choose either tool, but must use different types of queries to search each one successfully because of the content that is delivered. After a quick appraisal of the site search transaction logs revealed an unanticipated high number of queries without ensuing results, ADL administrators believed it would be useful to learn what types of queries were being

submitted in the site search box. If any of those queries are more appropriate for the federated search, patrons could be better educated about these two different options and changes be proposed for the website.

This research is a system evaluation based on patron interaction data comparing queries of physicians to those of nurses over a period of 12 months and reviewing the corresponding search results. This statistics are important to the ADL because site search has a valuable function which displays results according to resource type for easy assessment by patrons and must be used correctly to achieve patron satisfaction.

Two occupational groups are the subjects of this study – physicians and nurses. They are chosen because physicians and nurses comprise the largest percentage of ADL members, are targeted for outreach efforts, and the ADL wants to increase usage of resources for these particular healthcare professionals (M.B. Schell, personal communication, November 29, 2011; M.B. Schell, personal communication, March 27, 2012). By examining query choice aligned to these two occupations, new ADL resource groups may be created and the order of these groups altered on the website. Such changes would save health professionals time and would direct them towards a more useful search result. Depending upon the research outcome, the ADL may adjust the display layout according to the profession of the patron. Instructions for improved site searching could be added to the site as a link (M.B. Schell, personal communication, August 29, 2011).

This research is a somewhat different from most published studies about biomedical literature searching by clinicians in that it examines search for limited content. A number of inquiries, other than Online Public Access Catalog (OPAC) usage,

concentrate on how health care personnel develop a clinical question, narrow their searches, and access journal articles or abstracts from search engines or other information retrieval systems (Chambliss and Conley, 1996; Dee and Stanley, 2005; Doig and Simpson, 2003; Hersh, Crabtree, Hickam, Sacherek, Friedman, Tidmarch, Mosbaek, and Kraemer, 2002; Westbrook, Coiera, and Gosling, 2005). If already familiar with this type of federated searching, physicians and nurses may employ this strategy for the ADL site search box and not receive the results they need with this finding aid.

Search success is defined for the purposes of this project as returning one or more hits upon data entry. Further success is considered when a (Uniform Resource Locator) URL is clicked.

Librarians are the primary audience for this paper, as they are providing requested evidence to patrons in clinical settings (Eldredge, 2000) and creating vertical search engines for targeted content, as in Bracke, Howse, and Keim (2008). This investigation contributes to the evidence based medicine community by revealing ways health professionals search within a site for licensed content and suggesting how to achieve a successful outcome when using such a tool. This, in turn, will help guide librarians in the functional and visual design of the ADL website and in the teaching of ADL workshops for health care staff. This investigation will add to the scant literature comparing how physicians and nurses achieve favorable outcomes when pursuing information within a subscription-only digital library.

Research Questions

1. Is the search experience different between physicians and nurses when using the North Carolina AHEC Digital Library site search tool? How might the ADL site search tool contribute to a failed attempt to retrieve results? Is one occupational group more likely to commit certain types of errors? Is one group more successful than the other? What normally leads to failure (e.g., misspellings, lacking a subscription for a particular journal, author name, article title, or a query too specific for a site search)? Are unsuccessful queries re-entered by the patron?
2. Which occupational group uses the ADL site search tool more frequently – physicians or nurses? How many subject sessions were submitted during the sample time of January 1, 2010 to December 31, 2010? How many links are typically clicked by each occupational group? Which links are clicked and sites visited?
3. Are a minority of patrons using the site search box so frequently that they may skew the data?

Related Work

My literature search and review of relevant literature uncovered only a few articles comparing the search success of physicians to that of nurses within a database. A broad search was performed between August 2011 and March 2012 using the keyword phrases “North Carolina AHEC Digital Library,” “query analysis,” “transaction log analysis,” “content analysis,” “digital library,” “library transaction log analysis,”

“information retrieval,” “physician AND search,” and “nurse AND search” in the Library Literature & Information Science index, the Library and Information Science Abstracts index, CINAHL, MEDLINE, and Embase for relevant articles published between 2000 and 2012. “Physician AND nurse searching literature” entered into MEDLINE retrieved a review article from the limited realm of comparing physician to nurse search success for online internet-based evidence (Younger, 2010). “Physician nurse search information” was used in Google Scholar. The “Content Analysis” chapter in the UNC-CH School of Information and Library Science “Research Methods” course textbook, *Applications of Social Research Methods to Question in Information and Library Science*, listed several articles that were helpful in providing a basis for how the content analysis might be structured for the master paper’s methodology. Additional publications were discovered in the reference sections of several articles mentioned above through this “snowball” or “chaining” method and others were kindly given to me by my Master’s paper advisor, Dr. Jaime Arguello.

Literature in four main areas was acquired to inform the methodologies used in this project, which included material on resources used by physicians and nurses for clinical decision assistance, data preparation, data selection, and content analysis. Journal articles, book chapters, and other master’s papers provided excellent background to better understand information-seeking behavior on the internet, in personal libraries, and through academic library catalogs.

During the course of the day, physicians generate a number of questions spanning patient diagnosis and treatment to specific information about drugs (Alper, Stevermer, White, and Ewigman 2001; Chambliss and Conley, 1996; Ely, Osheroff, Gorman, Ebell,

Chambliss, Pifer, and Stavri, 2000; Gorman, 2001). An example of this is where Chambliss and Conley (1996) categorized family practice physician questions over 217 half-days as adult medicine, pediatric, gynecologic, and dermatologic issues and learned that finding answers can be expensive tedious. Librarians can play a key role in creating more efficient ways to address the expediency of a literature search.

A number of studies determined the resource needs of physicians and nurses. What was found was that these clinicians relied upon journals, textbooks, colleagues, drug reference manuals, educational activities, protocol manuals, personal libraries, and electronic databases to address their queries. Preferences were dependent upon familiarity with electronic searching, library proximity, availability of colleagues, and whether the clinician practiced in a rural or urban setting (Barta, 1995; Cogdill, 2003; Curtis, Weller, and Hurd, 1997; Dee and Stanley, 2005; Fakhoury and Wright, 2000; Gorman 2001; Pyne, Newman, Leigh, Cowling, and Rounce, 1999; Rasch and Cogdill, 1999; Urquhart and Davies, 1997).

Similar resource preferences and use among physicians and nurses were highlighted in Andrews, Pearce, Ireson, and Love (2005) and in Doney, Barlow, and West (2005). Query formulation or success was not examined. Younger (2010) published a review of how online tools were used by physicians and nurses to search for information in the healthcare environment, along with availability of computers and knowledge of tools designed for the hectic clinical wards. A systematic review aimed at determining how library services support clinical decision-making and the effect information had on patient care (Weightman and Williamson, 2005). Hersh, Crabtree, Hickam, Sachereck, Friedman, Tidmarsh, Mosbaek, and Kraemer (2002) designed a

study to compare the ability of medical and nursing students to choose correct answers using MEDLINE. Findings included that after database searching, the medical students chose correct answers to clinical scenarios more frequently than the nursing students. Previous experience with MEDLINE and spatial visualization skill attributed to locating the needed literature, making appropriate assessments using retrieved information, and applying what was learned to answer questions accurately or convert incorrect answers to a correct answer.

According to a study by Huntington, ten seconds tends to be the maximum amount of time a user will spend on a home page to locate the topic of interest before ending or amending the search (Huntington, Nicholas, and Warren, 2004). Having this knowledge, in combination with the realization that busy physicians in particular do not have much time for query reformulation, it is important that the ADL site search results be accurate and relevant (Merry, 1997). The ADL wants to increase site search satisfaction. Once it is established how physician and nurse patrons are searching and what obstacles are encountered, the ADL librarians can make changes to enhance the retrieval process.

Many primary care physician questions can be satisfactorily answered by electronic databases (Alper, Stevermer, White, and Ewigman, 2001; Chambliss and Conley, 1996). A comparison of health information databases used by nursing students and clinical nurses was conducted by Dee and Stanley (2005) and found that the most popular resources were CINAHL, PubMed, cancer.gov, and MEDLINEplus. Of the large biomedical literature databases, MEDLINE is often chosen first by health professionals to begin their searches due to its extensive coverage of the biomedical literature and because

citations are made possible at no cost through United States tax-payer funding (Cleary, Hunt, and Horsfall, 2009; “NCBI – Copyright and Disclaimers,” 2009; Wong, Wilczynski, and Haynes, 2006). Multiple databases should be explored if a comprehensive search is needed to ensure biomedical and clinical journals are accessible (Allen, Jacobs, and Levy, 2006; Grajek, Calarco, Frawley, McKay, Miller, Paton, Roderer, and Sullivan, 1997). The ADL offers links to many different resources for its guests and member patrons.

Strategies used for other databases are not always appropriate for the ADL site search. Since indexing methods and thesauri differ between databases, strategies used for MEDLINE should not be directly reproduced for other databases (Wong et al., 2006). As with MEDLINE, it is easy to become too specific with a site search (Vincent, Greenley, and Beaven, 2003). MEDLINE and Google-type search strategies submitted to the ADL site search box would lower the chances of finding desired material since journal article titles and author names are not indexed for the ADL site search tool.

Transaction logs are valuable for research purposes when analyzing web-based systems with an evaluation process consisting of data collection, preparation, and analysis (Jansen, 2006). A transaction log (i.e., web log, transaction file) is a file which captures the communications between that system and the person searching for information in that system (Jansen, 2006). As data files form the basis of a physical or digital library’s collection, librarians and information scientists study ways in which the data are searched and retrieved to appraise library services and resources.

Measuring the effectiveness of library services pinpoints where time should be spent implementing changes around the physical library space or modifying the digital interface. Unless a patron brings a problem to the attention of the library staff or an evaluation is performed, administrators may be unaware of service limitations. Moulaison (2008) and Ciliberti, Radford, Radford, and Ballard (1998) considered the reasons for unsuccessful searches conducted by patrons. When librarians at the College of New Jersey wondered if their OPAC needed to be updated and how it might fit into a new website, Moulaison initiated this study at a medium-sized academic library. Ciliberti et al. (1998) raised concerns about the patron's ability to use electronic tools satisfactorily and with material availability after using the OPAC. These inquiries looked at whether patrons use simple queries or the advanced search and to gain insight into why some patron searches are unsuccessful due to misspellings or typographical errors. Server transaction logs were manipulated and the number of terms used in keyword searches, the success rate of finding the desired item, and the use of advanced features were revealed. Focus was directed to patron responses to failure. It was learned that patrons usually submit 1-3 terms to an OPAC search box, rarely read instructions, infrequently implement Boolean operators, and use limits 10% of the time. On the other hand, making physical searching more difficult, items are not always shelved correctly by either library staff or patrons returning those items in the stacks (Moulaison, 2008; Ciliberti et al., 1998).

Since one of the major questions for the ADL project is the examination of failed searches, the information contained in these articles will be helpful when constructing approaches to evaluating problems which patrons encounter when using the ADL site

search box. As in the Moulaison (2008) study, a Microsoft Excel spreadsheet will work nicely for the ADL study as a relational database of extracted data.

Transaction logs were also manipulated by Liu (2010) and Villen-Rueda, Senso, and Moy-Anegon (2007) when evaluating search interfaces and options in a university library OPAC. The articles provided statistical evidence about simplifying basic search boxes, choosing default settings, and identifying whether browsing or analytical searches are performed more frequently by patrons. Web server transaction log data were filtered to identify the useful search query string patterns and queries were run to fulfill field assignments. Data were stratified by Liu into three different usage groups by search frequencies (e.g., 5; 5-100; 100< searches). Not surprisingly, most patrons preferred default settings in the basic search interface and used only one search box. Statistical analysis of Villen-Rueda's results was performed with the chi-squared test as well as in the Sokoloff (2006) study of the NC Health Info index on improving search success through taxonomy simplification. Delving further into the reasons for ineffective searches, Peters (1989) calculated that, typographical errors, together with misspelled words, accounted for over 20% of input errors. Less than 1% demonstrated a lack of clarity about the general structure of the database. Methods of data collection, preparation, and analysis presentation in those studies will serve as templates for the approaches to classifying data in the ADL project.

Voluminous amounts of data are possible when extracting the anticipated information from database transaction logs, but Nicholas and Huntington (2003) presented their case for micro-mining, which uses a sample from the total amount of data as a useful representation. Tracking smaller numbers of database users or library patrons

allows for a closer scrutiny of user characteristics and through this micro-mining, may give a more accurate view. Applying this theory to ADL content analysis, a characteristic sample of physician and nurse search sessions will be extracted from a twelve-month sample. Replicating some of the methodologies from this article, the number of sources viewed through link-outs and a representative number of users will be tallied.

Huntington, Nicholas, and Warren (2004) utilized transaction log analysis to support the hypothesis of whether health website searches increased when topic visibility was improved on homepage menus. The prominent menu item links were clicked more frequently. Digital visibility was proven to be essential in determining how to keep the attention of website visitors. As ADL resource groups are listed in the same order each time, regardless of relevancy, this could affect which links are being clicked by ADL patrons.

Huntington and Nicholas (2006) recognized that some website menus are inadequately constructed to demonstrate available content. Therefore, patrons, who do not look past the top two results, will often leave the site dissatisfied. Search expressions in query logs spanning 12 days were analyzed to develop a user-centered menu for a particular topic of diabetes. The top 20 search strategies were found, categorized, and compared to content menus for three separate websites. None of the websites contained all categories in their menus, meaning that only about one third of inquiries were met and many patrons must go elsewhere for their answers about diabetes. A new six-point menu was proposed for these websites that would comprise the top categories in these query submissions. These studies establish the importance of adding design features in ADL to aid in navigation.

This study employs similar methodologies to those used by Huntington and Nicolas (2006) by linking transaction log data with website menu construction. Comparable fields in extracted files will be utilized when data is extracted from the ADL server. Also, keyword terms are classified in a manner similar to that used by Huntington et al. (2006), albeit on a smaller scale. As a new menu was proposed in the article, a similar approach is used by considering new ADL resource types for altering placement in the results list. One method employed by Huntington and Nicholas (2006) was to follow an individual as their search was conducted on the internet and British Broadcasting Corporation health websites for multiple sessions. Although user identification would allow for following individuals over a long time period, it is beyond the scope of this project, but could be implemented for future studies.

As previously mentioned the ADL site search box retrieves item titles and groups them according to resource type. A relevancy ranking might be helpful to ADL patrons who require rapid and pertinent responses. Foust, Bergen, Maxeiner, and Pawlowski (2007) described a tool that was built at the University of Pittsburgh's Health Sciences Library System to search the full-text of 2,500 book titles in one easy step. Results were narrowed through clustering technology where a clustering engine placed results into hierarchical folders.

Coding for keyword changes in transaction logs, as described in Lau, Coiera, Zrimec, and Compton (2010), will serve as a template for evaluating searches with zero hits in the ADL database. Word order, inappropriate conjunction insertion, or word spacing are examples of syntactic reformulations that were found in the Lau et al. (2010)

study, in which participants answered questions in clinical scenarios. Keyword substitution, addition, or deletion represented semantic reformulations.

A database with content similar to that of the ADL is the Turning Research Into Practice (TRIP) meta-search engine used throughout the United Kingdom and internationally (Meats, Brassey, and Heneghan, 2007). When the system was examined by an independent authority for the purposes of improving the database, a count of unique terms or unique phrases was made. Selecting the best evidence for a clinical case begins with formulating a clinical question (Hersh, Stavri, and Detmer (2006). The Meats et al. (2007) report discovered that most clinicians use a single term, avoid Boolean operators, and require more training in formulating a clinical question. These characteristics may be helpful when using the ADL site search tool because results are limited to titles of journals, books, databases, among others, and do not extend to article titles or text in the body of the work.

Methodology

A mixed-methods approach is used to evaluate how search behavior differs between occupations. Data downloaded from the ADL SQL database is assessed through quantitative design to calculate numeric totals of queries and subject sessions. I am the only one conducting the content analysis and use qualitative methods to gather textual information and interpret queries to learn about which factors affect searching the ADL website. Employing additional coders is not an option for this project due to time and budget constraints, though the research might be strengthened if multiple coders could analyze the data.

As mentioned in the Zhang and Wildemuth (2009) chapter on “Qualitative Analysis of Content,” I look for patterns using inductive analysis for the queries. My health sciences background helps in the interpretation of what the physicians or nurses were trying to find, more than if I had not worked in a clinical setting. Conventional qualitative content analysis drives the development of coding categories.

All the data are de-identified, so an exemption by the UNC-CH Office of Human Research Ethics Institutional Review Board (IRB) was granted (study # 12-0214). As mentioned earlier, the ADL Privacy Policy alerts website patrons that their entries are stored for use by ADL staff, so all patrons are considered duly informed.

Member queries submitted between January 1, 2010 and December 1, 2010 to the ADL site search box are de-identified by ADL information technology staff and transferred from the SQL database to an MS Excel spreadsheet. Along with queries (i.e. search terms) the following information is also available in the spreadsheet, member login date and time, identification number for each login session, number of hits for each query, and title of the link the patron clicked on after results were provided. Data belonging to patrons of occupations other than physicians and nurses are filtered and excluded from analysis. The total number of queries submitted within the set data range will be realized using the summation feature in MS Excel.

Subject sessions are determined manually by grouping the log-in session queries by subject. If the patron changes the topic, there may be multiple search sessions (i.e. subject sessions) that occur within one log-in session. In that event, the first topic is analyzed.

A sampling pattern of every tenth subject session is analyzed within 12,798 Excel rows. Therefore, 472 subject sessions (1,261 rows) are coded.

Those queries which ended in failure are represented as “0 hits”. From the queries with one or more hits, the title of the result, which was clicked on by the patron, is listed in a separate column and will indicate which results are most popular. Codes are assigned to each category. A manual review of unsuccessful queries is conducted to look for misspelled words, whether the same query was re-entered multiple times, or other queries that are too specific for the site search box, such as journal article titles, journal article content, author names, etc. An “other” category is added in the codes to include situations in which the patron enters a topic which may not be an indexed ADL resource category, a publication that does not exist, added punctuation or the title abbreviation prevented the retrieval of licensed content, words switched in a title, syntactic errors, or an incompletely entered journal name. A “subscription” code is also created to cover those times when a journal title does exist, but it is suspected that a patron may not have access it to through their institutional subscription or when the ADL does not subscribe to that title for any of its patrons. Typographical errors are included in the category of misspellings. Submitting such entries is considered an “error.”

For the queries with “0” hits, a number “1” is entered for the presence of each category error and the number “0” entered if absent. A list of resource links clicked are gathered to gain an understanding of which links are most popular.

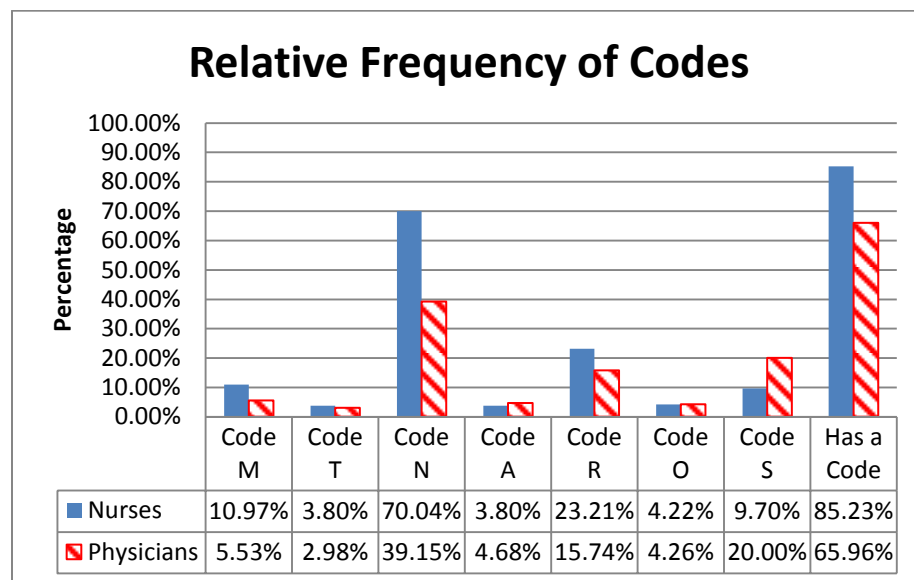
Table 3 outlines the categories that are assessed and for which purpose each is suited.

Table 3

Code	Category
M	Misspelled words
T	Title of journal article
N	Query is too narrow or specific
A	Author name
R	Re-entering unsuccessful query
S	Subscription for content may not exist
O	Other reasons not covered by defined categories

Results and Analysis

The 472 subject sessions were split evenly (237 subject sessions for nurses and 235 for physicians). To determine if one occupational group is more likely to have a failed search due to a certain error, a one-sided two-sample z-test was run on the coded categories. In Figure 3, the relative frequencies of category codes for physician and nurse subject sessions are displayed.

Figure 3

A hypothesis test was performed to see if the differences between these percentages are statistically significant. The null hypothesis is that physician and nurses are equally as likely to have a search fail due to each of the assigned categories. The small p-value will provide evidence that the null hypothesis is false and concludes that physicians and nurses are significantly different for each category.

A one-sided two sample z-test was done for each category code. Table 4 shows the p-values for each test. The codes of M, N, R, and S are significantly different across the two groups, unlike the other codes which are well above conventional significance thresholds.

Table 4

Category	p-value	Conclusion
Code M	0.015	Nurses are more likely to misspell
Code T	0.234	Nurses and physicians are not different with respect to this category
Code N	6.00E-13	Nurses are more likely to enter narrow searches
Code A	0.317	Nurses and physicians are not different with respect to this category
Code R	0.02	Nurses are more likely to repeat unsuccessful searches
Code O	0.492	Nurses and physicians are not different with respect to this category
Code S	0.0007	Physicians are more likely to encounter subscription issues
Has at least one error code	2.88E-07	Nurses are more likely to commit an error of type M,T, N, A, R, or O

Subject session statistics can reveal whether the two occupational groups exhibit different behavior with regards to other variables, such as the number of searches, total

number of hits, or if the physician or nurse chosen to click on a link after a successful search.

The sample averages of each of these variables, grouped by occupation, are totaled in Table 5. Nurses averaged more (2.24) attempts per subject session compared to 1.80 for physicians, for an average of the two groups of 2.02. The nurses did not average as many hits per subject session.

Table 5

Averages	Nurse	Physician	Total
Number of searches in a session	2.24	1.80	2.02
Total number of hits in a session	19.62	24.83	22.21
Number of linkouts in a session with at least one hit	2.18	1.73	1.53

Each of these variables is analyzed further in the following tables. The number of searches per subject session is dichotomized by examining subject sessions where one search was performed versus multiple searches in a session. Tallies are presented in Table 6. Nurses had multiple attempts per subject session – 139 times out of 237 versus the physicians with 106/235.

Table 6

Number of searches in a session	Nurse	Physician	Total
One	98	129	227
Two or more	139	106	245
Total	237	235	472

The search experience was further evaluated by investigating the variable of total number of hits per session, which are shown in Table 7. Of the 237 subject sessions, nurses had one or more hits 74 times and physicians had 116/235.

Table 7

Total number of hits in a session	Nurse	Physician	Total
Zero	163	119	282
One or more	74	116	190
Total	237	235	472

Table 8 holds the counts of how many sessions had links that were clicked. The first row acknowledges the number of times that the patron did not click on a URL. As a zero link-out could be indicative of the patron not finding what they need in the results list, this variable could be considered a “success index.” Nurses clicked on links 55 times/74 sessions while physicians did the same 98 times/116 sessions. Are these differences significant?

Table 8

Number of sessions with corresponding link-outs	Nurse	Physician	Total
Zero	19	18	37
One or more	55	98	153
Total	74	116	190

The null hypothesis that the physicians and nurses have similar behavior regarding these three variables is tested. The p-values are reported below in Table 9. A small p-value is strong evidence against the null hypothesis. Assuming the significance

level (α) equals 0.05, it is clear that nurses conduct more searches per subject session, see a results display of zero hits more often, and do not click on as many links when compared to physicians.

Table 9

Variable being tested	p-value	Conclusion
Number of searches in a session	0.0013	Nurses conduct more searches per session than physicians do.
Total number of hits in a session	3.00E-05	Nurses experience more searches that results in zero hits than physicians do.
Number of linkouts in a session with at least one hit	0.0477	Nurses experience more searches with zero links clicked than physicians do.

When analyzing so much data, could one patron be responsible for the majority of the searching and contribute disproportionately to the data? Table 10 shows this is not the case, in which the top ten patrons are listed. There are 2 nurses and 8 physicians who are the most frequent users of the site search, but of the 472 total subject sessions analyzed in 2010, the top-rated physician only conducted 8 separate subject session searches.

Table 10

Name IDs of top users	Number of sessions	Occupation
31493	8	Physician
12415	7	Nurse
40827	5	Nurse
27670	4	Physician
4908	3	Physician
8965	3	Physician
12253	3	Physician
12426	3	Physician
23044	3	Nurse
44751	3	Physician

Discussion

The data available are valuable assets by which to learn how search behavior and ADL website contribute to obtaining relevant results through the ADL site search box for content.

Since January 1, 2010, ADL patrons had the option of performing a federated search to retrieve abstracts, journal articles, or database content or do a site search to obtain links within resource groups, in which availability is limited by institutional subscriptions. Wanting to improve the search experience for patrons and understand more about how a particular segment of the ADL membership (e.g., physicians and nurses) was using the site search tool, the ADL needed particular aspects of the collected data to be investigated and I requested to be part of the project.

This study compared site search queries and results, based upon occupation to discover how physicians and nurses search and reveal the differences in outcomes when using the site search tool. Those which were unsuccessful were scrutinized for human error, misunderstanding of how the site search box is to be used, lack of content due to subscription restrictions, or inability of the tool to compensate for a wide range of query composition. Results will guide the ADL staff in determining what changes could be made to improve the search experience for ADL patrons.

It was uncovered that when nurses use the site search box, they submit more searches per subject session to find a result and see a display more often that reports zero hits than do physicians. When results are returned, nurses do not click on as many URLs

as physicians. It is unknown if this indicates that the links are irrelevant or that the links are being perceived as unhelpful.

Nurses are more likely to misspell search terms or have a typographical error, thereby needing repeat the search. This can be corrected with more careful effort at the keyboard or checking the correct spelling in advance.

Nurses are also inclined to over-specify for this single repository search engine. As the site search only looks for licensed content, and does so for only titles of journal names, books, databases, among others, and resource groups. This happened in over 70% of the searches performed by nurses – the most frequent of all the categories.

Query reformulation may occur to narrow or broaden a topic. In a recent study by Du and Evans (2011) it was recognized that almost all of their study participants built over 10 search queries for research topics, which a mean of 15 queries (range of 4 to 26). This is far more than the 2000 publication by Spink, Jansen, and Ozmultu that identified 2.84 queries per user when searching the Excite browser and is more in line with the ADL result average of 2.02 searches per subject session for physicians and nurses.

Physicians encounter negative results by looking for items that either their institution does not subscribe to or that the ADL does not carry at any subscription level. Visiting the available listings menu could give patrons an idea of what is obtainable before trying a site search for journal or book titles.

Physicians and nurses share equally in the propensity for entering article titles or author names. This is a search technique applicable to federated searching either within

the ADL website or through a web browser. It represents an error when used for site search, since entering an article title or author name will return no hits.

The nurses repeated failed searches nearly a quarter of the time and physicians did so in 15% of their sessions. Since the keyword entry is retained on the results screen, it is puzzling why some patrons insist on re-entering the same exact queries with no difference in results. Peters (1989) also noticed this occurrence and humorously coined the term “incredulous repetitions,” since the patron apparently couldn’t believe what was displayed on the screen. An extreme example of this was found in one of the ADL subject searches that was not among the sessions chosen for content analysis. A physician entered the acronym “ENT” (i.e. ear, nose, and throat) 89 times within a few minutes.

The database which was frequently searched for, but not accessible by all, was the UpToDate clinical support system. Patrons spelled it with and without dashes and spaces between words during reformulations, but it appeared to be only covered by certain subscription levels. It is a very popular resource and it is suggested that the ADL discuss with the institutions whether to include it in their subscriptions. Another possibility is to amend the ADL database dictionary code to accommodate the various alterations.

Appendix 2 is the listing of all URLs clicked by nurses and physicians. Duplicates were deleted. It gives a picture of which are the most popular with these two groups and reinforces the need to continue providing that content. A total of 294 links were clicked, though some were clicked multiple times by individuals. Of that total, there were 179 different links visited during the 12-month span.

Several search errors fit into the category of “other.” When this occurred, searches were for titles that may not exist. For two queries, a journal title existed, but the patron added a date or some punctuation which prevented a hit. Sometimes a website URL was copied and pasted into the box. Syntactic errors, such as incorrect word order for a journal title were observed, as were abbreviations for materials.

Some of the ineffective searching practices can be addressed during ADL teaching workshops or described in an instruction document on the website. Misspellings and use of author names or article titles are easy enough to rectify. The process of choosing the right keywords that are included in resource group content will need pointed instruction and experience using the tool. Once a patron visits the journal list or similar groups, s/he will have a better idea of which titles to search for in the future. Uncertain of how the site search tool may work or due to past failures locating needed information, it appears from the content analysis that some employ more of an explorative nature, as described in Du and Evans (2011).

Broad topics were occasionally searched and seemed to be reasonable entries, but resulted in zero hits. Perhaps adding “drug manual” or “formulary” would be helpful resource group headings. Also, a category for cardiac life support could aid those looking for the Basic or Advanced Cardiac Life Support manuals for their mandatory cardiac resuscitation courses. “Infusion therapy” was a popular search term, as was “nursing theory.” These suggestions may be too narrow for the general resource groups, but maybe they could be included somewhere in the website.

Although the resource group name “clinical answers” is available on the website, I could not retrieve that title. It may have been in a results list earlier in my study, but leads me to wonder which other resource groups I am not finding within my subscription level and how this affects other patrons. The same was true for “journals” and “journal collections.” One particular term, “websites,” did not list when trying the exact spelling, yet “website” brought up the group. The inability to access resource groups by name complicates the effort to see if the groups should be ordered differently in the results list.

The ADL was sent a copy of the analyzed data and will see which materials were desired, but were not apparently covered by subscriptions. Paired with personal suggestions by patrons, the ADL could gather valuable information for what resources may be added to the digital collection.

Conclusion

The frequency by which patrons are performing searches that are not returning results is highlighted in this project. The data show where the ADL can change system performance with respect to these behaviors and during instructional periods. There is now a better understanding of how the ADL can redesign its site, such as programming the site search tool to be more “forgiving” of misspellings or various ways popular item names are entered with dashes or spaces. Patrons can be better informed of the best ways to achieve results through website instructions or workshops conducted by ADL personnel with more specific examples.

The approach used in this study could be applied to similar websites or library OPACs for transaction log analyses. The errors considered are relatively easy to examine and for patrons to correct, once made aware of the deficiencies of particular concepts. More complicated than patron training might be the program design to adapt to so many potential misspellings or semantic revisions.

This content analysis is not the definitive answer to why a patron may have a successful search. The process lends itself to incremental success as real accomplishment is found on several levels – the results list, which URLs were clicked, and if the patron found what was needed on those sites. Without a survey, it will remain unknown why the patron stopped searching when receiving 0 hits or even when resource links were clicked on when retrieved. Did the patron become frustrated at the ADL content or were they called away, possibly to continue the search at another time? When the patron did click on a link was it because the patron found what they needed or was the link an interesting distraction unrelated to the original search? The qualitative analysis also cannot interpret why the same queries are repeated once or twice when 0 hits are returned.

It is unknown why physicians reached results more quickly with fewer misspellings. Educational levels, familiarity with similar tools, attention to detail may play a role, but these are only assumptions. Without speaking to the patrons about why particular terms were entered or their understanding about effective use of the site search tool, some questions will remain unanswered.

The ADL is an outstanding resource and its staff works diligently to find the best clinical literature and then to make the site work as smoothly as possible for its busy

patrons, who have many demands placed upon them. Periodic evaluations will help to keep the high quality of service presently provided. Future directions for the ADL to appraise the effectiveness of the collection and its tools could be to perform a closer examination of keyword strings, isolate a name identifying number and follow that individual through searches over a period of time, or to choose themes and search with synonyms if a particular topic is deemed pertinent and important. Any direction the ADL chooses to go, it will certainly strive to continue its valuable service to the health care field.

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Appendix 1

Examples of Select ADL Resources

1. Cochrane Database of Systematic Reviews – Database of high-level overviews of primary research addressing clinical questions using systematic methods to minimize bias.
2. CINAHL Plus with Full Text – Electronic bibliographic database owned and operated by EBSCO Publishing, the Cumulative Index to Nursing and Allied Health Literature is a comprehensive resource for nursing and allied health literature.
3. New England Journal of Medicine – The oldest continuously published medical periodical is available through the ADL journals database for current and archival issues.
4. PubMed – The interface which allows searching of the National Center for Biotechnology Innovation (NCBI) MEDLINE online database of biomedical abstracts and citations.
5. ICD-9-CM-Volumes 1,2,3 (2012) STAT!Ref Overview – The electronic version of the sixth edition of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) for morbidity coding.

6. National Library of Medicine Drug Information Portal – Database of selected drug information from the U.S. National Library of Medicine, along with other federal agencies.
7. Trauma Image Database – A repository of classified and searchable images, submitted by trauma care professionals, available for educational use.
8. TRIP Database – A clinical search tool to quickly locate the highest quality clinical evidence.

Appendix 2

Links clicked by physicians and nurses January 1-Dec 31, 2010

1	AACN Advanced Critical Care
2	About Herbs, Botanicals & Other Products
3	ACP PIER: Physician's Information & Education Resources
4	Adams and Victor's Principles of Neurology
5	Addressing Barriers to Learning Newsletter
6	ADHD Health Services Across North Carolina
7	Advanced Emergency Nursing Journal
8	Agency for Healthcare Research & Quality Evidence Based Practice
9	AIDS
10	Alternative Medicine Review
11	American Academy of Medical Acupuncture
12	American Academy of Osteopathy
13	American Academy of Pediatrics
14	American College of Cardiology
15	American College of Obstetricians and Gynecologists
16	American Diabetes Association
17	American Family Physician
18	American Heart Journal
19	American Journal of Medicine
20	American Journal of Respiratory and Critical Care Medicine
21	American Journal of Sports Medicine
22	American Journal of Surgery
23	Anesthesia & Analgesia
24	Annals of Internal Medicine
25	Annals of Surgery
26	Annual Review of Nursing Research
27	Archives of Disease in Childhood Fetal & Neonatal Edition
28	Archives of Surgery
29	Area L AHEC Continuing Education
30	Arthroscopy
31	Avery's Neonatology
32	Bates Visual Guide to Physical Examination
33	Best Practice: Falls in hospitals
34	BMJ: British Medical Journal
35	Brain

36	Brain Injury: Complications and Medical Problems
37	Breastfeeding Review
38	British Journal of Neuroscience Nursing
39	Cardiology Clinical Statements/Guidelines
40	Case Management Advisor
41	Charlotte AHEC Continuing Education
42	Circulation
43	Clinical Dermatology (Habif)
44	Clinical Journal of Pain
45	Clinical Nursing Research
46	Clinical Oncology (Abeloff)
47	Clinical Orthopaedics & Related Research
48	Clinical Toxicology (Ford)
49	Clinical Trials at UNC
50	Cochrane Library
51	Congestive Heart Failure Tutorial
52	COPD Guidelines
53	Critical Care Clinics
54	Critical Care Nursing Quarterly
55	Cultural Competence in Health Care: Emerging Frameworks and Practical Approaches
56	Current Opinion in Endocrinology & Diabetes (archival access only)
57	Dartmouth Atlas of Health Care
58	Delmar's Fundamental & Advanced Nursing Skills
59	Diabetes Awareness & Patient Education for Hispanic/Latino Americans
60	Dietary Guidelines for Americans, 2005
61	Drugs in Pregnancy and Lactation
62	DSM-IV-TR
63	e-Anatomy
64	EBM Reviews - Cochrane Central Register of Controlled Trials
65	EBM Reviews - Cochrane Database of Systematic Reviews
66	E-Books in the Health Sciences - Search the UNC Collection
67	Epocrates
68	European Heart Journal
69	Evidence Based Nursing Tutorial
70	Fall Management Guidelines
71	Fall Prevention
72	Fall Prevention Program Manual
73	Fall Prevention Project: Check it out!: Some things you can do to reduce your risk of falling
74	Falls in Hospitals and State Government Residential Aged Care Facilities
75	FIRSTConsult

76	Fundamental Immunology (Paul), 6th. ed.
77	Guideline: Preventing pressure ulcers & skin tears
78	Hand Clinics
79	Health Affairs
80	Health Care Reform and Health IT Stimulus: ARRA and HITECH
81	Health Education & Behavior
82	Health Topics: What Are Ways to Prevent Falls and Related Fractures?
83	Healthcare Benchmarks & Quality Improvement
84	Injury
85	Injury Center: Falls Among Older Adults: Brochures and Posters
86	International Journal of Health Promotion & Education
87	International Journal of Psychiatric Nursing Research
88	International Orthopaedics
89	Internet Journal of Medical Informatics
90	JAMA
91	Joint Commission National Patient Safety Goals
92	Joint Commission Perspectives
93	Journal of Ambulatory Care Management
94	Journal of Analytical Toxicology
95	Journal of Arthroplasty
96	Journal of Bone & Joint Surgery (American Volume)
97	Journal of Bone & Joint Surgery (UK Volume)
98	Journal of Cultural Diversity
99	Journal of ECT (archival access only)
100	Journal of Hand Surgery [American Edition]
101	Journal of Infusion Nursing
102	Journal of Intravenous Nursing
103	Journal of Nursing Administration (JONA)
104	Journal of Nursing Care Quality
105	Journal of Nursing Research
106	Journal of Oral & Maxillofacial Surgery
107	Journal of Orthopaedic Trauma
108	Journal of Patient Safety
109	Journal of Pediatric Gastroenterology & Nutrition
110	Journal of Pediatric Oncology Nursing
111	Journal of Pediatric Orthopaedics (archival access only)
112	Journal of Pediatrics
113	Journal of Psychosocial Nursing & Mental Health Services
114	Journal of Shoulder & Elbow Surgery
115	Journal of the American College of Cardiology
116	Journal of the American College of Surgeons

117	Journal of the American Society of Nephrology
118	Journal of trauma
119	Journal of Trauma: Injury, Infection, and Critical Care
120	Key Topics in Neonatology
121	Knee
122	Legal Eagle Eye Newsletter for the Nursing Profession
123	Mayo Clinic Proceedings
124	MD Consult
125	Medical Letter on Drugs & Therapeutics
126	MEDLINE 1950 - present
127	Medscape Free CME
128	MEDSURG Nursing
129	Men in Nursing
130	Michigan Informatics Tutorials: Evidence-Based Public Health
131	Micromedex
132	National Center for Complementary & Alternative Medicine
133	National Center for Cultural Competence
134	National Center for Patient Safety 2004 Falls Toolkit
135	Neonatology
136	New England Journal of Medicine
137	North Carolina Medical Society
138	Nursing Best Practice Guidelines
139	Nursing Research
140	Online Neurology Reference
141	Operative Anatomy
142	Oral Diseases
143	Orthopedic Patient Education Library
144	Orthopedics
145	Ovid MEDLINE (2004-present)
146	Patient Education Management
147	Patient Safety Solution 2: Patient Identification
148	Patient Safety: Achieving a New Standard for Care
149	PDR® Family Guide To Over-The-Counter Drugs
150	Pediatric Nephrology
151	Pediatric Patient Education
152	Pediatric Policy & Guidelines
153	Pediatrics in Review
154	Preventing Medication Errors: Quality Chasm Series
155	Preventing Pressure Ulcers: A Patient's Guide
156	Primal Anatomy.tv
157	Procedures Consult

158	PubMed Central: Free Archive of Life Sciences Journals
159	PubMed Medline
160	Quality Management in Health Care
161	Radiologic Technology
162	Radiology
163	Real Living with Multiple Sclerosis
164	Red Book
165	Research & Theory for Nursing Practice
166	Rosens Emergency Medicine: Concepts and Clinical Practice (Marx)
167	Search PubMed for Complementary and Alternative Medicine articles
168	Search PubMed for Traumatic Brain Injury Articles
169	Series of Articles on Cultural Competence
170	Skeletal Trauma (Browner)
171	Southern Medical Journal
172	Southern Online Journal of Nursing Research
173	Stroke
174	Surgery
175	Surgical Clinics of North America
176	Textbook of Clinical Neurology (Goetz)
177	Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care
178	UptoDate
179	Western Journal of Nursing Research

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