American Academy of Neurology  
Section on Neuroepidemiology  
Resident Core Curriculum

A Curriculum for Clinical Neuroepidemiology and Evidence-based Neurology

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1. Introduction and Justification

The American Academy of Neurology has begun to place a much greater strategic emphasis on demonstrating the value of the neurologist and on methodologies to track the outcomes of treatment by neurologists for the purpose of quality improvement. In addition, two prominent subcommittees of the AAN, the Quality Standards Subcommittee and the Therapeutics and Technology Assessment Subcommittee, produce evidence-based practice parameters, and technology assessments, respectively. The AAN, at its 1999 meeting in Toronto, sponsored two lively, relevant forums: The Educational Colloquium 99: Evidence Based Education, and the 1999 Guidelines and Outcomes Open House. The clear message from these well-attended sessions is that evidence-based medicine should become an integral part of post-graduate education for neurologists. Thus, educational opportunities for both neurology residents and for fellowship training should be developed and implemented in this area. The Section on Neuroepidemiology would thus propose a full two-year curriculum for fellowship training that would allow the development of research and teaching leaders in the field of Clinical Neuroepidemiology and Evidence-based Neurology. A less detailed curriculum, similar to that presented here, could be integrated into Neurology resident curricula on a more routine basis.

2. Goals and Objectives

This effort is intended to:

a. Stimulate the development of resources aimed at training neurologists in the field of Clinical Neuroepidemiology and Evidence-based Neurology.

b. Develop a comprehensive two-year educational curriculum sufficient to train research and education leaders in the field of Clinical Neuroepidemiology and Evidence-based Neurology.

c. Determine the types of academic institutions and resource environments most likely to be successful in training such research and education leaders.

d. Develop standards/certification requirements for the programs/individuals wishing to pursue fellowship programs.

e. Develop case modules from the comprehensive curriculum sufficient to apply to neurology resident education in routine training environments.
3. Definitions

Classic neuro-epidemiology has primarily involved the study of the population distribution of neurologic diseases, and of studies of causation of these diseases. The emphasis of classical epidemiology has been on primary prevention. Clinical neuroepidemiology would be defined as the application of scientific methods to the clinical practice of neurology, with a focus on diagnosis, treatment, and prognosis. The emphasis of clinical neuroepidemiology would be on secondary and tertiary prevention, that is, on improving the outcome of patient screening and treatment. A comprehensive curriculum would therefore encompass elements of both classic as well as clinical neuroepidemiology.

4. Content of Subjects to be Taught

The following is an outline of four core courses that would be taken over the first four trimesters of a 2-year post-doctoral curriculum. In addition to these courses, a one-year sequence of biostatistics courses would be taken in an affiliated Department of Biostatistics. The content of the core courses would likely require interdepartmental collaboration (e.g., between Neurology, Epidemiology, Biostatistics, and Health Services). Further work should be done to explore the attainment of a Masters Degree (Public Health, Health Services, etc.), rather than certification alone from this two-year course of fellowship training. Finally, it would be expected that the bulk of Year 2 would include a methodologically-oriented research project in one of the core areas of endeavor.

CORE COURSE I: Clinical Epidemiology and Trial Methodology

Diagnostic and Screening Tests
   (I) Evaluation of diagnostic tests (sensitivity, specificity, ROC curves, etc.)
   (II) Screening tests

Natural History of Disease
   (I) Prognostic studies

Clinical Trials
   (I) Design: randomized, blinded trial, other designs (factorial design, randomized block, etc.)
   (II) Conduct: Inclusion/exclusion criteria, choice of comparison groups, randomization of subjects
   (III) Conduct: Baseline evaluation, outcome measurements, quality-of-life measurements
   (IV) Conduct: Applying the intervention, assuring compliance, achieving complete follow-up
   (V) Logistics: Drug development (phase I, II and III trials, IND/NDA development)
   (VI) Analysis: Intention-to-treat analyses, interim analyses

Analytic Methods
   Estimating sample size and power
   Statistical analysis of trial data
CORE COURSE II: Epidemiologic Methods
   Measures of disease frequency
   Risk measures, measures of effect, attributable risk
   Causal inference
   Assessment of effect modification (interaction)
   Observational study designs
   Cohort design (retrospective, prospective)
   Cross-sectional
   Case-control, nested case-control
   Nested case-control
   Case-cohort
   Sample size and power estimation for observational designs
   Survey sampling methods
   Sources of study bias (!): selection bias, nonresponse
   Sources of study bias (II): confounding (methods for assessing/controlling; matching, stratification)
   Sources of study bias (III): measurement error

Statistical Analysis of Observational Data

CORE COURSE III: Health Services Research
Outcomes Research
Quality of Care Research
Cost-effectiveness Analysis
Statistical Analysis of Health Services Data
Evidence-based Medicine
Best Evidence Synthesis
Formal Consensus Development
Development and Evaluation of Treatment Guidelines
Quality Improvement Methods
Technology Assessment
Quality Indicators and Performance Measurement
Use of new technologies for literature search, evaluation and resource accession

CORE COURSE IV: Conduct of Clinical Research
Measurement
   (I) Theory, measurement scales, effects of measurement effort on power and validity
   (II) Development and evaluation of health outcome instruments, questionnaire design
   (III) Validity and reliability testing
   (IV) Qualitative methods
Data Management and Computing
   (I) Data collection methods/sources of error
(II) Quality control, methods for reducing measurement error
(III) Guide to statistics and database software
(IV) Database management (structures, design, reporting and query operations)
(V) Using the internet

Communication in Clinical Research
(I) Grant preparation and protocol development
(II) Abstracts, posters and slide presentations
(III) Journal article preparation, authorship concerns
(IV) Critical appraisal of the scientific literature

Ethical Issues in the Conduct of Research
(I) Ethical issues in the treatment of human subjects, federal guidelines
(II) Institutional review boards, informed consent
(III) Legal issues (intellectual property, patenting, conflict of interest)

5. Prerequisites for the Trainee

a. Completion of an ACGME-accredited Neurology residency

b. Board eligible or certified in Neurology by the American Board of Psychiatry and Neurology (ABPN)

6. Personnel and Qualifications Needed for the Training

a. Qualified Program Director—The program director should have formal training in one of the Core areas, and an appointment in both Neurology and at least one relevant department (Epidemiology, Biostatistics, Health Services, etc.).

b. Other Qualified Faculty—A liaison faculty person from each of the core contributing departments should be assigned as required.

7. Facilities Needed for the Training

In general, this is not a clinically-based fellowship. Therefore, minimum requirements for patient contact are not a requisite part of the program.

In order to fulfill the extensive curricular and research goals of the fellowship, it is likely that this program be conducted through both a school of medicine and a school of public health, or through a school of medicine alone with resources sufficient to meet curricular needs.

For the research (Year 2) part of the fellowship, appropriate research resources should be available in the institution (e.g., General Clinical Research Center, existing fellowship program in evidence-based medicine, etc.).
8. **Setup for the Training**

   a. The training program should be administratively housed in either a Department of Neurology accredited by the ACGME, or in another liaison core department (Epidemiology, Biostatistics, Health Services, etc.).

   b. The Program Director shall have overall responsibility for the conduct and oversight of the program. In addition, particularly in the case of pursuit of a Masters Degree, a graduate education advisory committee shall be assembled. In addition, the Program Director shall be responsible for:

   — Recruitment and appointment of qualified candidates
   — Demonstration of all affiliation agreements in writing by departments participating in Core Course or research teaching.
   — Providing a record of satisfactory completion of the fellowship, including transcripts of all Core courses, and demonstration of competence in conducting research in one of the core areas.
   — Maintenance of all training records, and coordination with Graduate Education Offices sufficient for record maintenance

9. **Methods of Training**

Most of the training related to the Core Courses would occur in a didactic forum in a school of graduate education or a school of medicine. Specific mentoring related to the Year 2 research project would also be required. In addition, liaison with affiliated AAN committees (QSS, TTA) would provide each trainee the opportunity to produce one practice parameter/technology assessment during their 2-year fellowship. Finally, each fellow would actively participate in relevant interdepartmental conferences.

10. **Timetable for Training**

Training would generally require a full time, 2-year program, or an equivalent, part time program as arranged by the candidate and Program Director. To the extent possible, flexibility in this area, and possible collaboration with extended degree programs, would be desirable in attracting experienced neurologists.

11. **Methods of Evaluation of the Trainee**

Since the emphasis in this program would be on formal training in affiliated departments, with a targeted Masters Degree in one of the core topic areas, evaluation would generally occur through graduate education programs. In addition, oversight by the Program Director, and certification of competence after fellowship completion, would be provided.
12. Methods of Evaluation of the Training Process

A national advisory group would be established through the Neuroepidemiology Section to monitor the quality of training programs. This group would proceed in collaboration with the AAN and other appropriate national certifying groups.

13. Mechanisms for Feedback

Each program shall receive regular feedback from all trainees, participating faculty, and the national advisory committee.

14. Methods of Constantly Upgrading Knowledge

It is expected that the majority of fellows completing this program would pursue academic or policy positions. As such, they would likely continue to independently participate in teaching and research programs.

15. List of References/resources

(This list will be augmented in the future)


16. Continuing Medical Education Needed

Continued participation within the AAN, the ANA, as well as with appropriate other relevant professional and research organizations.

Developed by the following members of the Neuroepidemiology Section:

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