Cape Fear Community College

Program Title: Medical Sonography

Credential: AAS

Proposed Semester and Year of Implementation: Fall, 2001

Contact Person for the Application: Rick Zigler

Phone: (910) 251-5956

Institutional Certification:

This curriculum program will enhance the workforce of North Carolina, will provide educational and training opportunities consistent with the mission of the college, and will not duplicate the opportunities currently offered.

Cape Fear Community College

has assessed the need for this program and the resources required to maintain a viable program and certifies that the college can operate this program efficiently and effectively within the resources available to the college.

Signature, President: ____________________________ Date: __________

Signature, Board of Trustees Chair: ____________________________ Date: __________

Is this a collaborative program application? Yes X No

For collaborative programs, please submit the attached Collaborative Agreement Plan Signature Page (see Attachment 1).

NCCCS Office Use Only

Date Received: ____________ Date Logged in: ____________

Date to Coordinator: ____________ Coordinator: ____________________________
CURRICULUM PROGRAM APPLICATION

I. Program Planning

A. Planning Area: The initial planning area is the CFCC service area of New Hanover and Pender counties; however, the program will support the needs of the entire southeastern North Carolina region.

B. Purpose: The purpose of the Medical Sonography program is to provide knowledge and clinical skills in the application of high frequency sound waves to image internal body structures. The primary regional hospital in southeastern North Carolina, New Hanover Health Network, has identified Medical Sonography as a critical skill – to the extent that they are willing to provide facilities, equipment and faculty to support the program. They are also willing, in the long run, to support the needs for sonographers at the other member hospitals of the Coastal Carolina Health Alliance: Bladen County, Brunswick Community, Columbus County, Dosher Memorial, Duplin General and Southeastern Regional.

Part of the mission of Cape Fear Community College, as revised by the Board of Trustees on January 18, 1996 is “implementing new curricula to serve the changing needs of the service area.” This application reflects that mission and is also in consonance with CFCC Institutional Effectiveness and Strategic Planning efforts. The CFCC Strategic Plan, 1997-2017, has as strategic goals to “…stimulate economic development and to enhance job opportunities for graduates,” as well as “…to accommodate growth in enrollment and programs.”

C. Notification: All North Carolina Community Colleges were notified of CFCC’s intention to apply for a Medical Sonography program on May 21, 2001. That notification is at Attachment 1. Johnston Community College expressed initial interest in participating in the planning process (see paragraph IIA) but could not attend the planning meeting and, following discussion, posed no objection to CFCC initiation of the program. No other colleges expressed interest as of June 13, 2001.

D. Planning Meeting: A combination planning and Advisory Committee meeting was held on May 23, 2001. Minutes are at Attachment 2.

E. Commuting Distance: In 1999, CFCC randomly surveyed 118 prospective students at its open house. The purpose of the survey was to determine interest and desired commuting time for a number of programs. Of the total surveyed, 67 (57%) expressed a desire for a commute of no longer than 30 minutes; 36 (30%) were willing to commute up to 60 minutes, and only 15 (13%) were willing to tolerate more than a 60 minute commute. Most recently, in a March 2000 random survey of 117 CFCC Adult High School students, 86 (74%) expressed a desire for a commute no longer than 60 minutes. Given the metropolitan nature of the commuting area especially CFCC’s downtown location, the reasonable commuting distance is defined as follows:

<table>
<thead>
<tr>
<th>Reasonable Commuting Distance for Medical Sonography</th>
<th>(program title)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of Program</td>
<td>Est. Mileage</td>
</tr>
<tr>
<td>Wilmington, NC</td>
<td>30 miles</td>
</tr>
</tbody>
</table>

F. Employment Availability:

Medical Sonographers are in demand. New Hanover Health Network has openings for seven employees immediately and estimates 10-20 annually in the future. Other service area employers estimate one vacancy per year. The Coastal Carolina Health Alliance projects immediate requirements within the region
but outside the service area at 4 moving to 7 in two years. Jobs will pay in the vicinity of $19.00 per hour to start in the service/planning area. Attachment 6 contains specific employment data.

<table>
<thead>
<tr>
<th>Tabulated Results of Employment Availability Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Within Planning Area</td>
</tr>
<tr>
<td>Within Service Area</td>
</tr>
</tbody>
</table>

G. Program Planning/Advisory Committee Members:

Tonda Verdejo  
Vice President for Workforce Development  
New Hanover Health Network  
2131 S. 17th St.  
Wilmington, NC 28401  
(910) 343-2779

Elizabeth Moore  
Acting Director of Radiology  
New Hanover Health Network  
2131 S. 17th St.  
Wilmington, NC 28401  
(910) 343-7082

Barbara Hyatt  
Ultrasound Manager  
New Hanover Health Network  
2131 S. 17th St.  
Wilmington, NC 28401  
(910) 815-5101

Bobbie Burn  
Radiology Manager  
New Hanover Health Network  
2131 S. 17th St.  
Wilmington, NC 28401  
(910) 343-2527

Eric Roseberg, MD  
Radiologist  
New Hanover Health Network  
2131 S. 17th St.  
Wilmington, NC 28401  
(910) 762-3882

Ex Officio:

Dr. William Atkinson  
Chief Executive officer  
New Hanover Health Network  
2131 S. 17th St.  
Wilmington, NC 28401

Sandra Woodfield  
Director, Radiography Programs  
Cape Fear Community College  
411 N. Front St.  
Wilmington, NC 28401  
(910) 251-5197

Susan Vinson-Greene  
Chair, Allied Health Department  
Cape Fear Community College  
411 N. Front St.  
Wilmington, NC 28401  
(910) 251-5182

Mr. Dan Hickman  
Vice President of Instruction  
Cape Fear Community College  
411 N. Front St.  
Wilmington, NC 28401  
(910) 251-5125

Mr. Robert Philpott  
Dean, Vocational and Technical Programs  
Cape Fear Community College  
411 N. Front St.  
Wilmington, NC 28401  
(910) 251-5109
II. Impact of the Proposed Program on Other Programs in the System

A. Similar Programs: The Medical Sonography program is approved at Caldwell, Forsyth, Johnston, Pitt and Southwestern Community Colleges. CFCC attempted to develop a cooperative agreement with Pitt to extend their program to Southeastern North Carolina, but Pitt rejected the offer. A similar discussion was recently held with Johnston Community College, but NHHN and CFCC officials now agree that a local program operated by CFCC at NHHN offers the maximum advantage in terms of flexibility and responsiveness. There are no same or similar programs within a reasonable commuting distance of CFCC.

B. Impact: CFCC envisions little or no impact on the program offered at any other community college.


D. Negative Responses: N/A

III. Feasibility Plan

A. Potential Students: New Hanover Health Network has begun internally advertising for prospective students and has already received 48 positive responses. CFCC has also received at least a dozen unsolicited inquiries. Because NHHN intends to continue to pay employees who enroll in the Medical Sonography program, enrollment should not be a problem particularly in the first two years.

<table>
<thead>
<tr>
<th>Name of Group</th>
<th>Number Surveyed</th>
<th>Number of Positive Responses</th>
<th>Full-time</th>
<th>Part-time</th>
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<tbody>
<tr>
<td>New Hanover Health Network</td>
<td>Advertised to all 4,000 employees</td>
<td>48</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>CFCC</td>
<td>Unsolicited</td>
<td>12</td>
<td>N/A</td>
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B. Enrollment Capacity:

<table>
<thead>
<tr>
<th></th>
<th>Program Enrollment Capacity</th>
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<tbody>
<tr>
<td></td>
<td>1st Class</td>
</tr>
<tr>
<td>Full-time</td>
<td>Up to 8</td>
</tr>
<tr>
<td>Part-time</td>
<td>0</td>
</tr>
</tbody>
</table>

C. Facilities: New Hanover Health Network will provide all facilities. NHHN operates three sonographic facilities accredited by the American College of Radiology. A facility and equipment
description is at Attachment 7.

D. **Equipment**: New Hanover Health Network will provide all equipment. A facility and equipment description is at Attachment 7.

E. **Specific Requirements:**

1. **Admission requirements**

   Students are admitted to the Medical Sonography Associates Degree Program once a year in the Fall term. They are considered for admission only after all admission requirements have been completed. Each student is required to meet the minimum admission requirements of the college. In addition, applicants must complete the following:

   a. Submission of a completed application to the school's admission office.

   b. Submission of records of high school graduation or equivalent and any post-secondary transcripts.

   c. Submission of a physical exam results as determined by a physician, physician assistant, or nurse practitioner. This physical history must include a TB skin test (chest X-ray if positive reaction), immunization record, urinalysis, rubella titer or evidence of rubella vaccination. This medical form evaluates emotional and mental well-being. Students may receive tentative acceptance into the Medical Sonography program prior to completion of the physical exam. The student must submit a physical exam prior to final acceptance.

   d. Completion of placement testing procedures as scheduled by student services. ASSET scores are valid for five-years. Applicants to the Medical Sonography program may take ASSET twice in each calendar year with a three month interval between testing dates. ASSET minimum requirements are:

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<thead>
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<th>Subject</th>
<th>Score</th>
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<tbody>
<tr>
<td>Asset Reading</td>
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</tr>
<tr>
<td>Asset Writing</td>
<td>42</td>
</tr>
<tr>
<td>Asset Computation</td>
<td>42</td>
</tr>
<tr>
<td>Asset Elementary Algebra</td>
<td>38</td>
</tr>
<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>Asset Intermediate Algebra</td>
<td>30</td>
</tr>
</tbody>
</table>

   e. Completion of the Psychological Services Bureau (PSB) Test for Health Occupations Admissions. Applicants may take the PSB once each calendar year. A student must meet the minimum PSB score requirement of 35<sup>th</sup> percentile in verbal, arithmetic, non-verbal, reading comprehension and natural science.

   f. Applicants will be ranked based upon points earned, and the students with the highest number of points will be selected. If students have the same total point count, the date and time that the application was received in the Counseling office will be considered.

   g. No student is registered for SON prefix courses until all the above requirements have been met.

In addition to the above, students applying for the Medical Sonography Diploma program must possess as a minimum an Associates Degree in an Allied Health discipline that involves direct patient care.

2. **Accreditation/special approval requirements**

   While the Commission on Accreditation of Allied Health Programs (CAAHEP) accredits Medical
Sonography programs, this accreditation is not a requirement for graduate certification and may occur, if desired, at any time after program initiation.

3. **Clinical site requirements**

New Hanover Health Network will provide all clinical facilities.

4. **Faculty requirements**

CFCC projects one full-time director and lead instructor ($71,123 including benefits) with clinical coordinator costs of $10,000. The program will be initiated as a one year diploma program; however, the program will ultimately also include an AAS degree and at that time a second full-time instructor/clinical coordinator will be required for the second year of the AAS program ($59,645). Supply costs are estimated at $5,000 per year.

5. **Library Resources**

Negligible impact

6. **Other**

N/A

**F. Estimated Costs:**

<table>
<thead>
<tr>
<th></th>
<th>Estimated Costs</th>
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<tbody>
<tr>
<td>Start-up</td>
<td>$86,123</td>
</tr>
<tr>
<td>(include instructor costs)</td>
<td></td>
</tr>
<tr>
<td>Ongoing</td>
<td>$145,768</td>
</tr>
<tr>
<td>(projected yearly costs)</td>
<td></td>
</tr>
</tbody>
</table>

**G. Funding:** CFCC will provide the program initially under a contractual agreement with New Hanover Health Network which will cover all costs less FTE revenues for the first two years of the program.

**H. Other Data:** N/A

**IV. Implementation of Collaboration Plan**

N/A

**V. Curriculum Design**

A. **Job Competencies:** See Attachment 10

B. **Program of Study:** See Attachment 3

C. **Curriculum Model:** See Attachment 4
Attachment 1

PROGRAM PLANNING PROCESS NOTIFICATION
Attachment 2

PLANNING AND ADVISORY COMMITTEE MEETING MINUTES
Meeting was called to order at 3:40PM in the Auxiliary Conference Room at New Hanover Regional Medical Center. Those in attendance included:

Bob Philpott      Rick Zigler
Susan Vinson-Greene     Sandra Woodfield
Bobby Burn      Tonda Verdejo
Elizabeth Moore

Mr. Philpott began the meeting by updating the committee on Pitt Community College’s decision to withdraw support from this sonography program. Dr. McKeithan has requested an application be submitted to the state for Cape Fear Community College’s own medical sonography program to start in August 2001. Dr. McKeithan has invited Dr. Atkinson (CEO, NHHN) to join him in Raleigh as this application is considered.

Mr. Zigler offered the 25-page document which is the application to the state for this program. This application is for a two-year associates degree program. The first class would be a diploma program lasting only one year. Copies of the application were distributed to members. Topics discussed included:

- Qualifications for applicants of the one-year diploma program would include: Graduates with a least an associate’s degree in the allied health field, with direct patient care experience.

- In subsequent years the associate’s program will accept qualified applicants with less experience and education.

- Students would be selected through a competitive selection process.

- Ms Verdejo suggested limiting the first year to not more than six students and subsequent years to not more than 10. Subject to change as clinical site staffing changes.

- New Hanover Health Network will provide a grant to the college in support of this program. This grant will underwrite expenses during the first year of operation. In addition to this grant New Hanover Health Network will supply clinical sites for students, space for class and laboratory and related equipment.

- Ms. Vinson-Greene expressed concern about problems experienced by Radiography students when using patient areas or equipment for labs. Labs were often disrupted (in the Radiography program) for patient imaging.

- Ms. Moore offered reassurances saying that would not be a problem.

- Ms Verdejo asked about the possibility of after hours labs (evening)

- Ms Vinson-Greene suggested that students often work evenings and that filling a faculty position, which requires specific credentials, and odd contact hours would be difficult.

- Mr. Burn suggested that Cardiology might be interested in participating in this program. Radiology offers an abundance of abdominal and obstetrical exams but is limited in vascular imaging.

- Ms Woodfield identified the concentration of the diploma program as abdominal or OB. Graduates would be prepared to take national registries in sonographic physics and abdominal or OB but not echo or vascular. That component could be included in the associate program, at which time Cardiology would be instrumental in providing clinical experiences for students.
Clarification was requested between clinical coordinator and clinical instructor. Governing bodies do not request a clinical coordinator for programs with less than 8 sites. But a clinical instructor must be present in the clinic whenever students are in the clinic. Clinical sites have been providing a designated staff member (clinical instructor) with release time to complete Radiography program responsibilities. This same arrangement could work in the Sonography program as well.

Ms. Verdejo identified the starting pay for sonographers at New Hanover at $20.03/hr with top pay ranging up to 29.90/hr. There are currently 7 positions open in the ultrasound department.

Ms. Verdejo offered that the hospital has 48 employees express interest in applying for this program. Ms. Woodfield identified another 10 unsolicited inquiries. Apparently there will be no problem filling the program.

Ms. Verdejo asked for assurances that the program would start in the fall of 2001.

Mr. Philpott responded yes, as long as approval from the state if forthcoming.

Ms. Moore suggested that we encourage students to start the application process.

Ms Vinson-Greene suggested that we immediately advertise the faculty position contingent on approval from the state. Advertising through the normal college procedure and on the web page for the society of medical sonographers in North Carolina.

The meeting was adjourned at 5:00PM.
Attachment 3

PROGRAM OF STUDY
College Approved or Applying to Offer Program Cape Fear Community College  Date March 15, 2000

Program Code  A45440  
(Not applicable for programs new to the System)

Program Title  Medical Sonography

Concentration Title  N/A  
(If applicable)

Credential  (Indicate the highest credential to be awarded)

  X  AAS  
  _____ Diploma  
  _____ Certificate

Proposed Semester and Year of Implementation  Fall, 2001

Contact Person for Program of Study  Rick Zigler

Phone (910) 251-5956  Extension  N/A  
E-mail  rzigler@capefear.cc.nc.us

Curriculum Description

The Medical Sonography curriculum provides knowledge and clinical skills in the application of high frequency sound waves to image internal body structures.

Course work includes physics, cross-sectional anatomy, abdominal, introductory vascular, and obstetrical/gynecological sonography. Competencies are attained in identification of normal anatomy and pathological processes, use of equipment, fetal growth and development, integration of related imaging, and patient interaction skills.

Graduates of accredited programs may be eligible to take examinations in ultrasound physics and instrumentation and specialty examinations administered by the American Registry of Diagnostic Medical Sonographers and find employment in clinics, physicians’ offices, mobile services, hospitals, and educational institutions.

Course Number/Title                              Class   Lab   Clinic/Exp   Credits

I.  GENERAL EDUCATION

1. Required Courses

ENG 111 Expository Writing                      3   0   0   3
ENG 114 Prof Research and Reporting             3   0   0   3
MAT 115 Mathematical Models                     3   0   0   3

2. Required Subject Area

PSY 150 General Psychology                      3   0   0   3
Humanities/Fine Arts Elective                    3   0   0   3

General Education SHC Sub-Total                 15
### II. MAJOR HOURS

#### 1. Required Courses

<table>
<thead>
<tr>
<th>Course Number/Title</th>
<th>Class</th>
<th>Lab</th>
<th>Clinic/Exp</th>
<th>Credits</th>
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<td>3</td>
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<tr>
<td>SON 111 Sonographic Physics</td>
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<td>4</td>
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<td>SON 131 Abdominal Sonography II</td>
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<td>SON 241 Obstetrical Sonography I</td>
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<td>SON 250 Vascular Sonography</td>
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<td>SON 289 Sonographic Topics</td>
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#### 2. Required Subject Area

<table>
<thead>
<tr>
<th>Course Number/Title</th>
<th>Class</th>
<th>Lab</th>
<th>Clinic/Exp</th>
<th>Credits</th>
</tr>
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<td>BIO 163 Basic Anatomy and Physiology</td>
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*Core SHC Sub-Total*  
54

#### B. Concentration None

#### C. Other Major Hours

#### 1. Required Courses

<table>
<thead>
<tr>
<th>Course Number/Title</th>
<th>Class</th>
<th>Lab</th>
<th>Clinic/Exp</th>
<th>Credits</th>
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#### 2. Required Subject Area None

*Other Major Hours SHC Sub-Total*  
4

*Major Hours SHC Sub-Total*  
54

### III. OTHER REQUIRED COURSES None

*Other Required Courses SHC Sub-Total*  
0

*Total Semester Hours Credit in Program*  
73
Attachment 4

CURRICULUM MODEL
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<th>TITLE</th>
<th>CLASS</th>
<th>LAB/CLINIC</th>
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<td>BIO</td>
<td>Basic Anatomy and Physiology</td>
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<tr>
<td>ENG</td>
<td>Expository Writing</td>
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<tr>
<td>MAT</td>
<td>Mathematical Models</td>
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<td>3</td>
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<tr>
<td>SON</td>
<td>Introduction to Sonography</td>
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<tr>
<td>SON</td>
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# CURRICULUM MODEL – Diploma

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14

**GRAND TOTAL SHC**

45
Attachment 5

CURRICULUM STANDARD
Attachment 6

EMPLOYMENT SURVEY
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<th>Respondent Information</th>
<th>Number of Positions Available</th>
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<th>Salary Average</th>
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<td>Current 1</td>
<td>$15.50/hour</td>
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<td>b. Marie Smith, HR Director</td>
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<td>c. Elizabethtown, NC</td>
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<td>d. (910) 862-5113</td>
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<td>a. Brunswick Community Hospital</td>
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<td>c. Supply, NC</td>
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<td>d. (910) 755-8121</td>
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<td>a. Columbus County Hospital</td>
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<td>b. Bill Ratliff</td>
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<td>c. Whiteville, NC</td>
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<td>d. (910) 642-1722</td>
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<td>b. Ron Moore</td>
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<td>d. (910) 343-7049</td>
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<td>d. (910) 762-3882</td>
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<td>TOTAL or AVERAGE</td>
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Attachment 7

FACILITY and EQUIPMENT DESCRIPTION
**Cape Fear Hospital**

**Hours of Operation:** Monday - Thursday 7am-8pm (on call after 8pm)  
Weekends - 24 hour on call

**Equipment:**  
Accuson Sequoia - 1 unit  
Kodak Dry View Laser

**Total Number of Exams per Year:** 3748 (85% OP)  
This site performs routine vascular studies

**Case Mix:**  
40% Abdomen/Renal Doppler  
30% Vascular (Carotid/DVT)  
20% Pelvis  
8% Breast/Small Parts  
2% OB

**Work Area:** Two Cubicles and adjoining staff work area – 440 Square feet

---

**NHRMC - Main Campus**

**Hours of Operation:** Monday thru Thursday - 24 hours  
Friday 7am - 11 pm (on call after 11pm)  
Weekends 7am-7pm (on call after 7pm)

**Equipment:**  
Accuson Sequoia - 2 units (4 additional units to be ordered this summer)  
Kodak Dry View Laser

**Total Number of Exams per Year:** 8820 (Monthly average 735 * OP 55%)  
**Case Mix:**  
50% Speciality Type Procedures (Biopsy, Para/Thora, OR)  
20% Abdomen (including renal artery)  
15% Pelvis  
10% OB (mainly 1st trimester)  
5% Small Parts (breast/thyroid)

---

**Medical Mall Imaging Center**

**Hours Of Operation:** Monday - Friday 7am - 5pm  
Closed Weekends

**Equipment:**  
Accuson XP 128 - 2 units  
Kodak Dry View Laser

**Total Number of Exams per year:** 4938 (Monthly avg 412 - all OP)  
**Case Mix:**  
30% Abdomen  
30% Pelvis  
15% Renal  
15% Breast  
8% Small Parts  
2% OB

**Work Area:** Two exam rooms – 120 sq ft each - Staff work area 30 sq ft - 270 Total
Attachment 8

SUPPORTING CORRESPONDENCE
Attachment 9

IMPACT ASSESSMENT SURVEY
Attachment 10

JOB COMPETENCIES
MEDICAL SONOGRAPHER COMPETENCIES

The following competencies were adopted by the American Institute of Ultrasound in Medicine in 1996 and modified by the Cape Fear Community College Medical Sonography Advisory Committee.

General Competencies

1. Utilize oral and written communication.
   a. Maintain clinical records.
   b. Interact with the interpreting physician or other designated physicians with oral or written summary of findings as permitted by employer policy and procedure.
   c. Recognize significant clinical information and historical facts from the patient and the medical records, which may impact on the diagnostic examination.
   d. Comprehend and employ appropriate medical terminology, abbreviations, symbols, terms, and phrases.
   e. Educate other health care providers and the public in the appropriate applications of ultrasound/non-invasive diagnostic vascular evaluation, including the following:
      - Medical terminology
      - Sonographic/other non-invasive diagnostic vascular terminology
      - Pertinent clinical signs, symptoms, and laboratory tests
      - Pertinent legal principles

2. Provide basic patient care and comfort.
   a. Maintain infection control and utilize universal precautions.
   b. Anticipate and be able to respond to the needs of the patient.
   c. Identify life-threatening situations and implement emergency care as permitted by employer procedure, including the following:
      - Infection control and universal precaution procedures
      - Pertinent patient care procedures
      - Principles of psychological support
      - Emergency conditions and First Responder procedures
      - First aid and resuscitation techniques

3. Demonstrate knowledge and understanding of human gross and sectional anatomy.
   a. Evaluate anatomic structures in the region of interest.
   b. Recognize the sonographic appearance of normal tissue structures, including the following:
Gross sectional anatomy
Embryology
Normal sonographic patterns

4. Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
   a. Obtain and evaluate pertinent patient history and physical findings.
   b. Extend standard diagnostic testing protocol as required by patient history or initial findings.
   c. Review data from current and previous examinations to produce a written/oral summary of technical findings, including relevant interval changes, for the interpreting physician's reference.
   d. Recognize examination findings that require immediate clinical response and notify the interpreting physician of such findings, including the following:

   Patient interview and examination techniques
   Chart and referral evaluation
   Diagnostic testing protocols related to specific disease conditions
   Physiology including blood flow dynamics
   Pertinent pathology and pathophysiology
   Pertinent legal issues

5. Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
   a. Select the appropriate technique(s) for examination(s) being performed.
   b. Adjust instrument controls to optimize image quality.
   c. Perform linear, area, circumference, and other related measurements from sonographic images or data.
   d. Recognize and compensate for acoustical artifacts.
   e. Utilize hard-copy devices to obtain pertinent documentation of examination findings.
   f. Minimize patient exposure to acoustical energy, which includes the following:

   Acoustical physics
   Sound production and propagation
   Interaction of sound and matter
   Instrument options and transducer selection
   Principles of ultrasound instruments and modes of operation
   Operator control options
   Physics of Doppler
   Principles of Doppler techniques
   Methods of Doppler flow analysis
   Techniques for recording static and dynamic images
   Acoustical artifacts
6. Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations, including the following:

   Biologic effects
   Pertinent in-vitro and in-vivo studies

7. Employ professional judgment and discretion.

   a. Protect the patient's right to privacy.
   b. Maintain confidentiality.
   c. Perform within the scope of practice.
   d. Adhere to professional codes of conduct/ethics.

8. Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory, including the following:

   Administrative procedures
   Quality control procedures
   Elements of quality assurance program
   Records maintenance
   Personnel and fiscal management
   Trends in health care systems

9. Recognize the importance of continuing education, through the following:

   Professional journals
   Conferences
   Lectures
   In-house educational offerings
   Professional organizations and resources
   Recent developments in sonography
   Research statistics and design

**Specific Competencies**

1. Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes:

   Demonstration/laboratory sessions
   Clinical education
2. Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns:

- Liver
- Biliary system
- Pancreas
- Urinary tract
- Adrenal glands
- Spleen
- Prevertebral vessels
- Peritoneal cavity, including potential spaces
- Gastrointestinal tract
- Noncardiac chest
- Neck
- Breast
- Scrotum
- Prostate
- Anterior abdominal wall
- Extremities
- Brain and spinal cord
- Neonatal neuro anatomy

3. Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis:

- History and physical examination
- Related imaging, laboratory, and functional testing procedures
- Clinical differential diagnosis
- Role of ultrasound in patient management
- Sonographic and Doppler patterns in clinical diseases which may occur in the following categories:
  - Iatrogenic
  - Degenerative
  - Inflammatory
  - Traumatic
  - Neoplastic
  - Infectious
  - Obstructive
  - Congenital
  - Metabolic
  - Immunologic

4. Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns:

- Reproductive system
- Pelvic muscles
- Suspensory ligaments
5. Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters:

- Sonographic sectional anatomy
- Pertinent measurement techniques
- Doppler applications
- Normal sonographic appearance of fetal and maternal structures

6. Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology:

- History and physical examination
- Related imaging, laboratory, and functional testing procedures
- Differential diagnosis
- Role of ultrasound in patient management
- Abnormal sonographic patterns:
  - Iatrogenic
  - Degenerative
  - Inflammatory
  - Traumatic
  - Neoplastic
  - Infectious
  - Obstructive
  - Congenital
  - Metabolic
  - Immunologic
  - Contraceptive devices
  - Infertility procedures
  - Doppler applications

7. Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology:

- History and physical examination
- Related imaging, laboratory, and functional testing procedures
- Differential diagnosis
- Role of ultrasound in patient management

- Abnormal sonographic patterns in pregnancy:
  - Placenta
  - Congenital/genetic anomalies
  - Growth abnormalities
  - Amniotic fluid
  - Viability
  - Multiple gestation
  - Fetal monitoring
Maternal factors
Postpartum
Fetal therapy
Ectopic pregnancy

8. Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.