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ANSWERING THE NEED FOR MULTI-SKILLED PRACTITIONERS IN RADIOLOGIC SCIENCE: A MODEL CIRCULAR DESIGN

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ABSTRACT: In response to recent cost containment pressures due to the restructuring of health reimbursement and shifts in patient care, hospitals have begun to focus on the efficiency of their operations. The necessity of reducing idle time and overall personnel costs has generated interest in health care workers who are able to perform more than one function. Radiologic science represents the single largest group of graduates under the auspices of the American Medical Association's Council on Allied Health Education and Accreditation. Staffing in departments of radiology represent a major personnel need within the hospital setting. The purposes of this paper are (a) to provide a rationale for educating multi-skilled personnel within medical imaging and therapy for more cost effective delivery of health care and (b) to present a curricular model that enables students to become multi-skilled within radiologic science.

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An important policy for any institution offering programs in allied health is a commitment to be responsive to the needs of the population it serves. The World Health Organization (1987) calls this concept community based education and considers a community to be a state, region, or country. Certainly, institutions involved with allied health training need to be responsive to personnel needs as dictated by those who offer various health services within their community. The University of Alabama at Birmingham has developed a curriculum model in radiologic science with input from its community, which consists of the state of Alabama, the southeastern region of the United States, and, to some extent, the entire country. It is important to remember that curricular models should be developed within the context of the community, its health service needs, and its overall industrial and societal development. The focus of this paper is two fold: First is the need for educating multi-skilled health personnel with implications for cost effective delivery of health care. Second is a curricular model in radiologic science that demonstrates how multi-skilled personnel may be prepared for clinical applications in medical imaging and therapy.

Definition of Terms

There have been various terms used in referring to health professionals who are capable of performing clinical skills in assorted areas. In addition to multi-skilled, the terms multi-competent, cross-trained, dual credentialed, and skill enhanced have appeared in the literature. The term multi-skilled will be used. The following definition was developed by the advisory panel of the National Multi-Skilled Health Practitioner Clearinghouse (1988):

> The multi-skilled health practitioner is a person who is cross trained to provide more than one function, often in more than one discipline. Their combined functions can be found in a broad spectrum of health related jobs ranging from the nonprofessional to the professional level including both clinical and management functions. The additional functions added to the original health care worker's job may be of a higher, lower, or parallel level (p. 2).

Job enrichment, which is similar to the multi-skilled concept, has been prevalent in business and industry for several decades. Job enrichment is the deliberate upgrading of responsibility and scope of one's work (Hersey & Blanchard, 1982). Various corporations, after instituting job enrichment programs, measured higher productivity levels (Helbriegel & Slocum, 1974; Walton, 1972). This concept was utilized to increase productivity while positively affecting the employee's job satisfaction.

Herzberg's (1966) two factor theory of motivation reinforces the idea that the work itself is an important factor to employees. Herzberg's theory suggests that job content is one of a number of motivators for individuals in the workplace. Thus, enrichment of job content may benefit both the institution and the individual.

Certainly, the payoff of this practice in terms of more effective utilization of staff while increasing motivation and job satisfaction is something educational institutions should consider in developing programs for health care providers. Although the term multi-skilled is a relatively new term in allied health, the practice of utilizing health personnel to perform a variety of tasks that cover diverse clinical

specialties

selected hospitals and offices and clinics of physicians indicated that almost half of the smaller rural hospitals and about 70% of the responding physicians employed individuals with clinical skills representative of two or more allied health disciplines (Clark, 1980). The use of personnel in dual roles by some health care facilities is not uncommon, but, in most cases, it has been the institution's responsibility to train those persons for their expanded job duties.

In a recent World Health Organization's health personnel development report on the progress of countries training health personnel, Fulop (1986) states that there exists a grave problem of the irrelevance of curricula in many schools when compared to the needs of the health system. This may be due, in part, to the lack of coordination between educational institutions and health agencies and resistance to change by educational institutions with set curricular patterns.

The establishment of formal multi-skilled health practitioner programs in educational institutions initiated during the 1970's has expanded considerably. This expansion has been documented by Bamberg, Blayney, & Wilson (1988) in reviewing the history and evolution of multi-skilled health practitioners. In two surveys that have provided more data on multi-skilled health personnel, it was determined that skills in radiologic science were listed in both surveys as one of a group often added to staff job responsibilities (Clark, 1980; Low & Weisbard, 1987). In 1987, there were 7,411 graduates from programs in radiologic science (radiography, radiation therapy, and nuclear medicine) representing the greatest number of students from any area covered by the American Medical Association's Committee on Allied Health Education and Accreditation (American Medical Association, 1988).

With expanding technology in the area of medical imaging and therapy, radiologic science is becoming a prime area for the development of multi-skilled practitioners. Currently, some hospitals are cross training personnel in their radiology departments to perform diagnostic tests in several areas. Radiographers are doing ultrasound examinations, radiation therapy technologists are performing computed tomography (CT) and ultrasound for localization procedures before patient treatment and nuclear medicine technologists also are conducting various ultrasound examinations. Although the above practices are not widespread, the advent of cost containment, due to restructuring hospital reimbursement, has health care institutions examining ways to utilize their staff more effectively.

Radiology departments capable of utilizing a combination of imaging and/or therapeutic modalities certainly provide the potential for cost savings via better personnel utilization. A number of hospitals in the Birmingham area give hiring and salary priorities to individuals who can perform examinations in more than one modality. These individuals are qualified, for example, to work in both radiography and ultrasound or radiography and radiation therapy. Not only are these personnel more employable, but they provide a hospital with ways to save labor costs by utilizing one person in two imaging areas as opposed to hiring two people to perform two separate functions.

In 1986, hospital expenditures in the United States amounted to 165 billion dollars. The cost of labor, as a percentage of total expenses for all community hospitals in the United States, was 54% in 1986 (American Hospital Association, 1987). Multi-skilled educational programs in allied health can provide personnel that may be utilized more effectively to help reduce labor costs. These programs also would

provide graduates with better marketability in the health care industry via expanded clinical capabilities and the potential for enhanced motivation and job satisfaction.

Traditionally before the mid 1970's, radiologic science consisted of the basic clinical specialties of radiography, nuclear medicine technology, and radiation therapy technology. Training in each specialty area involved an established curriculum developed by national accrediting bodies. A certification test was offered for each area at the end of the curriculum that enabled students to become credentialed. Since the mid-seventies, computed tomography (CT), magnetic resonance (MR), ultrasound, and vascular interventional techniques have emerged as integral parts of medical imaging. Also, radiation therapy has expanded to include dosimetry and localization techniques that involve some of the previously mentioned imaging modalities.

While separate programs in the basic specialties of radiography, nuclear medicine, and radiation therapy still exists, the curricula in these areas are not focused on CT, MR, ultrasound, or vascular procedures. Certainly, they do not provide students with the ability to function clinically in any of the previously mentioned advanced imaging areas.

There exists little articulation or upward mobility between radiography, radiation therapy and nuclear medicine basic areas within radiologic science. Of 887 approved programs in the basic clinical specialties in the United States, 80% are offered in hospitals or junior colleges (American Medical Association, 1988). In most cases, students who become credentialed in one area and seek to become certified in another clinical specialty must complete another certificate or associate degree. The idea of spending three to four years completing requirements

for two clinical specialities, one of which is usually considered an advanced area and ending up with two associate degrees (or certificates) is an educationally ineffective method. One mission of the baccalaureate degree in radiologic science would be to offer linkages or paths from the junior college (or hospital program) enabling students to expand their clinical capabilities within the discipline.

Only 18% of all accredited programs in the basic areas of radiologic science are offered at four year educational institutions, but they account for 35% of the students (American Medical Association, 1988). Of these, there are few institutions offering students an opportunity to specialize in more than one clinical area while completing their baccalaureate degree. In a recent survey of 200 selected programs nationwide, 94% of the respondents indicated that multi-skilled or dual credentialed options should be offered at four year institutions within radiologic science (Goldsworthy & Meyers, 1986).

The American Registry of Radiologic Technologists (iiRR'l') is the nationally recognized organization that provides certification testing in the areas of radiography and radiation therapy technology. Of all registered radiation therapy technologists in the 'United States, 65% are also registered in radiography (J. Reed, personal communication, June 3, 1988) . In practice, the majority of radiation therapy technologists were registered first in radiography, then in radiation therapy. Thus, it seems that these people finished radiography school, acquired a better understanding of radiologic science and looked to other areas of the discipline for further clinical specialization.

The American Registry of Diagnostic Medical Sonographers is the nationally recognized organization that provides the certification test for medical sonographers (ultrasonographers). Of the currently

registered sonographers in the United States, approximately 67% are also registered in radiography by the ARRT (L. Early, personal communication, June 2, 1988). Similar to the case of radiation therapy technologists, the vast majority of sonographers who also are registered in radiography entered ultrasound after their radiography education.

In planning a baccalaureate degree in radiologic science, The University of Alabama at Birmingham was responsive to the needs of the health care community. It was necessary to formalize within the curriculum various options in advanced clinical specialties, offer a degree that would follow the logical patterns of clinical practice and provide some upward degree of mobility for practitioners. After input from health care agencies and a review of the existing certification trends and/or work practices in radiation therapy, ultrasound, CT, MR and vascular special procedures, the curriculum was set up with certification in one area of radiologic science as the basis for advancing to other specialty imaging or therapeutic areas. The majority of applicants for the baccalaureate degree undoubtedly will be radiographers since 86% (6,385) of the 1987 graduates from all the basic clinical areas in radiologic science were radiographers (American Medical Association, 1988). Also, the potential for students transferring into the programs is great since 80% of the accredited programs in the basic specialty areas are sponsored by hospitals or junior colleges (American Medical Association, 1988).

Students must have completed an accredited program in one of the basic clinical specialties in radiologic science and possess the prerequisites required for entrance into the upper division aspect of the baccalaureate degree in radiologic science. Generally, most students

that complete an associate degree program will have the majority of the prerequisites (Table 1).

Table 1

Prerequisite Courses and Semester Hours For Certification In Radiography Nuclear Medicine, or Radiation Therapy

Prerequisite courses	Semester Hours
Humanities	
English Composition	6
Elective (Literature or other Humanities)	3
Social and Behavioral Sciences	
Psychology	3
Elective	3
Natural Science and Math	
Human Anatomy and Physiology	6 - 8
General Biology	3 - 4
College Algebra	3
General Physics	3 - 4
Total	30 - 34

This curriculum offers opportunity to specialize in one of three clinical areas. The advanced imaging option consists of didactic and clinical course work in CT, MR and angiography (Table 2). The radiation therapy option offers classroom and clinical work in various therapeutic treatment modalities and dosimetry skills related to treatment planning

Table 2

Term and Curricular Content of the Advanced Imaging Option

Term and Curricular Content	Semester Hours
Spring Term	
Advanced Pathophysiology	3
Vascular Special Procedures I	3
CT Scanning	3
Humanities and/or Social Sciences Elective	6
	15
Summer Term	
Physics and Instrumentation of MRI	3
Pharmacology for Vascular Procedures	1
Humanities and/or Social Sciences Elective	3
Clinical Education	5
Vascular Special Procedures 11	2
	14
Fall Term	
Heart Monitoring	2
MR Scanning	3
Clinical Education	5
Human Relations	3
	13
Winter Term	
Applied Research	1
Departmental Personnel Function	3
Clinical Education	5
Humanities and/or Social Sciences Elective	3
	12
Spring Term	
Clinical Education	5
Departmental Fiscal Management	3
Administration Department Level	3
Humanities and/or Social Sciences Elective	3
	14

enabling eligibility for certification in radiation therapy technology (Table 3). The ultrasound option offers classroom and clinical work

Table 3

Term and Curricular Content of the Radiation Therapy Option

Term and Curricular Content	Semester Hours
Spring Term	
Radiation Biology	2
Introduction to Radiation Therapy	1
Radiation Oncology I	2
Radiotherapeutic Calculation	1
Applied Clinical Oncology	1
Clinical Education I	4
Humanities and/or Social Science Elective	3
	14
Summer Term	
Simulator Applications	1
Physics of Radiotherapy	2
Radiation Oncology II	1
Clinical Education II	6
Applied Clinical Oncology II	1
Humanities and/or Social Science Elective	3
	14
Fall Term	
Advanced Treatment Planning	3
Directed Readings	1
Clinical Education III	4
Human Relations	3
Humanities and/or Social Science Elective	3
	14
Winter Term	
Applied Research	1
Concept Integration	1
Dosimetry I	2
Clinical Education IV	6
Departmental Personnel Function	3
	13
Spring Term	
Dosimetry II	4
Clinical Dosimetry I	4
Departmental Fiscal Management	3
Administration Department Level	3
	14
Summer Term	
Dosimetry III	4
Clinical Dosimetry II	4
Humanities and/or Social Science Elective	6
	14

enabling eligibility for certification in Obstetrical and abdominal ultrasound (Table 4). In addition to the general education requirements of the university, each option contains a core of management courses (9-12 semester hours) in anticipation that many graduates will eventually become clinical supervisors.

Figure 1 depicts a flow chart for the baccalaureate degree in radiologic science at The University of Alabama at Birmingham. The university general education requirements are dispersed throughout the curriculum. The length of the entire sequence for a full-time student is approximately four years depending on the radiography program content of transfer students. The curriculum enables students to enter one upper division option if certified in one area of radiologic science. Since the specialty options begin in March of each year, transfer students have the opportunity to work and complete prerequisites in the evening or take classes full-time.

Summary

The curriculum design in radiologic science at The University of Alabama at Birmingham has attempted to be responsive to its community. It is anticipated graduates of this program will have very marketable skills, offer quality care, and make available to health care agencies their capability to offer patient care in a more cost effective manner.

An educator of health personnel must assess the community in terms of conditions of the health care system and the type of personnel skills needed to serve the system effectively. That would serve as the basis for developing effective multi-skilled curricular models. In addition to providing multi-skilled individuals, another advantage would be the ability to adjust enrollment in each option based on the needs of the

Table 4

Term and Curricular Content of the Ultrasound Option

Term and Curricular Content	Semester Hours
Spring Term	
Ultrasound Physics & Instrumentation	4
Ultrasound of Abdomen & Small Parts	3
Pathophysiology of Abdomen	3
Cross Sectional Anatomy	3
	13
Summer Term	
OB-GYN Ultrasound	3
Pathology of OB-GYN	3
Humanities and/or Social Sciences Elective	9
	15
Fall Term	
Humanities and/or Social Sciences Elective	3
Echocardiography	3
Case Study	1
Clinical Education	6
	13
Winter Term	
Applied Research	1
Related Diagnostic Procedures	3
Clinical Education	6
Case Study	1
Departmental Personnel Function	3
	14
Spring Term	
Clinical Education	6
Case Study	1
Humanities and/or Social Sciences Elective	3
Administration Department Level	3
	13
Summer Term	
Clinical Education	8
Case Study	1
	9

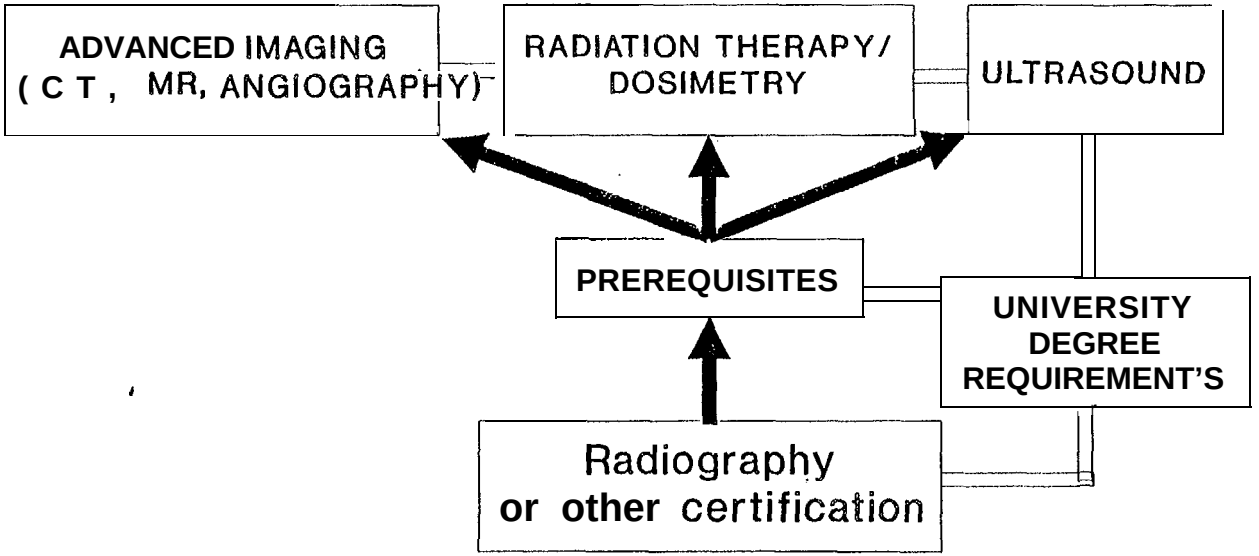

Figure 1. Flow chart of baccalaureate degree in radiologic science at The University of Alabama at Birmingham.

health care community. Such a curricular model could provide flexibility in response to personnel supply in various areas of radiologic science. Also, such a model could facilitate modification of existing options or incorporation of additional ones as new technologies are developed.

In rural areas, the emphasis is usually on basic health care services. A multi-skilled curricular model in such circumstances should probably involve appropriate health care workers with some basic skills in nursing, radiography, medical laboratory, and respiratory care. The program could be similar to several of the earlier multi-skilled models developed in the United States (Blayney, 1982; Clark, 1980; Lugenbeel, 1979).

Only a small percentage of educational institutions offer multi-skilled clinical programs in radiologic science for students at the baccalaureate level. The number of educational institutions which offer multi-skilled programs will grow if the academic community is responsive to the needs of the health care system.

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