

Introduction to Evidence Based Practice at National University of Health Sciences

Evidence Based Practice at NUHS

Barbara M. Sullivan, Ph.D. Essential EBP for Complementary and Alternative Medicine Study and Practice Guide. 2009.

What is “Evidence-based Practice?”

The Benefits of Evidence Based Practice

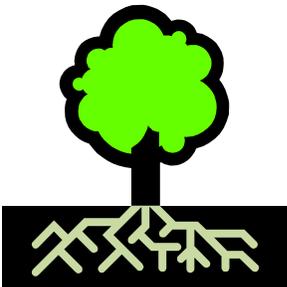
Evidence Based Practice in Action at NUHS

What is “Evidence-based Practice?”

Evidence based practice (EBP) can be defined generally as “using research information and documented, supported facts (evidence) to support or determine a critical decision or judgment.” EBP encompasses professional practice of all kinds:

- law,
- education,
- journalism,
- health care...

The Roots of Evidence Based Health Care



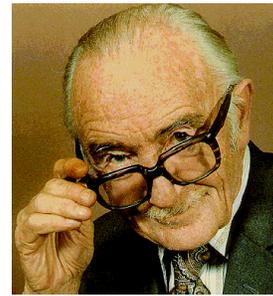
For the health care professions, evidence based practice (EBP), is not a new fad. In fact, the roots of evidence based health care philosophically reach back to the mid-19th century to the “Age of Enlightenment” and the use of scientific method when physicians and scientists applied scientific inquiry and research methodology to medical issues. In fact, some advocates of using strong evidence to support health care decisions argue that evidence based practice dates back to the European Renaissance, centuries old Oriental medicine and even the early Greek civilization when scientists used observation, experience, experimentation and documentation to diagnose, treat and determine causes of disease and illness.

Evidence-based medicine (EBM) became a movement unto its own in the 1970s when Dr. Archie Cochrane¹ led a global movement to use substantiated epidemiological information and well-designed research studies, in particular, the randomized controlled trial (RCT) design, to develop effective and efficient diagnostic tools and therapy plans.²

Cochrane reasoned that because resources – time, people, money -- would always be constrained and limited, the health care profession should provide health services shown to be effective, in turn, proven to be reliable, efficient and economical. He emphasized relying on properly designed, solid, scientific evaluations and research studies as sources of information and evidence, and promoted the use of randomized controlled trials (RCT) because standardized, highly structured RCTs were likely to provide much more reliable, solid information than other sources of evidence.¹

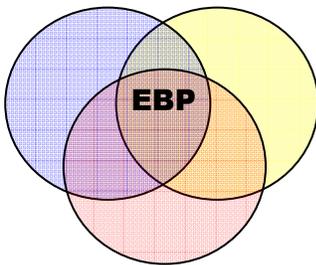
1970's: Dr. Archie Cochrane ³

- Resources are always limited
- Use resources wisely
- Provide health care shown to be effective using:
 - substantiated epidemiological information
 - research studies representing properly designed evaluations
 - well designed randomized controlled trials (RCT)



www.cochrane.org

In the 1980s and 90s, a team of medical professionals from Oxford, McMaster University, Duke and other medical universities, led by David Sackett defined evidence based medicine (EBM), also known as evidence based health care (EBHC) and evidence based practice (EBP) as having **three essential components**.^{4,6}



1. The best available evidence supported by research

“... the conscientious, explicit, and judicious use of the best evidence in making decisions about the care of individual patients.”

2. Patient values

“... “thoughtful identification and compassionate use of individual patients' predicaments, rights, and preferences.”

3. Clinical expertise

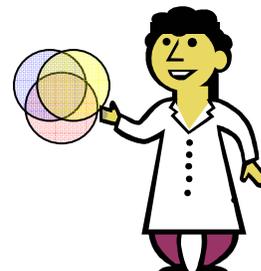
“...Without clinical expertise, practice risks becoming tyrannised by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient.”⁴

“Evidence-based practice,” “evidence-based medicine,” “evidence-based healthcare,” evidence-informed practice (EIP), and similar terms all revolve around using the highest quality basic and clinical research information to make a well-formed decision regarding a patient's well being along with the experience and expertise of the health care provider and the patient's informed preferences. At the same time, evidence-based practitioners point out that being evidence-based does not mean “evidence-enchained” or evidence-restricted.⁷

Evidence Based Practice is an important activity for medical practice, not just a definition.

True evidence based practice involves more than just using research literature to determine or support a diagnosis or therapy. EBP “is an **approach** to [health care and] medical practice⁸

in which you (the clinician)
are able to **evaluate**
the strength of that evidence and
use it in the best clinical practice
for the **patient** sitting in your office.”
(Mayer 2004)



Why is evidence based practice important in the real world?

While academics and health care professionals argue nuances and weighting of the essential EBP components,⁹⁻¹¹ the benefits of evidence-based health care practice are clear: effective, efficient, and optimum care for a specific patient,¹²⁻¹⁶ bridging and closing clinicians' knowledge gaps efficiently,¹⁷⁻²¹ better provider-patient relationships including improved patient participation, adherence to instructions, and retention;²²⁻²⁴ support of professional competency through efficient continuing education,²⁵⁻²⁸ and more efficient reimbursement of costs based on effective diagnoses and treatments.^{6,29-31}

Benefits of Evidence Based Practice:

- Effective, efficient, and optimum care for a specific patient¹²⁻¹⁶
- Bridging and closing clinicians' knowledge gaps efficiently¹⁷⁻²¹
- Enhanced provider-patient relationships including improved patient participation, adherence to instructions, and patient retention²²⁻²⁴
- Supports professional competency through efficient continuing education, managing the need to “keep up” and the increasing volume of medical information²⁵⁻²⁸
- More efficient reimbursement of costs based on effective diagnoses and treatments, answering challenges to clinical decisions with strong research evidence^{6,29-31}
- Supports patients with well-researched health care questions and the desire to participate in their own health management

EBP is a necessity, not just a “nice-to-do”

“Passion, enthusiasm, and philosophy are great. However, the need for *evidence-based* clinical decision making is growing stronger.”

Dr. Christopher Wolcott
Instructor, Evidence Based Practice,
National University of Health Sciences
Southport Grace Wellness Center, Chicago, IL
2003 NUHS graduate

Professional health care practitioners encounter:

- “Scientific uncertainty”
- Increase in medical information
- The need to “keep up” efficiently and continuing education
- Patients with well-researched questions
- Doctor-patient relationship needs
- Challenges to support clinical decisions with strong research evidence



Evidence-based health care decisions support effective, efficient patient centered care

The use of evidence while relying on the health care professional to integrate and implement decisions and therapies for their patients in clinical settings leads to more effective, efficient and patient centered care. Lockwood, et al. demonstrated that integrating evidence-based decision making into routine hospital based practice resulted in utilizing and following treatment guidelines based on published evidence. Health care providers documented improved patient care and appropriate changes in practice.³²

Similarly, Straus and others measuring the effect of an EBM educational program in a community hospital found that after health care providers received training in evidence-based practice and when resources were provided to support evidence-based decision-making, patients were more likely to receive therapies proven to be beneficial through strong research studies, particularly randomized, controlled trials (RCTs).²⁴

EBP skills help close the knowledge gap and bridge “scientific uncertainty.”

In a study to determine the information needs of doctors, experienced clinicians encountered some aspect of scientific uncertainty three times for every two patients.^{22,33-36} Interns & residents encountered uncertainty up to five times per patient in a similar studies.^{6,37}

Questions generated by patient encounters included^{34,36}:

- What is the best therapy for this particular patient?
- What is the patient specific diagnosis?
- Is a specific diagnostic test useful or more useful than...?
- What is the prognosis for this patient?
- What is the etiology of this disorder?
- Will this help or harm?
- Is this therapy efficacious and cost effective?

To answer patient generated clinical questions, 30% of physicians typically turned to²²



- Textbooks
- Colleague
- Computer application/Internet
- Medical records or
- Hospital information system
- “Refrigerator notes”

Sackett et al. found that 60% of the clinical questions generated on grand rounds at McMaster needed a structured search for information & evidence.⁵ Ely’s results were similar.^{22,35,36}

Despite significant benefits to the health care provider, consumers, and overall health care system, there remains a “chasm between real evidence-based health care practice and what has proven to be most effective and efficient”³⁸ (see also^{29,30}). Several studies found that only about 55% of the clinical questions that needed a formal search were followed up.

Health care providers have cited significant obstacles to the practice of evidence-based health care: the lack of essential EBP skills;^{22,30,35,39-46} doubt that relevant or complete answers exist;⁴⁷ the increasing volume of published evidence and lack of access to the evidence;⁴⁷⁻⁴⁹ the lack of time to pursue answers;²² and the lack of institutional or environmental support.^{28,50} In addition, while EBP begins and ends with a patient^{4,8} not all patient visits elicit clinical questions requiring a search of the literature or critical appraisal.^{22,47,51}

The reasons cited by professionals regarding why they did not follow up on questions were:^{22,35}

- Doubt that the answers existed
- Lack of time to pursue answers
- Lack of confidence in skills to find answers
- Lack of access to good journals, resources
- Cost (subscriptions, literature access, time)
- Lack of applicability or reliability of information
- Too much information (not enough time to sift through information)



However, Michaud, Straus and others researching professionals’ use of medical literature and research studies found that.^{28,52,53}

- Of **145 cases** and clinical decisions analyzed, **only 22 cases could not be supported** with a published research study from the medical literature

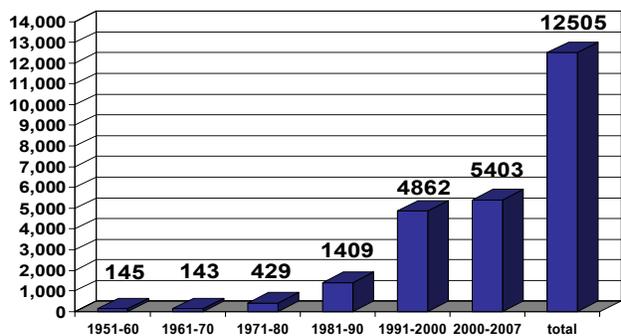
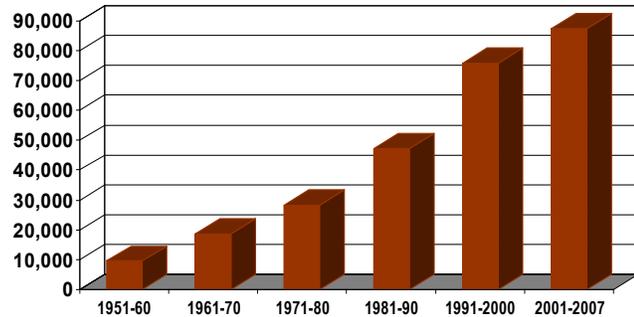
Addressing the concerns that when research could be found, it may not be applicable to the patient situation, researchers found

- Of 520 clinical questions for which answers were sought in the medical literature:
 - 53% confirmed the clinical decision
 - 47% changed the clinical decision.⁵⁴
- In 71 information searches to answer clinical questions generated on medical rounds:
 - 37 (52%) confirmed the management decision
 - 18 (25%) lead to a new therapy or diagnostic test
 - 16 (23%) corrected a previous plan.²⁸
- And the target time range for finding these answers was 15 seconds to 30 minutes.⁶



Managing the increase in medical information, research and evidence can be efficiently accomplished using evidence based practice skills

The increasing volume of medical literature affects every person aiming to find medical information or to keep up with the latest information. A simple search of the term “diabetes” on PubMed by decade from 1950 to the present illustrates the phenomenal increase in the number of peer reviewed scientific items regarding current health issues. Peer-reviewed scientific literature regarding diabetes more than doubled each decade, up to and including the present decade with no signs of slowing down.



Results from a simple search of the terms “low back pain” in PubMed by decade from 1950 to the present show the number of peer reviewed scientific items associated with “low back pain” as a search term generates currently over 1,000 items per year. Searching specific chiropractic literature that is not included in PubMed using CAM databases increase the number of high quality, peer-reviewed articles.

Effective learning and efficient continued education can be accomplished using evidence based practice skills.

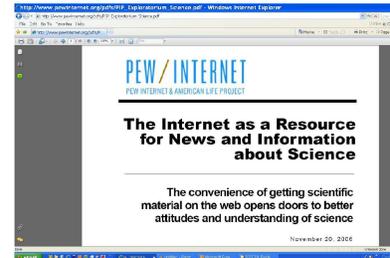
- Medical professionals skilled in EBP followed by Sackett and McMaster University researchers were up-to-date for 10 to 15 years post-grad versus for “control cohort” given no EBP training.^{6,55,56}
- The time allocation for continuing education and question follow-up was 30 - 60 min per week.⁶



Evidence based practice supports the doctor patient relationship.

With access to the internet, patients do their own research. Forty million Americans use the Internet as their “primary source of news and information about science”, according to the Pew Internet and American Life Project.⁵⁷

Not only do health care professionals need to keep up with the professional literature, but they also need to keep up with the information, substantial or not, that their patients are finding, reading and questioning.



Patients have expectations and ask specific questions. If you want your patients to follow your recommendations for care, you will need to back them up with more than your opinion.”
-C. Wolcott, DC

Evidence Based Practice Retains Patients²²

- Self-reported “non-expert” physicians randomly selected for the study pursued 55% of clinical questions, citing “obstacles” & “needs”
- Non-pursued clinical questions led to consultation and referral
- 40% to 92% of referred patients did not return to the referring practice

Challenges to clinical decisions require efficient and effective evidence based practice skills effectively answered.

Third party payors increasingly are requiring demonstration of support for clinical decisions using solid medical research literature.

Following are examples of clinical decisions recently challenged for substantiation:

- Research reporting the clinical efficacy of electrotherapy (interferential currents [IFC] and transcutaneous electrical nerve stimulation [TENS]) was requested by a large, well-known insurance company.
- A 75 YO BM with osteoarthritis of the knee wanted to know if acupuncture therapy is effective and/or better than NSAIDs in treating knee pain secondary to osteoarthritis. His insurance company challenged payment for acupuncture therapy provided in a Chicago chiropractic practice.
- Research supporting the use of spinal decompression procedures: *“Our health care management organization periodically contacts representatives of our provider network or health care provider organizations to obtain feedback on medical policy development for specific topic areas. Our company is seeking input from you and your organization on the current peer reviewed evidence for spinal decompression therapies and mechanical traction.”* (from a request sent to NUHS Evidence Based Practice researchers, 2007)

Evidence Based Practice in Action at NUHS

Experts allow that not all health care providers need to use all the EBP steps to deliver high-quality evidence-based health care for each patient visit.⁵⁸⁻⁶⁰ However, studies show that medical professionals trained in EBP skills could keep up with most new advances in the literature in one-half to one hour per week while in clinical practice; significantly more efficiently and effectively than medical school cohorts not trained in EBP.^{6,37,61} Ely²² found that primary health care providers who had some previous training in accessing and appraising the biomedical literature were more likely to pursue evidence when needed. Thus, exposure to and training in EBP skills has an impact on clinical decisions, making the process more efficient and effective.

Why the difference in behavior & success?



Pursuers:
Specific training in EBP skills
Self-reported competency

Non-pursuers
No specific EBP training
Self-reported lack of skills
Self-reported non-experts



Essential Evidence Based Practice Skills⁶²

Key skills and behaviors associated with effective and efficient EBP include asking a focused, structured clinical question that facilitates searching and finding literature; accessing (searching) the biomedical research databases and compiled evidence websites for relevant, high-quality information and evidence; critical appraisal of research; applying the evidence to a patient or practice; and assessing the clinical and professional outcomes and impact of the use of the evidence.^{6,8,14,18,22,24,24,26,31,55,61,63,63-74} Strong EBP skills and knowledge from effective training ensures comfort with and practice of EBP skills.^{15,24,56,75-80}



- Asking a focused, “searchable,” clinical question
- Accessing the medical literature through a structured search and understanding available resources
- Appraising -- critically evaluating the evidence to determine if it is robust, reliable and valid.
- Applying the evidence to the particular patient situation
- Assessing the outcome of using (or not using) particular information its impact on clinical practice

Asking

Evidence based practice starts and ends with the patient.^{68,74,81-83} The clinician determines what information is needed using their expertise, skills and knowledge.^{34,65} Patient expectations focus the clinical relevance of the question.

When a clinical question necessitates a search for high-quality evidence, the professional poses a “structured” clinical question to lead the search, using key concepts for patient characteristics, issues, expectations and values along with concepts for the intervention, diagnosis or exposure and additional concepts for comparison interventions or therapies and the desired outcomes.^{82,84-86}

The “PICO” format for a clinical question provides structure for an efficient literature search. PICO stand for Patient – Intervention – Comparison – Outcome.⁸¹⁻⁸⁶ The skill to develop a “PICO-format” question leading to a structured search is discussed in “*Asking* Constructing the Patient Focused, Searchable Clinical Question” (section 2).⁸⁷

Patient
Intervention
Comparison
Outcome

Accessing high quality biomedical literature: NUHS Evidence Based Practice Resources

As many as 60% of the questions, generated in a clinical practice, may require a structured search for information and evidence that will support a clinical decision or plan.^{6,17,22,65,67,85,88} EBP happens in real time with real patients under real circumstances. Searches for information and evidence take place in real time, under real conditions and for real patients.^{14,22,28,34,36}



At National University of Health Sciences, research scientists, practicing clinicians, clinical instructors, academic professors, the medical librarians in the NUHS Learning Resource Center (LRC), and information technology professionals work closely to integrate evidence based practice skills, knowledge and behaviors into the curriculum and clinical practice. Using real patients and patient scenarios to initiate evidence-based practices such as searching and accessing high quality evidence to support clinical decisions, appraisal of resources and research articles supporting course

content and clinical decisions, discussions of applying evidence through journal clubs and on-line forums, and assessment of the process and the impact on education and health care under real circumstances, students, faculty and clinicians hone the skills of evidence based practice.^{87,89}



The NUHS LRC provides collections of biomedical resources which include high quality informational sources, journal subscriptions and electronic access to high quality databases of the biomedical literature. The NUHS website www.nuhs.edu provides access to the LRC catalogue as well as specific databases through the LRC web pages (www.NUHS.edu >> [About Us](#) >> [Learning Resource Center](#) <http://www.nuhs.edu/show.asp?durki=134>).

The [LRC Services and Features page](#) highlights the NUHS journal holdings, physical and virtual access to the LRC and holdings, information regarding access to “A to Z,” a subscription database linking to the electronic full text of over 10,000 journals, links to numerous biomedical literature databases which include literature for complementary and alternative medicine (CAM), health care and research such as EBSCOhost, Ovid, and PubMed, links to professional journal subscriptions, and the Interlibrary Loan Request Form (ILL) (http://www.nuhs.edu/student_services/AllLoanRequestForm.aspx) with which students, faculty, alumni and other LRC users can request books, journal articles and other resources not immediately available through the electronic access resources.

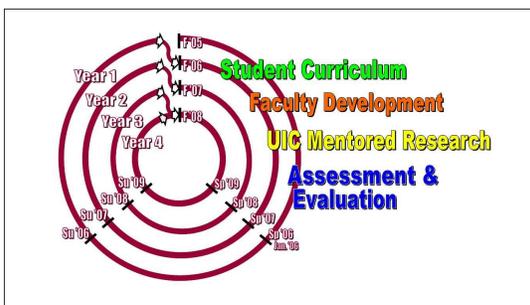
Additional LRC and EBP electronic resources are available through the NUHS on-line learning platform, CygNET (<http://cygnet.nuhs.edu>). Faculty, staff, students and registered users can link to numerous on-line journal subscriptions, databases and compiled evidence websites in the on-line resource EBP @ NUHS. Also in the CygNET EBP @ NUHS e-LRC Resources pages are information and evidence resource webliographies, summaries, critical appraisals, and journal club presentations.

Students in all programs are introduced to high quality resources and databases. Students learn how to access the best evidence early in their education in courses such as Fundamentals of Natural Medicine. In Public Health, students perform a guided, structured search of recommended websites, compiled evidence databases, and databases of the biomedical literature based on PICO questions formed from patient scenarios based on current, “hot” public health topics. Students document and evaluate their search strategy and results, then recommend resources and articles as evidence for specific public health topics. Topics are based on patient scenarios and assess the general state and impact of the available evidence on that particular public health topic.



Students also learn the finer points of study designs utilized in clinical research in stand-alone on-line (EBP 1) and face-to-face classes, along with critical appraisal skills (EBP 2). In other courses, EBP skills and knowledge are integrated into the courses through discussions and appraisal of literature, using evidence, access and appraisal to augment course content as well as projects that encompass the “A-team” EBP skills gamut.

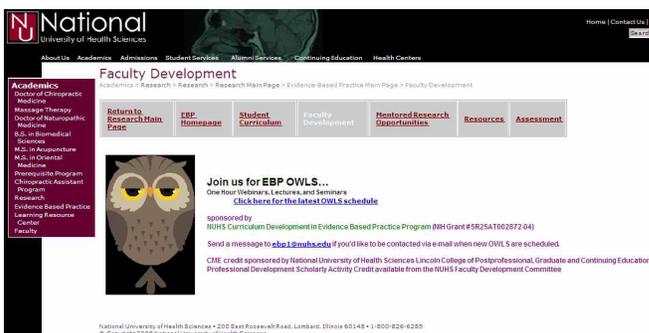
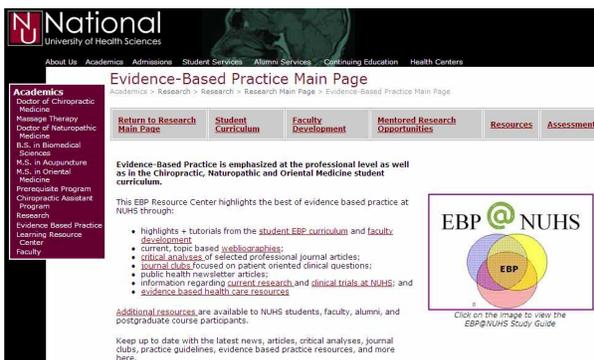
Appraising -- critically evaluating the evidence to determine if it is robust, reliable and valid.



The NUHS Curriculum Development in Evidence Based Practice project is supported by a grant from the National Institutes of Health (NIH) National Center for Complementary and Alternative Medicine (NCCAM), grant 1R25AT002872.⁹⁰ The multifaceted program focuses on developing an integrated student curriculum, faculty development program, student and faculty mentored research opportunities at the University of Illinois Chicago, and an outcomes assessment component.

The NUHS EBP student curriculum is featured in the www.NUHS.edu web pages. ([www.NUHS.edu](#) >> [About Us](#) >> [Research](#) >> [Evidence Based Practice](#)).

The student curriculum focuses on EBP essentials, asking clinical questions, searching for information, evidence and research regarding patient health care, critically appraising journal articles and compiled evidence for quality, relevance and validity, archiving synthesized, summarized evidence as critical appraisals, webliographies, journal clubs and Patient-oriented Evidence that Matters (POEM) summaries.^{87,91} Links to student projects, RSS feeds to searches using patient generated clinical questions, critical appraisals, and journal club schedules are posted throughout the web pages and the CygNET EBP@NUHS learning and resource pages, serving as archived, evidence based CAM practice resources.



The NUHS EBP OWLS program (One hour Webinars, Lectures and Seminars) enhances the NUHS faculty development program as well as the University-wide EBP curricula. The OWLS program features webinars and lectures based on applying EBP skills to education, learning and clinical practice.

Experts in accessing evidence, appraising evidence, evidence-based education, and evidence-based clinical practice are invited to campus (physically and virtually) to interact with students and faculty. Faculty can participate in workshops, sponsored by the EBP R25 grant, focused on integrating EBP skills, knowledge and behaviors into courses as well as clinical practice. Schedules for Journal Club, OWLS and workshops are posted on the [EBP Faculty Development web pages](#).



In addition to learning new ways to effectively and efficiently incorporate current evidence and evidence based practice skills into courses, faculty and clinicians become role models for real time EBP skills and behaviors.^{28,56,89,92-101} Faculty and other participants can earn continuing education credit as well as professional credit for providing service to the NUHS and professional community.

Applying the evidence to the particular patient situation



Student and faculty evidence based practice programs meet in the faculty invited lecture series and in the student and faculty journal clubs.^{91,102-125} Critically appraised professional journal articles are discussed in light of real patients and the applicability of current evidence to particular patient and clinical situations. Evidence based health care professionals are invited to speak to students, interns, faculty and other professionals throughout the year, focusing on applying evidence based practice skills in private practice, large clinical institutions and at other educational institutions.

Information about on-going research studies at NUHS can be found on the NUHS Research pages (www.NUHS.edu >> [About Us](#) >> [Research](#)). Faculty and students are encouraged to participate in research studies as investigators and research assistants. The numerous faculty publications can be found on the Research web pages as well as in the CygNET e-LRC.



Students are provided the opportunity to participate in a full-time, research intensive semester in partnership with the University of Illinois Chicago, School of Public Health through the NUHS UIC EBP Student Mentored Research Program (MRP).¹²⁶ Stepping away from the professional Doctor of Chiropractic program for one term, students engage in at least two graduate level courses in the Master's of Public Health program and participate in an active research project with a UIC faculty researcher. While designed to be a single term program, several students have elected to enroll in the UIC Masters of Public Health program or a Ph.D. program following their MRP experience.

Assessing the outcome of using (or not using) particular information its impact on clinical practice

Armed with relevant, high quality evidence, the practitioner, using clinical expertise, can determine the applicability of research to the patient and the patient circumstances, values and expectations. The practitioner constantly assesses the outcomes of his or her critical appraisal and determines the impact of the literature and studies on his or her practice.



Students, faculty and clinicians at NUHS have the opportunity to assess the outcome of using (or not using) particular information and evidence for the care of patients. Particularly through the discussions of journal clubs which are recorded and archived, through one-on-one clinician – student mentoring and through faculty forums, EBP is a dynamic, integrated behavior at National University of Health Sciences.

Evidence based practice encompasses problem solving requiring clinical expertise and experience, using relevant and applicable research studies and always keeping the patient in the forefront of any clinical decision.

Bibliography and References Cited

- 1 The Cochrane Collection. The Name Behind the Cochrane Collaboration [Online]. The Cochrane Collaboration 2008 Available from: URL: <http://www.cochrane.org/docs/archieco.htm>
- 2 Cochrane AL. Effectiveness and Efficiency. Random Reflections on Health Services. 1972.
- 3 Manheimer E, Berman B. NCCAM support for the Cochrane Collaboration CAM Field. *Complement Ther Med* 2003 Dec;11(4):268-71.
- 4 Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ* 1996 Jan 13;312(7023):71-2.
- 5 Sackett DL. Evidence-based medicine. *Spine* 1998 May 15;23(10):1085-6.
- 6 Sackett DL, Straus SE, Richardson WS, Rosenberg W, Haynes RB. *Evidence-Based Medicine: How to Practice and Teach EBM*. 2nd edn. Edinburgh: Churchill Livingstone; 2000.
- 7 Triano J. What Constitutes Evidence for Best Practice? *JMPT* 2009;31(9):637-43.
- 8 Mayer D. *Essential Evidence Based Medicine*. New York: Cambridge University Press; 2004.
- 9 Tonelli MR, Callahan TC. Why alternative medicine cannot be evidence-based. *Acad Med* 2001 Dec;76(12):1213-20.
- 10 Hunter A, Grant A. *Complementary Medicine and Evidence-Based Practice: Power and Control in Healthcare - Questions About an Arranged Marriage*. *Current Opinion Evidence-Based Integrative Medicine* 2005;2(4):189-94.
- 11 Jonas WB. The evidence house: How to build an inclusive base for complementary medicine. *West J Med* 2001 Aug;175(2):79-80.
- 12 Antman E, Lau J, Kupelnick B, Mosteller F, Chalmers T. A comparison of results of meta-analyses of randomized control trials and recommendations of clinical experts. *Treatments for myocardial infarction*. *JAMA* 2008;268(2):240-8.
- 13 Bellamy N, Goldstein LD, Tekanoff RA. Continuing medical education-driven skills acquisition and impact on improved patient outcomes in family practice setting. *J Contin Educ Health Prof* 2000;20(1):52-61.
- 14 Glasziou P, Guyatt G, Dans A, Dans L, Straus S, Sackett D. Applying the results of trials and systematic reviews to individual patients. *ACP J Club* 2008;129(3):A15-6.
- 15 Hatler C, Carol DM, Jeannie C, Gina M, Kathleen H, Jackie A, et al. Using evidence and process improvement: strategies to enhance healthcare outcomes for the critically ill. A pilot project. *American Journal of Critical Care* 2006 Nov;15(6):549-54.
- 16 Rosemann T, Szecsenyi J. General practitioners' attitudes towards research in primary care: qualitative results of a cross sectional study. *BMC Fam Pract* 2004 Dec 21;5(1):31.
- 17 Alper BS, White DS, Ge B. Physicians answer more clinical questions and change clinical decisions more often with synthesized evidence: a randomized trial in primary care. *Ann Fam Med* 2005 Nov;3(6):507-13.
- 18 Armstrong E, Parsa-Parsi R. How can physicians' learning styles drive educational planning? *Acad Med* 2005 Jul;80(7):680-4.
- 19 Choudhry NK, Fletcher RH, Soumerai SB. Systematic review: the relationship between clinical experience and quality of health care. *Ann Intern Med* 2005 Feb 15;142(4):260-73.
- 20 Ely JW, Osheroff JA, Ferguson KJ, Chambliss ML, Vinson DC, Moore JL. Lifelong self-directed learning using a computer database of clinical questions. *J Fam Pract* 1997 Nov;45(5):382-8.
- 21 McConaghy JR. Evolving medical knowledge: moving toward efficiently answering questions and keeping current. *Prim Care* 2006 Dec;33(4):831-7, v.
- 22 Ely JW, Osheroff JA, Chambliss ML, Ebell MH, Rosenbaum ME. Answering physicians' clinical questions: obstacles and potential solutions. *J Am Med Inform Assoc* 2005 Mar;12(2):217-24.
- 23 Epstein RM, Alper BS, Quill TE. Communicating evidence for participatory decision making. *JAMA* 2004 May 19;291(19):2359-66.
- 24 Straus S, Ball C, Balcombe N, Sheldon J, McAlister F. Teaching Evidence-based Medicine Skills Can Change Practice in a Community Hospital. *JGIM* 2005 Apr;20(4):340-3.
- 25 Bravata DM, Huot SJ, Abernathy HS, Skeff KM, Bravata DM. The development and implementation of a curriculum to improve clinicians' self-directed learning skills: a pilot project. *BMC Med Educ* 2003 Oct 22;3:7.
- 26 Guyatt G, Rennie D. *User's guide to the medical literature: a manual for evidence-based clinical practice*. 2002.
- 27 Lim RF, Hsiung BC, Hales DJ. Lifelong learning: skills and online resources. *Acad Psychiatry* 2006 Nov;30(6):540-7.
- 28 Straus SE, Sackett DL. Using research findings in clinical practice. *BMJ* 1998 Aug 1;317(7154):339-42.
- 29 Keckley PH. Evidence-based medicine in managed care: a survey of current and emerging strategies. *Med Gen Med* 2004;6(2):56.
- 30 Dawes M, Summerskill W, Glasziou P, Cartabellotta A, Martin J, Hopayian K, et al. Sicily statement on evidence-based practice. *BMC Med Educ* 2005 Jan 5;5(1):1.
- 31 Haneline M. The case for Evidence-Based Chiropractic. *JACA* 2007 Dec;10-2.
- 32 Lockwood D, Armstrong M, Grant A. Integrating evidence-based medicine into routine clinical practice; seven years' experience at the hospital for tropical diseases. *BMJ* 2004;329:1020-3.
- 33 Covell DG, Uman GC, Manning PR. Centre for Evidence Based Medicine Oxford CAT Library Oxford-Centre for Evidence Based Medicine Information needs in office practice; are they being met? *Ann Intern Med* 2008 Aug 25;103:596-9.
- 34 Ely JW, Osheroff JA, Ebell MH, Gus GR, Levy BT, Chambliss ML, et al. Analysis of questions asked by family doctors regarding patient care. *BMJ* 1999 Aug 7;319(7206):358-61.
- 35 Ely JW, Osheroff JA, Ebell MH, Chambliss ML, Vinson DC, Stevermer JJ, et al. Obstacles to answering doctors' questions about patient care with evidence: qualitative study. *BMJ* 2002 Mar 23;324(7339):710.
- 36 Ely JW, Osheroff JA, Maviglia SM, Rosenbaum ME. Patient-care questions that physicians are unable to answer. *J Am Med Inform Assoc* 2007 Jul;14(4):407-14.

- 37 Shin JH, Haynes RB, Johnston ME. Effect of problem-based; self-directed undergraduate education on life-long learning. *CMAJ* 1993;148(6):969-76.
- 38 Institute of Medicine Committee on Quality of Health in America. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington DC: National Academy of Sciences; 2008.
- 39 Cabana MD, Rand CS, Powe NR, Wu AW, Wilson MH, Abboud PA, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA* 1999 Oct 20;282(15):1458-65.
- 40 Cabana MD, Rand CS, Becher OJ, Rubin HR. Reasons for pediatrician nonadherence to asthma guidelines. *Arch Pediatr Adolesc Med* 2001 Sep;155(9):1057-62.
- 41 Cochrane LJ, Olson CA, Murray S, Dupuis M, Tooman T, Hayes S. Gaps between knowing and doing: understanding and assessing the barriers to optimal health care. *J Contin Educ Health Prof* 2007;27(2):94-102.
- 42 Garber E, Desai M, Zhou J, Alba L, Angst D, Cabana M, et al. Barriers to adherence to cystic fibrosis infection control guidelines. *Pediatr Pulmonol* 2008 Sep;43(9):900-7.
- 43 Maue SK, Segal R, Kimberlin CL, Lipowski EE. Predicting physician guideline compliance: an assessment of motivators and perceived barriers. *Am J Manag Care* 2004 Jun;10(6):383-91.
- 44 Edmonson SR, Smith-Akin KA, Bernstam EV. Context, automated decision support, and clinical practice guidelines: does the literature apply to the United States practice environment? *Int J Med Inform* 2007 Jan;76(1):34-41.
- 45 Espeland A, Baerheim A. Factors affecting general practitioners' decisions about plain radiography for back pain: implications for classification of guideline barriers--a qualitative study. *BMC Health Serv Res* 2003 Mar 24;3(1):8.
- 46 Kljakovic M. Practising GPs teaching medical students evidence based medicine--a questionnaire survey. *Aust Fam Physician* 2006 Dec;35(12):999-1002.
- 47 Osheroff JA, Bankowitz RA. Physicians' use of computer software in answering clinical questions. *Bull Med Libr Assoc* 1993 Jan;81(1):11-9.
- 48 Alper BS, Hand JA, Elliott SG, Kinkade S, Hauan MJ, Onion DK, et al. How much effort is needed to keep up with the literature relevant for primary care? 2004 Oct;92(4):429-37.
- 49 Green ML. Evidence-based medicine training in internal medicine residency programs a national survey. *J Gen Intern Med* 2000 Feb;15(2):129-33.
- 50 McCaughan D, Thompson C, Cullum N, Sheldon TA, Thompson DR. Acute care nurses' perceptions of barriers to using research information in clinical decision-making. *J Adv Nurs* 2002;39:46-60.
- 51 Ramos KD, Linscheid R, Schafer S. Real-time information-seeking behavior of residency physicians. *Fam Med* 2003 Apr;35(4):257-60.
- 52 Michaud G, McGown JL, van der JR, Wells G, Tugwell P. Are therapeutic decisions supported by evidence from health care research? *Arch Intern Med* 1998;158:1665-8.
- 53 Straus SE, Richardson WS, Glasziou P, Haynes RB. *Evidence-based medicine (3rd ed)*. Edinburgh, New York: Elsevier/Churchill Livingstone; 2005.
- 54 Crowley SD, Owens TA, Schardt CM, Wardell SI, Peterson J, Garrison S, et al. A Web-based compendium of clinical questions and medical evidence to educate internal medicine residents. *Acad Med* 2003 Mar;78(3):270-4.
- 55 Shuval K, Shachak A, Linn S, Brezis M, Feder-Bubis P, Reis S. The impact of an evidence-based medicine educational intervention on primary care physicians: a qualitative study. *J Gen Intern Med* 2007 Mar;22(3):327-31.
- 56 Shuval K, Berkovits E, Netzer D, Hekselman I, Linn S, Brezis M, et al. Evaluating the impact of an evidence-based medicine educational intervention on primary care doctors' attitudes, knowledge and clinical behaviour: a controlled trial and before and after study. *J Eval Clin Pract* 2007 Aug;13(4):581-98.
- 57 Horrigan JB. *The Internet as a Resource for News and Information about Science* Pew Internet and American Life Project 2006 Nov. Available from: URL: http://www.pewinternet.org/pdfs/PIP_Exploratorium_Science.pdf
- 58 McColl A, Smith H, White P, Field J. General practitioners' perceptions of the route to evidence-based medicine; a questionnaire survey. *BMJ* 1998;316:361-5.
- 59 McAlister FA, Graham I, Karr GW, Laupacis A. Evidence-based medicine and the practicing clinician; a survey of Canadian general internists. *J Gen Intern Med* 1999;14:236-42.
- 60 Muir Gray JA. *Evidence-Based Medicine. How to Make Health Policy and Management Decisions*. 1997.
- 61 Verhoeven AA, Schuling J. Effect of an evidence-based answering service on GPs and their patients: a pilot study. *Health Info Libr J* 2004 Sep;21 Suppl 2:27-35.
- 62 Del Mar C., Glasziou P, Mayer D. Teaching evidence based medicine. *BMJ* 2004 Oct 30;329(7473):989-90.
- 63 Haynes RB, McKibbon KA, Fitzgerald D. How to keep up with medical literature. I. Why try to keep up and how to get started. *Ann Intern Med* 1986.
- 64 Evidence Based Medicine Working Group. Evidence-based Medicine: A new approach to teaching the practice of Medicine. *JAMA* 1992;268:2420-5.
- 65 Gorman PN, Helfand M. Information seeking in primary care: how physicians choose which clinical questions to pursue and which to leave unanswered. *Med Decis Making* 1995;15:113-9.
- 66 Greenhalgh T, Macfarlane F. *Towards a competency grid for evidence-based practice*. 3 ed. 1997.
- 67 Ebell M. Information at the point of care, answering clinical questions. *J Am Board Fam Pract* 1999;12:225-35.
- 68 Wilson K, McGowan J, Guyatt G, Mills EJ. Teaching evidence-based complementary and alternative medicine: 3. Asking the questions and identifying the information. *J Altern Complement Med* 2002 Aug;8(4):499-506.
- 69 Ebell MH, Shaughnessy A. Information mastery: integrating continuing medical education with the information needs of clinicians. *J Contin Educ Health Prof* 2003;23 Suppl 1:S53-S62.
- 70 Del MC, Glasziou P, Mayer D. Teaching evidence based medicine. *BMJ* 2004 Oct 30;329(7473):989-90.
- 71 Straus SE, Green ML, Bell DS, Badgett R, Davis D, Gerrity M, et al. Evaluating the teaching of evidence based medicine: conceptual framework. *BMJ* 2004 Oct 30;329(7473):1029-32.
- 72 Slawson DC, Shaughnessy AF. Teaching evidence-based medicine: should we be teaching information management instead? *Acad Med* 2005 Jul;80(7):685-9.

- 73 Greenhalgh T. How to read a paper; the basics of evidence-based medicine (3rd ed). 2006.
- 74 Keitz S, Edelman L, Green B, Oddone G. EBM Curriculum at Duke. 2006
- 75 Coomarasamy A, Khan KS. What is the evidence that postgraduate teaching in evidence based medicine changes anything? A systematic review. *BMJ* 2004 Oct 30;329(7473):1017.
- 76 Aiyer MK, Dorsch JL. The transformation of an EBM curriculum: a 10-year experience. *Med Teach* 2008;30(4):377-83.
- 77 Ghali WA, Saitz R, Eskew AH, Gupta M, Quan H, Hershman WY. Successful teaching in evidence-based medicine. *Med Educ* 2000 Jan;34(1):18-22.
- 78 Sewell J, Culpa-Bondal F, Colvin M. Nursing program assessment and evaluation: evidence-based decision making improves outcomes. *Nurse Educ* 2008 May;33(3):109-12.
- 79 Rod T, Barnaby R, Paul E, Sarah B, John K, Rebecca M. A systematic review of the effectiveness of critical appraisal skills training for clinicians. *Medical Education* 2000;34:120-5.
- 80 Taylor J, Wilkinson D, Blue IA, Dollard JT. Evidence-based rural general practice: barriers and solutions in South Australia. *Rural Remote Health* 2002 Jan;2(1):116.
- 81 Richardson WS, Wilson MC, Nishikawa J, Hayward RS. The well-built clinical question; a key to evidence-based decisions. *ACP J Club*. In press 1995.
- 82 Sackett DL SSRWRWHR. Asking answerable clinical questions. How to Practice and Teach Evidence-Based Medicine. 2 ed. Edinburgh: Churchill Livingstone; 2000. p. 13-27.
- 83 Richardson W, Wilson M, Nishikawa J, Hayward R. The well-built clinical question: a key to evidence-based decisions. *ACP J Club* 2009;123(3):A12-3.
- 84 Weinfeld JM, Finkelstein K. How to answer your clinical questions more efficiently. *Fam Prac Mgmt* 2005;Jul-Aug:37-41.
- 85 Virgilio RF, Chiapa AL, Palmarozzi EA. Evidence-Based Medicine. Part 1. An Introduction to Creating an Answerable Question and Searching the Evidence. *JAOA*:295-7.
- 86 Huang X, Lin J, Demner-Fushman D. Evaluation of PICO as a Knowledge Representation for Clinical Questions. *AMIA Annu Symp Proc* 2006 2006;2006:359-63.
- 87 Sullivan BM, Rizzo L, Cambron JA, Cramer GD. Essential EBP Study and Practice Guide for Evidence Based Practice at the National University of Health Sciences. Lombard, IL USA: National University of Health Sciences; 2008.
- 88 Green ML, Ruff TR. Why do residents fail to answer their clinical questions? A qualitative study of barriers to practicing evidence-based medicine. *Acad Med* 2005 Feb;80(2):176-82.
- 89 Del Mar CB, Glasziou PP. Ways of using evidence-based medicine in general practice. *Med J Aust* 2001 Apr 2;174(7):347-50.
- 90 Cramer GD. Curriculum Development in Evidence Based Practice. National Institutes of Health National Center for Complementary and Alternative Medicine CRISP [5R25AT002872-03]. 8-1-2005.
- 91 Sullivan BM, Wolcott CC, Ashley LE, Cambron JA, Cramer GD. Implementing an Evidence Based Journal Club in a Complementary and Alternative Medicine (CAM) University. 2008. ACCRAC proceedings.
- 92 Greenhalgh T, Toon P, Russell J, Wong G, Plumb L, Macfarlane F. Transferability of principles of evidence based medicine to improve educational quality: systematic review and case study of an online course in primary health care. *BMJ* 2003 Jan 18;326(7381):142-5.
- 93 March JS, Chrisman A, Breland-Noble A, Clouse K, D'Alli R, Egger H, et al. Using and teaching evidence-based medicine: the Duke University child and adolescent psychiatry model. *Child Adolesc Psychiatr Clin N Am* 2005 Apr;14(2):273-ix.
- 94 Straus SE. A potential framework for teaching evidence-based health care. 2007 Available from: URL: <http://www.cebm.net/?o=1021> accessed Aug 19 2008.
- 95 DeLisa JA, Jain SS, Kirshblum S, Christodoulou C. Evidence-based medicine in psychiatry: the experience of one department's faculty and trainees. *Am J Phys Med Rehabil* 1999 May;78(3):228-32.
- 96 Beasley BW, Woolley DC. Evidence-based medicine knowledge, attitudes, and skills of community faculty. *J Gen Intern Med* 2002 Aug;17(8):632-9.
- 97 Cartwright CA, Korsen N, Urbach LE. Teaching the teachers: helping faculty in a family practice residency improve their informatics skills. *Acad Med* 2002 May;77(5):385-91.
- 98 Ramani S. Twelve tips to promote excellence in medical teaching. *Med Teach* 2006 Feb;28(1):19-23.
- 99 Hendricson WD, Anderson E, Andrieu SC, Chadwick DG, Cole JR, George MC, et al. Does faculty development enhance teaching effectiveness? *J Dent Educ* 2007 Dec;71(12):1513-33.
- 100 Nicholson LJ, Warde CM, Boker JR. Faculty training in evidence-based medicine: improving evidence acquisition and critical appraisal. *J Contin Educ Health Prof* 2007;27(1):28-33.
- 101 Diner BM, Carpenter CR, O'Connell T, Pang P, Brown MD, Seupaul RA, et al. Graduate medical education and knowledge translation: role models, information pipelines, and practice change thresholds. *Acad Emerg Med* 2007 Nov;14(11):1008-14.
- 102 Linzer M. The journal club and medical education: over one hundred years of unrecorded history. *Postgrad Med J* 1987 Jun;63(740):475-8.
- 103 Seelig CB. Affecting residents' literature reading attitudes, behaviors, and knowledge through a journal club intervention. *J Gen Intern Med* 1991;6:330-4.
- 104 Shmerling A. Journal clubs for general practitioners. *Aust Fam Physician* 1991;20(6):814-6.
- 105 Sheehan J. A journal club as a teaching and learning strategy in nurse teacher education. *J Adv Nurs* 1994;19(3):572-8.
- 106 Sidorov J. How are internal medicine residency journal clubs organized and what makes them successful? *Arch Intern Med* 1995;155(11):1193-7.
- 107 Kirchhoff KT, Beck SL. Using the journal club as a component of the research utilization process. *Heart Lung* 1995 May;24(3):246-50.
- 108 Sandifer QD, Lo SV, Crompton PG. Evaluation of a journal club as a forum to practice critical appraisal skills. *J R Coll Physicians Lond* 1996;30(6):520-2.
- 109 Burstein JL, Hollander JE, Barlas D. Enhancing the value of journal club: Use of a structured review instrument. *Am J Emerg Med* 1996;14:561-3.

- 110 Alguire PC. A review of journal clubs in postgraduate medical education. *J Gen Intern Med* 1998 May;13(5):347-53.
- 111 Melchior JA, Meals RA. The journal club and its role in hand surgery education. *J Hand Surg [Am]* 1998 Nov;23(6):972-6.
- 112 Elnicki DM, Halperin AK, Shockcor WT, Aronoff SC. Multidisciplinary evidence-based medicine journal clubs: curriculum design and participants' reactions. *Am J Med Sci* 1999 Apr;317(4):243-6.
- 113 Dwarakanath LS, Khan KS. Modernizing the journal club. *Hosp Med* 2000 Jun;61(6):425-7.
- 114 Greene WB. The role of journal clubs in orthopaedic surgery residency programs. *Clin Orthop Relat Res* 2000 Apr;(373):304-10.
- 115 Ebbert JO, Montori VM, Schultz HJ. The journal club in postgraduate medical education: a systematic review. *Med Teach* 2001 Sep;23(5):455-61.
- 116 Hunt C, Topham L. Setting up a multidisciplinary journal club in learning disability. *Br J Nurs* 2002 May 23;11(10):688-93.
- 117 Forsen JW, Jr., Hartman JM, Neely JG. Tutorials in clinical research, part VIII: Creating a journal club. *Laryngoscope* 2003 Mar;113(3):475-83.
- 118 Grant MJ. Journal clubs for continued professional development. *Health Info Libr J* 2003 Jun;20 Suppl 1:72-3.
- 119 Phillips RS, Gasziou P. What makes evidence-based journal clubs succeed? *ACP J Club* 2004;140(3):A11-A12.
- 120 Glasziou P. What makes evidence-based journal clubs succeed? *Evidence-Based Medicine* 2004 Mar;9(2):36-7.
- 121 Goodfellow LM. Can a journal club bridge the gap between research and practice? *Nurse Educ* 2004 May;29(3):107-10.
- 122 Kanthraj GR, Srinivas CR. Journal Club: Screen, Select, Probe, Evaluate. *Indian J Dermatol Venereol Leprol* 2005;71(6):435-40.
- 123 Hammond J, Whalen T, Heneghan C, Perera R, Mant D, Glasziou P. Electronic Journal Club. An Asynchronous Problem-based Learning Technique Within Work-Hour Constraints Hypertension guideline recommendations in general practice; awareness, agreement, adoption, and adherence. *BJGP* 2007;57:948-52.
- 124 Doust J, Del Mar CB, Montgomery BD, Heal C, Bidgood R, Jeacocke D, et al. EBM journal clubs in general practice. *Aust Fam Physician* 2008 Jan;37(1-2):54-6.
- 125 American College of Physicians. ACP Journal Club. American College of Physicians Philadelphia, PA USA 2008. Available from: URL: <http://www.acpjic.org>
- 126 Sullivan BM, Cramer GD. The Evidence Based Practice Student Mentored Research Program at National University of Health Sciences and the University of Illinois Chicago. <http://www.nuhs.edu/show.asp?durki=688> 2009 January 8 [cited 2009 Feb 11]; Available from: URL: <http://www.nuhs.edu/show.asp?durki=688>