Special Committee on Manpower

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Future Nuclear Medicine Physician Requirements

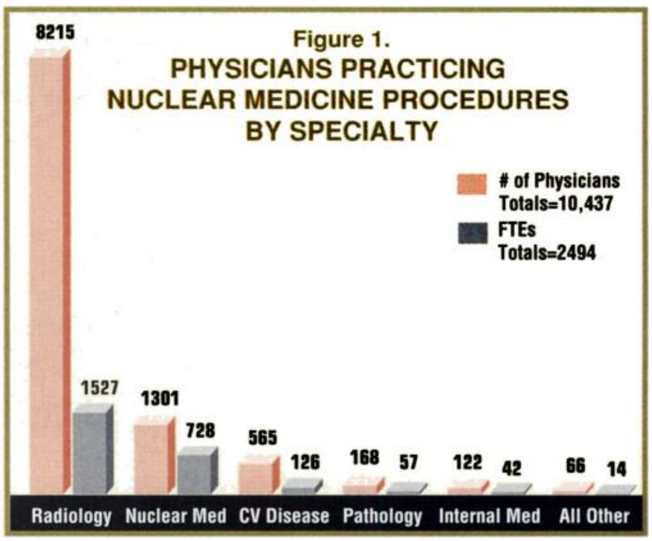
The nuclear medicine manpower workforce is aging, and this fact raises an important question: Will there be a sufficient number of Board-certified nuclear medicine physicians to meet the needs of health care consumers in the year 2000? The 1980 Graduate Medical Education National Advisory Committee (GMENAC) Report estimated that there would be 630,000 U.S. physicians by 1990, with a surplus of 70,000 physicians.[1] Where does the nuclear medicine physician workforce fit into this prediction for the future?

In November 1992, the Society of Nuclear Medicine Manpower Survey Report appeared in *Newsline*: It estimated then that there were 2494 Full Time Equivalent (FTE) nuclear medicine physicians (see Fig. 1). An important distinction is that between the number of individual FTEs as opposed to the number of physicians needed to provide nuclear medicine services required by the public: The reason is that the 1992 Report showed that a large number of physicians allocated only a fraction of their time performing nuclear medicine services. *Thus, an accurate definition of "full-time equivalent nuclear medicine physician" would be someone who works 48 hours a week, 48 weeks a year, or 2304 hours a year, providing nuclear medicine services.*

Since the 1992 report, the SNM Committee on Manpower has sought to calculate a reasonable estimate of nuclear medicine physician FTE requirements needed to provide nuclear medicine services for the next 10 years in the interests of better health and well-being. Simply speaking, the professional objective should be to develop a balance between supply and requirements. In the current study, the Committee selected a demand-based mathematical model to project the future manpower requirements based on use of nuclear medicine services during 1993. This model had the following characteristics:

- It was limited by the degree to which one considered alternative diagnostic procedures or changes in demand patterns
- It was modified by a demand-based model to develop projections—factors that experts believed would alter requirements.

Although the demand-based model neglected a certain segment of the population with inadequate health care coverage, the Committee nevertheless believes it statistically provided an accurate, though somewhat limited, prediction based on current available information. Moreover, the assumptions used in the report did not address the dramatic effects that managed care will have on health care requirements.



The Committee realizes changing referral rates may affect projections, but given the volatility of health care reform patterns, solid estimates are currently impossible to predict. Further extensive investigation of these effects is needed, although preliminary surveys on managed care suggest a dynamic impact on forecasting future manpower requirements. For example, physicians may spend fewer working hours with patients and more in nonpatient care activities, while procedure utilization levels may also drop.

The Manpower Committee's data analysis uses procedure volume estimates from the 1993 Technology Marketing Group (TMG) Nuclear Medicine Survey (see Fig. 2), along with physician count and FTE data from the Society of Nuclear Medicine 1992 Manpower Survey (see Fig. 1). The data collection methodology for the 1993 TMG Nuclear Medicine Survey is outlined in "Methodology: Arriving at Future Physician FTE Requirements" (sidebar).

Phase II of the project will provide more accurate estimates regarding the effect of services in a high-managed-care environment on volume. The data are expected to be published in *Newsline* within the next 24 months.

A paradigm shift was used in developing a mathematical formula for determining future nuclear medicine physician workforce requirements in terms of "workload," the main

[1]All nuclear medicine projections by GMENAC for 1990 were estimates rather than being based on workload requirements.

Figure 2.
PROCEDURES BY CATEGORY (In 1000's)

symbolic expression used in the formula.

The study used collected data representative of the total number of nuclear medicine procedures performed in 1993. These procedures were then assigned current CPT code terminology and CPT code numbers developed by the August 1994 RBRVS Nuclear Medicine Update Study.

By using the time required to perform each CPT-coded procedure—multiplied by the total number of CPT-coded nuclear medicine procedures collected in a 1993 TMG study and by other data provided by commercial companies—the Committee established an estimate of workload.

A modifier factor was developed to adjust for nonpatient care activities, such as teaching, research, administrative activities, compliance with quality control and NRC requirements, and communications with technical personnel. As a result, the Committee estimates that 30% (14.6 hours of a 48.0 hr workweek) of a nuclear medicine physician's time is spent performing nonpatient care activities. This modifier factor is expected to increase as managed care becomes a more dominant factor within the health care environment.

Finally, the Committee used the time modifier factor coupled with the procedure estimates and various procedure time models to estimate that, in the next few years, 2564 FTE nuclear medicine physicians will be needed in U.S. health care, plus or minus 10% (this figure is an average of the two "middle" estimates). This number is especially important in light of the fact that the 1992 Manpower Report showed the total supply of nuclear medicine physicians to be 2495 FTEs.

Yet by the year 2010, the Committee predicts a deficit in the number of nuclear medicine physicians. This is based on a triad of factors: the aging of the physician work force coupled with trends having to do with the numbers of women and iInternational medical graduates (IMG) physicians entering the field.

In regard to the first factor, data regarding age distribution analysis of ABNM-certified nuclear medicine physicians show the majority of them to be aging. Ajit N. Shah, MD, has reported (*Investigative Radiology*, July 1992) that in 1992, 12% of physicians studied were 65 years of age or older; 12% were 60 to 64; 17% were between the ages of 55 to 59 years of age; and 21% were 50 to 54. These results show that more than 41% of ABNM-certified nuclear medicine physicians are 55 years of age or older, while 62% are 50 years of age or older.

Detailed retirement rates are not currently known. However, what is known is that 41% of physicians certified by the ABNM were 55 years old or older in 1990. Under the reasonable assumption that those physicians work at least 50% of their time in nuclear medicine and will be retired by age 70, a loss of 764 FTE by the year 2005 is estimated. The average certification rate by the ABNM has been 68 per year over the past five years. Thus, a rough extrapolation indicates a replacement of 510 FTEs between 1991 and 2005 for a net loss of at least 254 FTEs in nuclear medicine by 2005.

Secondly, forecasting models developed by the Department of Health and Human Services have established that women graduates from U.S. medical and osteopathic schools choose nuclear medicine at a somewhat lower rate than men. This is despite the fact that the percentage of women among U.S. medical students has been projected to increase (to about 50% by 2003)

And thirdly, studies show that IMGs train in nuclear medicine at a higher rate than U.S. graduates, but the share of IMGs is projected to decline between 2000 and 2010.

The net result is predicted to be a decline in the total supply of nuclear medicine physicians over the next ten years. Based on current available data and using workload as the main predicting factor, there appears to be a near balance between supply and requirements for nuclear medicine physicians at this time.

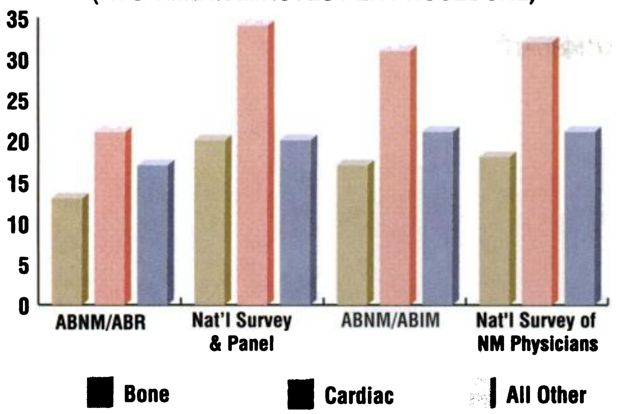
In the next phase of this study (to appear in a future issue of *Newsline*), the Committee will describe further nuclear medicine physician manpower requirement trends. In particular, the impact of managed care on the work force will be highlighted.

Methodology: Arriving at Future Physician FTE Requirements

The national and regional FTE requirements were calculated using estimated time required to perform CPT-coded nuclear medicine procedures. The time required to perform each individual procedure was based on data from the RBRVS Nuclear Medicine Update Study, August 1994, by Brann et al., Department of Health Policy and Management, Harvard School of Public Health. However, based on the great hetereogeneity in practice patterns of physicians providing nuclear medicine services, the Manpower Committee selected four subsets to study to better reflect the current time values reported by national surveys (see Fig. 3). Time estimates were compared to four subsets using double-boarded physicians in: (1) ABNM/ABIM and (2) ABNM/ABR, (3) the National Survey of Physicians Performing Nuclear Medicine procedures and (4) the National Survey modified by an expert panel. It was found that times required to perform nuclear medicine procedures varied among physicians having different certifying boards and physicians at large performing nuclear medicine procedures.

Next, the Committee sought to determine how many times each

Figure 3.
ESTIMATED FTE TIME REQUIREMENTS BY PROCEDURE (AVG TIME IN MINUTES PER PROCEDURE)



Procedure Category	# of Procedures	ABNM & ABR	Nat'l Survey & Panel	ABNM & ABIM	Nat'l Survey of NM Physicians
Bone	3,844,000	13	20	17	18
Cardiac	3,720,000	21	34	31	32
All Other	3,205,000	17	20	21	21
Total	10,769,00				

of the identified procedures was performed by using the total procedure volume of 10,769,000 estimated by the TMG in the 1993 SNM Survey. This number was utilized to calculate the total FTE requirements since the TMG database of all diagnostic nuclear imaging facilities in the U.S. was also available by state, region and for the years 1993-1995, if needed (see Fig. 2), and a known methodology was used for data collection (see below).

A further step was to fine-tune the procedure categories used in the Committee's calculations. Because TMG procedure categories included only bone, cardiac and "all other," the more

Table 1

Step 1

FTE Clinical NM Physician Requirements	=	1993 TMG Total Number of CPT-Coded NM Services	×	1994 RBRVS Times Required to Perform Procedures

Step 2

$$\frac{\text{Total Workload Mins.}}{60} = \frac{\text{Total Workload Hours}}{\text{1 FTE Year (48 hr/wk} \times \text{48 wk= 2304 hr/yr)}}$$

Step 3

A = Needed FTEs (Before Modifier*) B = Modifier Factor = FTE/(1.0 - 0.30 = 0.70)

Step 4

Total Number of NM Physician FTE Requirements = A/B

Step 5

A/B 0.7 = Total FTE NM Physician Requirements

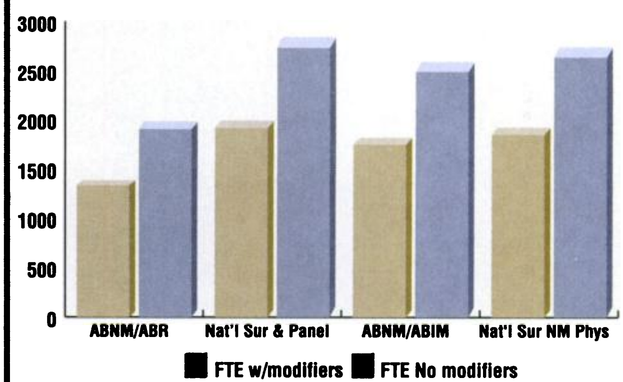
*Modifier Requirements (B): teaching, research, education, administration, QC/NRC compliance. 14.6/hr per week are spent in nonpatient care activities of a 48-hr work week.

finely-tuned CPT-coded categories were overlaid on the TMG volume estimate: little deviation in total time was observed between overall TMG estimates and the CPT-based volume estimates provided by the commercial sector and three different datasets. The procedure volume for each CPT-code was multiplied by the estimated time required to perform the procedure to yield the total time in minutes for each CPT code.

Table 1 illustrates the general mathematical model used by the Committee. The model uses time as a common metric to measure workload requirements. Work-time minutes were selected due to low variation in using this metric.

- **Step 1**, the total number of each CPT-coded procedure was multiplied by the appropriate RBRVS time needed to provide that service. The result gave the total time required to perform each CPT-coded nuclear medicine procedure for one year.[1]
- **Step 2**, the total time, given in minutes, was converted to hours, which in turn were converted to "FTE years." The total number of

Figure 4.
CALCULATED FTE REQUIRED
As determined by various SNM work times and TMG 1993 procedure vilumes



Avg Work Times as Determined by:	Avg Min/ Procedure	'93 TTl Proc Vol	Total Mins.	Total FTE	Total FTE*
ABNM & ABR	16.9	10,842,883	183,881,675	1330	1990
Nat'l Survey & Assess. Panel	24.38	"	264,378,461	1912	2732
ABNM & ABIM	22.23	"	241,067,176	1744	2491
Nat'l Survey of NM Physicians	23.54	"	255,207,766	1846	2637

*Calculation includes modifiers for non-patient care activities

hours for each of the four subsets was divided by 2,304 working hours per FTE (48 hr/wk x 48 wk) to provide the estimates of FTE requirements, "A" in the table above, and shown in Figure 4. This process was repeated for each of the four subsets previously cited.

- **Step 3**, a modifier, defined by the Committee to account for time not directly related to the performance of procedures, was calculated – "B" in the table above.
- **Step 4**, the total number of nuclear medicine FTE requirements was derived.
- **Step 5**, the result of Step 4 was divided by the modifier factor of 0.7 to account for nonpatient care activities.

The data were summarized for all sites in the U.S. as well as all

[1]The data analyzed did not take into consideration the factors of quality or cost-effectiveness which seem unquantifiable at this time. However, procedure guidelines now under development may help standardize quality in the future.

Figure 5.
FTE'S BY CERTIFICATIONS:
ABNM, ABR, ABIM, (CV) and Other

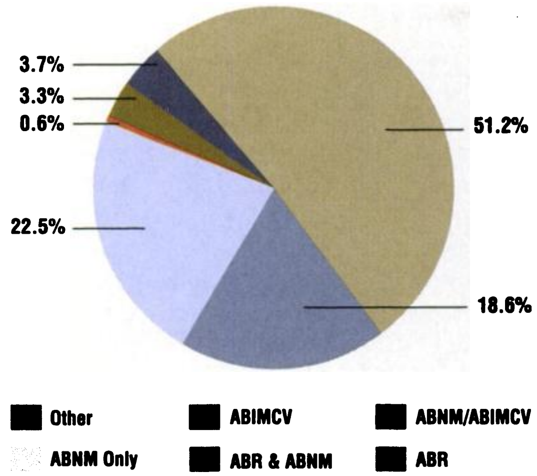
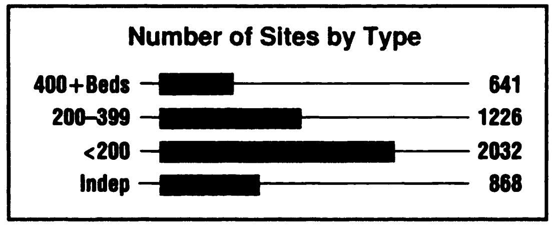


Figure 6.
U.S. Summary of
Procedure Volume Estimates*

1992 Prod Volume	Prod per 1K Pop	# of Sites	Count of Phys Perf	FTE Phys Perf NM	Sites Perf >4000 Prod
10,770	42.28	4823	9850	2595	707



* Derived from 1993 TMG Nuclear Medicine Census: data on staffing levels from 1992 SNM Study

sites in each of nine regions. Regional data will be reported in Phase II of this project.

Methodology for the TMG Procedure Volume Survey

The principal instruments for the TMG survey were mail and telephone interviews which were used to identify and query all hospital and independent (non-hospital) sites in the U.S. performing diagnostic and therapeutic nuclear medicine.

The initial database of facilities was established in 1990. Candidate sites were identified using the American Hospital Associated Guide to Health Care Field (AHA Guide), licensing lists obtained from the Nuclear Regulatory Commission and licensing lists obtained from state licensing agencies. Sites were screened by telephone to determine if their use of radioactivity included nuclear imaging and therapy. In each survey, respondents were asked to identify other sites in their service areas. Responses were checked against the database, and newly identified sites were verified and added to the database.

All identified sites were mailed a questionnaire to determine procedure volume. Sites not responding to the mail questionnaire were subsequently phoned and offered the option of responding by phone, telefax or mail.

The data collection for the 1993 survey took place from March 1992 through January 1994.

Quality Control and Accuracy

Questionnaire responses were entered into a computer as they were completed, and the information was added to the database. Data were entered using a key-and-verify technique which virtually eliminated errors.

The quality of data was checked by a series of tallies and comparisons which assured that only the appropriate codes had been used and that values were within anticipated limits.

Items flagged by the quality control process were first reviewed to determine whether they were explained by related data and thus acceptable, or whether they required further investigation and/or correction. The questionnaires and other relevant documentation, such as the AHA Guide, were checked for explanations of those items warranting further investigation. For those items remaining unexplained and unacceptable after the foregoing, the responding site was called for clarification and/or correction.

Even though the estimates were based on a sample that was essentially 90% of the whole body of identified sites, they still bore a margin of error. Beyond the statistical margin, there were other, usually overriding, considerations. For example, few questions were answered by all respondents, and for most questions the sample was less than 90%. A further source of error, although estimated as minimal, was the possible omission of sites from the universe of all nuclear medicine sites, particularly independent sites.

Because of the above, and because of segmentation and wide ranges of variances in numerical responses, it was impractical to provide an indication of accuracy for each estimate. Nevertheless, estimating to a finite universe of nearly 5,000 sites from a 90% sample, rather than from 500 sites or about 10%, resulted in a tenfold increase in accuracy.

The Committee gave consideration to a possible increase in procedure volume reflecting an aging population, based on Census Bureau estimates and projections of the United States Aging Population Survey. It will continue to review and adjust data in updates to this report.

Finally, although the model reflected the current delivery system for 1993, sizable changes are expected to occur as a result of the impact of managed care, with possibly shorter physician working hours in patient care with more time required for nonpatient care activities.

A range of requirement estimates were calculated reflecting different work-time ratios for the physicians providing nuclear medicine services. There is a need for additional data to reflect the effect on nuclear medicine physician requirements produced by managed care. The current procedure utilization levels are higher than would be predicted under high-level managed care.

Data tables comprising primary analysis of the data, consisting of a series of cross-tabulations, are on file and available from the Manpower Committee. ■