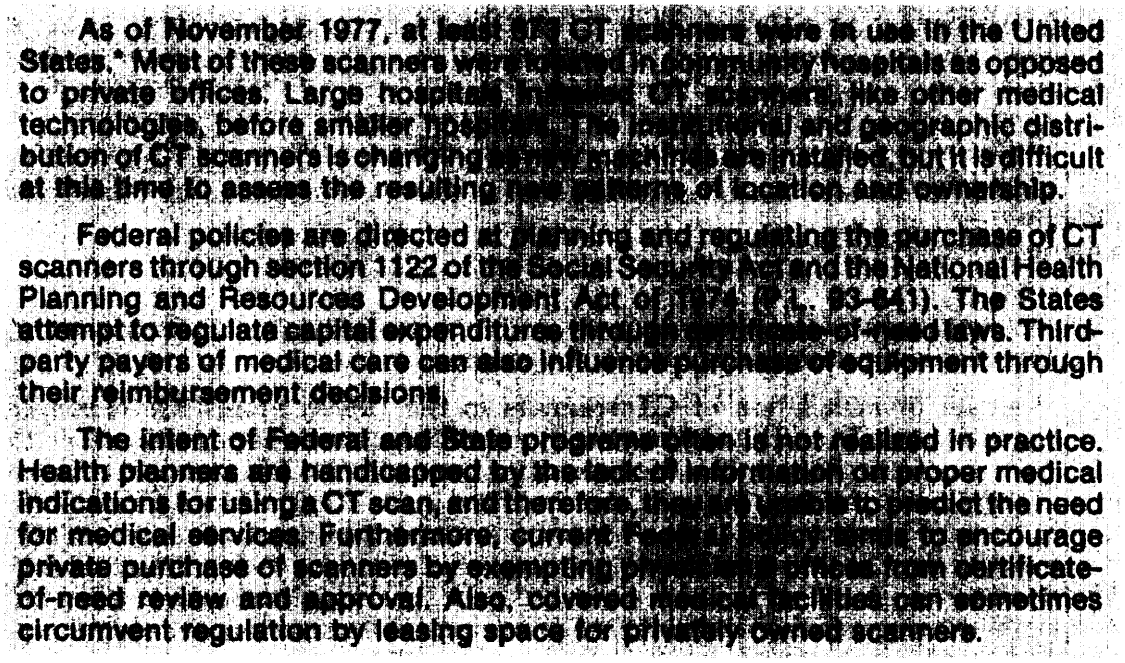
4.

NUMBER AND DISTRIBUTION

NUMBER AND DISTRIBUTION



EXPERIENCE WITH CT SCANNING

Number of CT Scanners

As of May 1977, 401 machines were known to be in use in the United States.** Nearly three-fifths were head scanners; the rest were full-body scanners. However, body scanners account for most new purchases **(29).** By **1978,** more than half of the operational scanners were body scanners.

EMI, Pfizer, and Ohio Nuclear manufactured 95 percent of the machines used in the United States in May 1977 (table 6). The first CT scanners, and most of the scanners used then, were sold by EMI. At that time, six companies were producing machines for sale in the United States, and at least six more were developing

*A survey by J. Lloyd Johnson Associates reported **560** operational **scanners** by April 1977, and **637** by June 1977 **(263).** Fineberg, **et al. reported 567 operational scanners** by April 1977 (168).

**institutions with CT scanners are listed in appendix I.

Table 6.—Type and Manufacturer of CT Scanners in Use May 1977[a]

Manufacturer	Type of CT Scanner					
	Total		Head		Body	
	No.	Percent	No.	Percent	No.	Percent
EM I Ltd.	232	58	211	92	21	12
Ohio Nuclear (Delta)	109	27	0	0	109	64
Pfizer (Acta)	40	10	—	—	40	23
General Electric	8	2	7	3	1	1
Syntex	9	2	9	4	0	0
Artronix	3	1	3	1	0	0
Total	401	100	230	100	171	100

[a]Since May 1977, informal reports indicate that American Science and Engineering has installed several machines.

Source: Off ice of Technology Assessment.

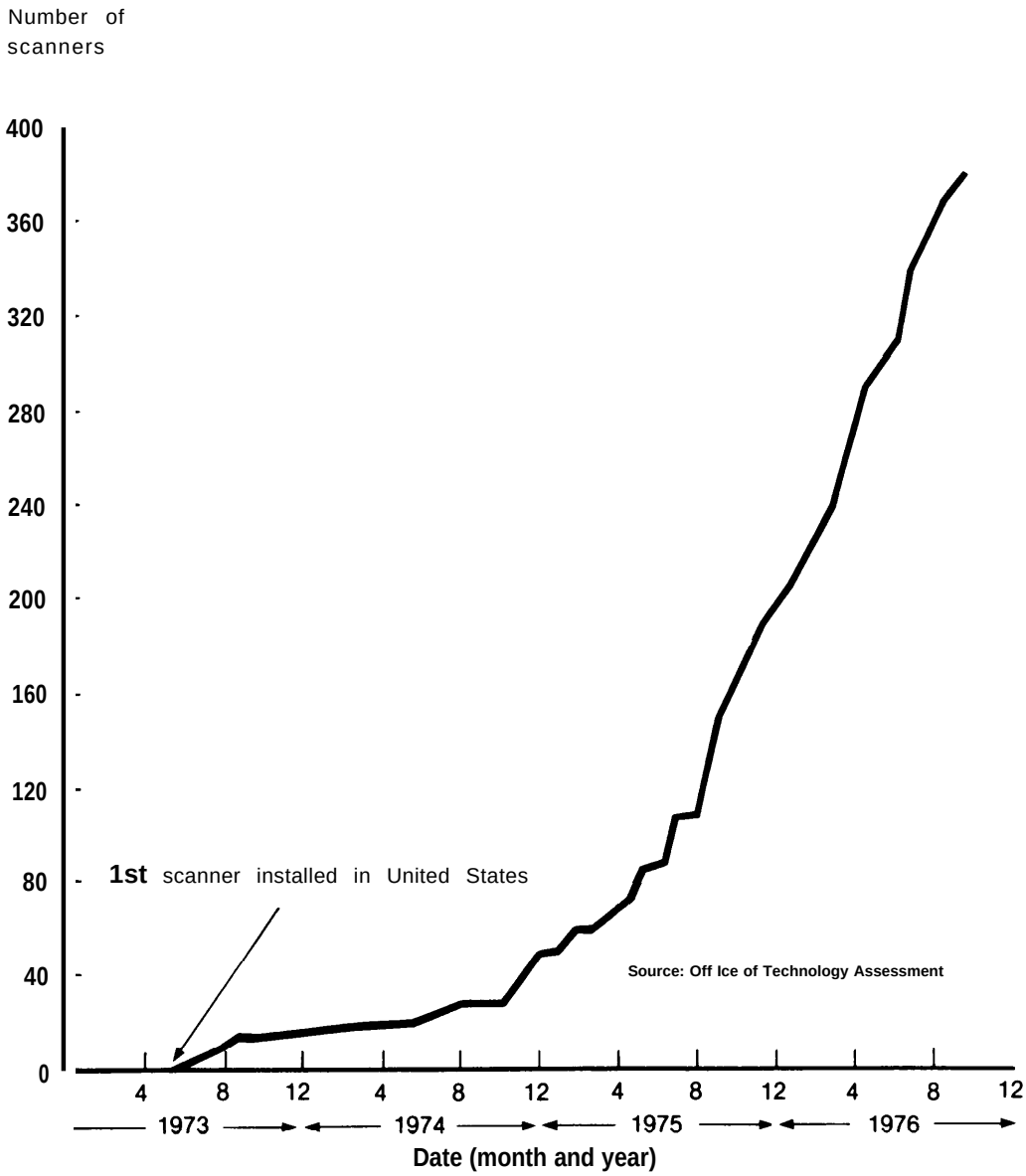
scanners for future sales or were about to enter the market (147,377). By May 1978, 11 companies had commerial machines in operation.

The rate of installation of CT scanners in the United States has increased steadily over time. The diffusion curve in figure 10 falls into three periods, each with a higher rate of installation than the preceding one (table 7). The first period began in June 1973, with the installation of the first head scanner at the Mayo Clinic. From that date until October 1974, the rate of installation was less than 5 per month. Between October 1974 and June 1975, the rate increased to just below 10 per month. The third and most recent period for which the data are complete began in July 1975 and extended through September **1976; an average** of 19 scanners per month was installed during that period. Incomplete data for 1977 show an even more rapid installation rate for that period.

The most recent rate might have been higher if manufacturers had been able to produce more machines. For example, in 1975, twice as many scanners were ordered as were shipped (402). EMI's **1976** year-end backlog of unfilled orders exceeded **250** machines (362). In response to the demand throughout 1976, EMI and Ohio Nuclear prepared to increase their 1977 production schedules of CT scanners (29). EMI is also increasing its production capacity.

The rate of installation will probably continue at more than 19 per month in the immediate future. Nationally, 330 scanners were either ordered from manufacturers or approved by planning agencies, and 200 applications for scanners were awaiting approval by State agencies as of August **1976 (266).** Longer term rates of orders and installations are not yet clear. The number of new orders in the first half of 1977 fell from the high of **1976. One estimate predicted 200** new orders in 1977 compared to more than **400** in **1976 (263).** In fact, orders during **1975 and 1976** may have been abnormally high in anticipation of State and Federal regulations on purchases. Experience during 1977 may represent a temporary adjustment to a more stable growth rate for sales.

Figure 10.—Cumulative Number of CT Scanners in the United States by Date of installation



Geographic Distribution of CT Scanners

The distribution of CT scanners by State and region of the country as of August 1976 is shown in table **8.** At that time, 44 States and the District of Columbia each had at least one scanner. Vermont, Delaware, Montana, Wyoming, and Alaska, which are 5 of the smallest States by population, as well as West Virginia, had no scanner. California had 60 scanners, the largest number of any State. The Los Angeles area alone had 29 scanners. Florida had the second highest number of machines, **27,** followed by Texas with 19, and Ohio with **16.**

Table 7.—Coordinates of Diffusion Curve

Date of Installation (Month and Year)	Number of CT Scanners (Cumulative)
1973	
6 June	1
8 August	2
9 September	5
10 October	6
1974	
1 January	9
2 February	12
4 April	13
5 May	15
6 June	18
7July	21
8August	23
9 September	26
IO October	31
11 November	39
12 December	45
1975	
1 January	47
2 February	55
3March	60
4April	67
5May	83
6June	92
7July	109
8August	123
9 September	142
IO October	167
11 November	183
12 December	196
1976	
1 January	216
2 February	236
3March	258
4April	285
5May	304
6June	327
7July	343
8August	363
9 September	379

Source: Office of Technology Assessment.

Table 8.—Distribution of CT Scanners by State, Region, and Population[a]

Region or State	Number of CT Scanners		CT Scanners per Million Population[b]	
	Installed	Installed plus Committed[c]	Installed	Installed plus Committed[c]
New England	17	24	1.4	2.0
Maine	1	3	1.0	2.8
New Hampshire	1	1	1.2	1.2
Vermont	0	1	0	2.1
Massachusetts	11	12	1.9	2.1
Rhode Island	1	1	1.1	1.1
Connecticut	3	6	1.0	1.9
Middle Atlantic	35	79	.9	2.1
New York	17	41	.9	2.3
New Jersey	2	12	.3	1.6
Pennsylvania	16	26	1.4	2.2
East North Central	50	134	1.2	3.3
Ohio	16	36	1.5	3.4
Indiana	4	15	.8	2.8
Illinois	15	49	1.3	4.4
Michigan	7	17	.8	1.9
Wisconsin	8	17	1.7	3.7
West North Central	30	48	1.8	2.9
Minnesota	9	10	2.3	2.5
Iowa	1	7	.4	2.4
Missouri	13	17	2.7	3.6
North Dakota	1	2	1.6	3.1
South Dakota	1	2	1.5	2.9
Nebraska	1	5	.6	3.2
Kansas	4	5	1.7	2.2
South Atlantic	49	99	1.4	3.0
Delaware	0	2	0	3.4
Maryland[d]	3	4	.7	1.0
District of Columbia	2	10	2.9	14.2
Virginia	5	14	1.0	2.8
West Virginia	0	5	0	2.7
North Carolina	4	4	.7	1.0
South Carolina	2	5	.7	1.8
Georgia	6	17	1.2	3.4
Florida	27	38	3.2	4.5
East South Central	18	36	1.3	2.6
Kentucky	3	5	.9	1.5
Tennessee	7	17	1.7	4.0
Alabama	6	11	1.6	3.0
Mississippi	2	3	.9	1.3

Table 8.—Cent.

Region or State	Number of CT Scanners		CT Scanners per Million Population	
	Installed	Installed plus Committed	Installed	Installed plus Committed
West South Central	30	59	1.4	2.8
Arkansas	3	5	1.4	2.4
Louisiana	5	11	1.3	2.9
Oklahoma	3	7	1.1	2.5
Texas	19	36	1.5	2.9
Mountain	19	39	1.9	4.0
Montana	0	2	0	2.7
Idaho	3	4	3.6	4.8
Wyoming	0	0	0	0
Colorado	4	12	1.6	4.6
New Mexico	2	2	1.7	1.7
Arizona	5	8	2.2	3.5
Utah	3	4	2.4	3.3
Nevada	2	7	3.3	11.5
Pacific	69	134	2.4	4.7
Washington	5	6	1.4	1.7
Oregon	3	6	1.3	2.6
California	60	119	2.8	5.5
Alaska	0	(e)	0	(e)
Hawaii	1	3	1.1	3.4
Total	321	652	1.5	3.0

[a] Statistics are current as of August 1976, andare fairly complete through May 1976. But therewere873 CT **scanners knownto be installed by November 1977.**
[b] **Population data were provisional asof July 1, 1976.**
[c] **Committed refers to CT scanners already ordered and approved by** local Health Systems Agencies.
[d] Four CT scanners at the National institutes of Health are excluded from Maryland, but included in Total.
[e] Not available.
Sources: 495; Office of Technology Assessment.

Throughout 1976, the national average was about 1.5* CT scanners per million population. States with the highest ratios of scanners per million population included Idaho (3.6), Nevada (3.3), Florida (3.2), the District of Columbia (2.9), California(2.8) and Missouri (2.7).

By November 1977, at least 873 scanners were operational, and every State had at least one. The national ratio was approximately 4 scanners per million population. The District of Columbia had the highest ratio of scanners to population (16.8), and States with high scanner to population ratios included Nevada (13,5), Florida (9.6), Alaska (8.5), California (8.4), and North Dakota (7.9). States with the lowest

*Only crude ratios are shown.

concentration of scanners included South Carolina (2.1), Rhode Island (2.2), New Hampshire (2.4), New Jersey (2.5), and Massachusetts (2.6). *

By the end of 1977, the CT scanner manufacturers reported 921 operational scanners, 85 percent of which were in hospitals.**

Institutional Distribution of CT Scanners

Table 9 shows that 76 scanners, or 19 percent of the 401 machines identified in May 1977, were owned by physicians in private offices and clinics. At least 33 scanners, or 43 percent of those 76 were in radiological offices.

Hospitals accounted for **325** scanners, or 81 percent, of the machines identified. The overwhelming majority of these institutions are nonprofit community hospitals

Table 9.—Distribution of CT Scanners by Type of Facility [a]

Type of Facility	Percent of All Facilities	Number of Facilities with CT Scanners	Percent with CT Scanners	Number of CT Scanners
Community Hospitals (by number of beds)	**100**	**302**	**5.1**	**323**
0-99	50	**6**	0.2	**6**
100-199	23	**10**	0.7	**10**
200-299	12	**43**	6.5	**43**
300-399	6	**53**	14.0	**53**
400-499	4	**58**	25.2	**60**
500-599	5'	**43**	44.0'	**48**
600-699		**30**		**32**
700-799		**13**		**13**
800-899		**14**		**16**
900-999		**10**		**12**
1,000-1,099		**7**		**8**
1,100-1,199		**6**		**7**
1,200-1,299		1		**4**
1,300 and over		**5**		**5**
Other Short-term Hospitals	100	**3'**	0.5	**6**
All Hospitals (total)	**100**	305	**4.7**	**323**
Offices		76		**78**
Total		381		**401**

[a] **Includes scanners known to reinstalled by May 1977.**
[b] **Percentages** apply to **all hospitals with** 500 beds **and over. Hospitals with** 1,000 **beds and over** account for 0.5 **percent of all beds, and68 percent of these hospitals havea CT scanner,**
[c] **Includes three Federal hospitals: Veterans Administration, Boston, Mass., 291 beds, 1 scanner; Veterans** Administration, Indianapolis, Ind., **725 beds, 1 scanner; and National Institutes of Health,** Clinical **Center, Bethesda, Md , 511 beds, 4 scanners.**

Sources: 30,32, 33. Office of Technology Assessment.

*** Data** from the Center for the Analysis of Health practices, Harvard School of Public Health.
** Information furnished by the National Electrical Manufacturers Association.

with general medical and surgical services. Six Federal hospitals and 50 non-Federal governmental hospitals were identified as owning CT scanners. Table 9 also compares the size of hospitals with scanners to the size of all community hospitals. Forty-four percent of all community hospitals with 500 beds or more had a CT scanner; 5 percent of all community hospitals are in this bed size category.

The diffusion of CT scanners by size of hospital has followed a pattern similar to the diffusion of other expensive technologies. For example, the largest hospitals were also the first to adopt cobalt therapy, electroencephalographs, and intensive care facilities **(448).** While small hospitals might eventually obtain an expensive medical technology, frequently they are not able to meet operating expenses due to a low patient load. The same reason may explain why smaller hospitals have not purchased scanners at the same rate as larger hospitals.

Like other large hospitals, those affiliated with medical schools have been among the first to acquire equipment requiring large initial expenditures, as borne out with CT scanners. Eighty-nine of the Nation's 113 accredited medical schools, or 79 percent, had a major affiliation with a hospital that had a scanner by May 1977 (24). This high percentage is consistent with a suggestion from the Department of Health, Education, and Welfare (HEW) that Health Systems Agencies give priority to placement of scanners in medical school teaching centers and hospitals with large neurological and neurosurgical caseloads **(500). ***

The greater the number of physicians in an area, the greater seems to be the purchase by hospitals of technologies with high fixed costs **(123).** However, a test of this hypothesis showed little correlation between physician to population ratios and CT scanners to population ratios.**

Little can be inferred from the data about the pattern of ownership of scanners. The scanners known to be in private offices and clinics are owned privately or by the facilities. Of the scanners located in hospitals, less is known about ownership. One report indicated that at least **61,** or 10 percent, of the **637** CT scanners identified in June 1977, were owned or leased by physicians (usually radiologists), but located in hospitals **(263).**

GOVERNMENTAL AND NONGOVERNMENTAL POLICIES

An objective of the Congress in enacting health planning legislation was to achieve equal access to quality medical care at a reasonable cost (505). Under the provisions of the National Health Planning and Resources Development Act of 1974 and other health laws, this objective applies to CT scanners. In addition, some policies adopted by the private sector complement those of the public sector.

Section 1122 of the Social Security Act

In **1972,** P.L. 92-603, section 221, added section 1122 to the Social Security Act. This section introduced an important concept that has influenced subsequent health

● HEW's reason for issuing this advice has not been made explicit.

Kendall's coefficient of τ = **.04. Possible values of τ are -1 (inverse relationship), O (no relationship), and +1 (identity). It would be useful to retest the hypothesis with a different statistical technique; a different geographical division, for example, by Standard Metropolitan Statistical Area; and ratios of medical specialists to population in lieu of all physicians.

legislation: that financing of medical care should be closely related to health planning.

Section 1122 provides that "health care facilities" may not be reimbursed for any depreciation, interest or return on equity relating to capital expenditures that the Secretary of HEW finds to be inconsistent with a State health plan. Those funds available from Medicare, Medicaid, and Maternal and Child Health Programs (titles XVIII, XIX, and V, respectively, of the Social Security Act) may be withheld under the provisions of section **1122. By statute, capital** expenditures that exceed $100,000 are subject to review. Currently, 37 States have contracts with HEW to conduct reviews of capital expenditures under section 1122 (table 10). Section 1122 also covers increases and decreases in numbers of beds, services offered in medical care facilities, the introduction of new services, and the cessation of existing ones that involve capital expenditures.

Federal regulations implementing section 1122 were amended in January 1977 to define medical care facilities subject to review as hospitals; psychiatric hospitals; tuberculosis hospitals; skilled nursing facilities; kidney disease treatment centers, including free-standing hemodialysis units; intermediate care facilities; and ambulatory surgical facilities. Health maintenance organizations are also included, but offices of private physicians are explicitly exempted **(234).**

Since operating expenses and physician services are not subject to regulation, only a small percentage of a provider's total income is at risk under section 1122. (For CT scanners, operating expenses account for **50 to 75** percent of the machine's technical expenses.) Even without strong penalties, compliance with the law is widespread. One explanation suggests that compliance is due to the threat of stiffer sanctions and to the tradition, among medical care providers, of voluntarily abiding by public regulation **(323).** A more critical interpretation cites the high rate of approvals of capital expenditures under section 1122 as evidence that it rarely threatens providers' investment plans **(85).**

State Certificate-of-Need Laws

Expenditures for the construction and expansion of medical facilities are also regulated through State certificate-of-need laws, In the 35 States that have enacted such laws since 1965, new construction and equipment purchases, additions to existing physical plant, expansion of the number of beds, or changes in services may occur only with prior State review and approval.

The type of facilities covered by certificate-of-need laws varies from State to State. Most States cover hospitals and nursing care facilities. Less than half cover outpatient facilities not associated with hospitals, such as surgical centers and health maintenance organizations. Like section 1122, most certificate-of-need laws exempt private physicians' offices from review. However, coverage of medical care facilities under section 1122 is usually more comprehensive than it is under current certificate-of-need laws.

Providers of medical services are subject to stringent sanctions if they do not comply with certificate-of-need rulings. The designated agencies can deny operating licenses, obtain court injunctions, and levy fines. State certificate-of-need laws differ in the minimum expenditure on physical plant or equipment that is subject to review. Furthermore, some States require a review whenever any facility, equipment, or service change is proposed, regardless of capital expenditures.

95-703 O - 78 - 5

Table 10.—States With Certificate-of-Need Legislation, Section 1122 Agreements, or CT Planning Criteria[a]

State	Certificate-of-Need Legislation	Section 1122 Agreement	CT Planning Criteria[b]
Alabama	Yes	Yes	Statewide
Alaska	No	Yes	No
Arizona	Yes	No	Statewide
Arkansas	Yes	Yes	Statewide
California	Yes	No	Statewide
Colorado	Yes	Yes	Statewide
Connecticut	Yes	No	Statewide
Delaware	No	Yes	No
District of Columbia	No	No	No
Florida	Yes	Yes	Regional only
Georgia	Yes	Yes	No
Hawaii	Yes	No	No
Idaho	No	Yes	Statewide
Illinois	Yes	No	Statewide
Indiana	No	Yes	Statewide
Iowa	Yes	Yes	Statewide
Kansas	Yes	No	No
Kentucky	Yes	Yes	Statewide
Louisiana	No	Yes	No
Maine	No	Yes	Statewide
Maryland	Yes	Yes	Statewide
Massachusetts	Yes	No	Statewide
Michigan	Yes	Yes	Statewide
Minnesota	Yes	Yes	Regional only
Mississippi	No	Yes	No
Missouri	No	No	Statewide
Montana	Yes	Yes	No
Nebraska	No	Yes	Statewide
Nevada	Yes	Yes	No
New Hampshire	No	Yes	No
New Jersey	Yes	Yes	Statewide
New Mexico	No	Yes	No
New York	Yes	Yes	Statewide
North Carolina	No	Yes	No
North Dakota	Yes	Yes	Statewide
Ohio	Yes	Yes	Statewide
Oklahoma	Yes	Yes	Regional only
Oregon	Yes	Yes	Regional only
Pennsylvania	No	Yes	Regional only
Rhode Island	Yes	No	Statewide

Table 10.—Cont.

State	Certificate-of-Need Legislation	Section 1122 Agreement	CT Planning Criteria
South Carolina	Yes	Yes	No
South Dakota	Yes	No	No
Tennessee	Yes	No	Statewide
Texas	Yes	No	Statewide
Utah	No	Yes	Statewide
Vermont	No	Yes	No
Virginia	Yes[c]	No	No
Washington	Yes	Yes	Statewide
West Virginia	Yes	Yes	No
Wisconsin	Yes[c]	Yes	Statewide
Wyoming	Yes	Yes	Statewide

[a] Data concerning certificate-of-need laws and section 1122 agreements are current as of July 1977. Data concerning CT planning criteria are current as of August 1976.
[b] Includes formal guidelines, regulations, and staff papers used in reviewing applications.
[c] Review and approval authority may extend to physicians' offices.

All certificate-of-need laws review the impact of a proposed change in existing facilities, equipment, or services on the basis of the population's need for medical services. Therefore, the critical component in the review process is how to determine need for the medical services and how to relate it to the number and distribution of facilities and equipment. The certificate-of-need form of regulation will continue to be associated with health planning since it figures prominently in the National Health Planning and Resources Development Act, P.L. **93-641.**

The National Health Planning and Resources Development Act of 1974, P.L. 93-641

P.L. 93-641 revised existing health programs and added new ones in order to unify the Federal Government's role in health planning, program development, regulation, and financing (505). The provisions of the Act which have particular relevance to CT scanners are those that authorize development of the National Guidelines for Health Planning and those that establish Health Systems Agencies (HSAs) and State Health Planning and Development Agencies (SHPDAs). The National Guidelines are intended to clarify and coordinate national health policy, thereby assisting in area plan development. The responsibility for areawide planning and development is given to the HSAs. Statewide planning and administration of regulatory programs are the responsibility of. the SHPDAs. The major programs administered by the State agencies include certificate-of-need and reviews of existing institutional health services and facilities. Reviews under section 1122 of the Social Security Act are also conducted by SHPDAs.

The certificate-of-need provisions of P.L. **93-641** are to be implemented according to uniform minimum requirements and standards. The kinds of facilities to be covered have been specified and correspond to those covered under section 1122 of the Social Security Act. Minimum capital expenditures subject to review have been set at $150,000. Criteria for review of proposed services have also been specified

according to section 1532(c). HSAs and SHPDAs are required to consider at least the following criteria:

(1) The relationship of the health services being reviewed to the applicable HSP and AIP. *

(2) The relationship of services reviewed to the long-range development plan (if any) of the person providing or proposing such services.

(3) The need that the population served or to be served by such services has for such services.

(4) The availability of alternatives, less costly, or more effective methods of providing such services.

(5) The relationship of services reviewed to the existing health care system of the area in which such services are provided or proposed to be provided.

(6) In the case of health services proposed to be provided, the availability of resources . . . for the provision of such services and the availability of alternative uses of such resources for the provision of other health services.

(7) The special needs and circumstances of those entities which provide a substantial portion of their services or resources, or both, to individuals not residing in the health service areas in which the entities are located or in adjacent health service areas. . . .

(8) The special needs and circumstances of health maintenance organizations for which assistance may be provided under title XIII.

(9) In the case of a construction project—
(A) the costs and methods of the proposed construction, and
(B) the probable impact of the construction project reviewed on the costs of providing health services by the person proposing such construction project.

Because of their prices, CT scanners purchased or leased by covered facilities are subject to review by an HSA and approval by an SHPDA. These agencies will be assisted in their reviews of scanners by the National Guidelines. Seen as a short-term way to moderate escalating medical care costs, the National Guidelines set limits on supplies of CT scanners and eight other facilities and services. Health systems plans and, in turn, State health plans and medical facilities plans are to be consistent with the National Guidelines by March 28, 1979. The standards of the National Guidelines will be reflected in the States' criteria for review of certificate-of-need applications since certificate-of-need criteria are also required to be consistent with health systems plans.

Lastly, the SHPDAs are required to review existing medical services and make public findings of their appropriateness. Unlike the other two programs, no mechanism has been provided to translate these findings into recommendations for action. Nonetheless, inclusion of the reviews in the law may presage more comprehensive regulation.

*HSP refers to health systems plan and AIP refers to annual implementation plan.

Non-Governmental Policy

Increasingly, third-party payers link their reimbursement policies to the planning policies of the Federal and State governments. In 1976, 16 of 46 Blue Shield Plans limited payment for CT scans to institutions whose scanners had been approved by a planning agency. Eighteen had no such policy, and 12 had the matter under study (374). Similarly, most Blue Cross Plans link reimbursement to approval by planning agencies. Forty-two of 59 plans reporting in 1976, or 71 percent, had conformance clauses in their contracts or operated in States with certificate-of-need laws. These clauses made reimbursement for services contingent upon approval of equipment by planning agencies. * Unlike Blue Cross and Blue Shield, commercial insurance companies have shown little interest in coordinating reimbursement practices with the planning policies of the Government. There are indications that this pattern is changing. In response to a request from a commercial insurance company, the Connecticut Insurance Department in August 1976, authorized a rider denying payment for procedures performed in facilities or on equipment not approved by a designated State agency. The rider further provided that when State approval is not required, CT scanning will be reimbursed only if performed in a hospital (233).

FEDERAL POLICIES IN PRACTICE

Federal law ties planning for medical care services to the population's health "needs. " In the absence of readily available, valid, or reliable measures of the need for CT scanning, State and local planners have adopted substitute indicators of need. For a variety of reasons, to be explained in the concluding section, it cannot be shown that planning in practice has guided the diffusion of CT scanners in a manner consistent with the intent of the law.

Often, planners have used a fixed ratio of scanners per population to indicate the number of scanners needed, and therefore approved for installation within an area. This ideal or "target" ratio is derived in several ways (250). Three commonly used approaches are: (1) to specify by a "rule of thumb" the population served; (2) to specify the population by the incidence and prevalence of specific diseases; and (3) to determine the number of scanners needed by the number of diagnostic procedures that could be replaced by CT scanning.

In the first approach, much discretion is used to choose an optimal ratio of scanners to population. As a result, planning targets vary among planning areas, Indiana allowed one scanner in each service area with more than 100,000 population (554), while Alabama suggested that a service area should have at least 500,000 population (544). Massachusetts' (564) and New Jersey's (572, 573) guidelines stated that each health service area should have one scanner, while in Ohio, (581) the guidelines suggested one for every major medical center.

Instead of directly specifying the number of machines required, the second and third approaches estimate the number of scans required by the population and then

*Conformance clauses notwithstanding, some Blue Cross plans are contractually obliged to reimburse hospitals for CT scanning services rendered in private offices (70).

translate this number into a specific number of machines. Arriving at a number of scanners in this way depends on how the operating capacity of the machine is computed. The variables which determine the operating capacity of a CT scanner together with actual data from operating machines are presented in appendix II.

The second approach calculates the incidence and prevalence of diseases for which CT scanning is used and estimates the number of scans needed. Kentucky, for example, used data on risks, prevalence, and incidence of cancer and certain neurological diseases. The State estimated that **46,000** persons per year needed CT scans (558). However, identifying diseases suitable for CT scanning assumes knowledge of appropriate medical indications for use. As seen, information about the efficacy of scanning is still being accumulated.

Estimates of the replacement of other diagnostic procedures by CT scanning are being derived from both clinical and experimental data as discussed in the previous chapter. Some of these data have been incorporated into planning criteria by various States. For example, the South Central Pennsylvania Health Planning Council **(583)** used the formula (.90A + .20B + .75C) K = the number of CT scans needed; where A, B, and C are the number of brain scans, cerebral arteriograms, and pneumoencephalograms (respectively) that are performed yearly. * However, applying rates of use of alternative procedures as a guideline for CT scanning incorporates utilization patterns which were also developed without first evaluating their efficacy.

While an average of the results that different calculations yield might appear to reconcile different assumptions, it often does not in practice. A staff paper from the Massachusetts Department of Public Health (564) applied formulas from 11 different sources and found estimates of "need" ranging from 5 to **52** scanners for the State. The range is so wide that an average of the estimates is not representative of any set of assumptions.

Ideally, once the number of scanners needed by a population has been estimated, that number becomes the upper limit in approving purchases of additional scanners. The issue of the distribution of scanners is important in this phase of the planning process. Because of the large number of proposed purchases by mid-1975, many States and localities developed criteria for the placement of machines (table 11).

Many of these criteria reflect current medical practices. There is a preference for placing CT scanners in medical centers, usually university-affiliated ones with an active radiological-neurological service. Presumably, the motivation is to place scanners close to the more seriously ill patients and to large population centers, thereby maximizing potential use. However, concern for sharing services and proximity to ambulatory patients is also evident.

Most agencies do not specify the relative importance of various criteria. Among agencies that do assign priorities to certain criteria over others, there is little agreement among rankings. Available information has been widely circulated. Guidelines developed by the Comprehensive Health Planning Council of Philadelphia published early in 1974 **(582),** for example, have had a noticeable influence on guidelines of other States (appendix 111).

The standards for CT scanners in the National Guidelines are more specific than the criteria used by most planning agencies. The intention is that as the health

● K is an adjustment factor added to account for referrals and other unique circumstances.

systems plans become consistent with these standards, so too will the ranking of criteria for review of scanners. The three standards are:

1. A Computed Tomographic Scanner (head and body) should operate at a minimum of 2,500 medically necessary patient procedures per year, for the second year of its operation and thereafter.

Table II.—Criteria Used by Health Planning Agencies in Reviewing Applications for CT Head Scanners[a] August 1976

Type of Criteria	Number of Agencies Using Criteria
Active neurosurgical service	**29**
Requirement for full-time neurosurgeon	**12**
Specification of number of procedures	**18**
Requirement for an "active service"	**9**
Active neurological service	**29**
Requirement for full-time neurologist	**12**
Specification of number of beds or admissions	**13**
Requirement for an "active service"	**12**
Active radiology service	30
Requirement for full-time radiologist	4
Requirement for radiologist with training in neuroradiology	21
Radiologist merely mentioned	7
Requirements concerning other personnel (technicians, engineers, etc.)	12
Specified number of certain neurodiagnostic procedures	20
Utilization beyond an 8-hour day	20
Commitment to more than 8 hours	18
Commitment to 24 hours availability	5
Regionalization and geographic proximity	29
Proximity	15
Availability to ambulatory patients	11
Formal referral arrangements	14
Letters of endorsement from providers and/or consumers	11
University medical centers favored	5
Low priority for noninstitutional (physician offices) scanners	8
Requirement for scanning those unable to pay	11
General quality of care	18
Peer review	5
Availability of emergency services	6
Neuropathologist	3
Research and education capability	10

Table 11.—Cont.

Type of Criteria	Number of Agencies Using Criteria
Financial data	30
Statement of expected charge	15
Statement of projected volume	21
Statement of financial feasibility	14
Financial reporting after operational	18
General reporting	20
Long-range plan and evaluation	12
Consideration of alternatives	5
Training plan for staff	4
General reporting required after operational	16

[a] Arequestmade to all States to submit criteria used by the State or local agencies to review head and body scanners. Criteria submitted by Statesfor reviewof body scanners were similar to that for head scanners, with the exception of the neurological criteria.

Sources: 544-546,550,552-553,555-561 ,563-566,568-57O,573-577,579,58l-584,585-586,589-59O.

2. There should be no additional scanners approved unless each existing scanner in the health service area is performing at a rate greater than 2,500 medically necessary patient procedures per year.

3. There should be no additional scanners approved unless the operators of the proposed equipment will set in place date collection and utilization review systems. ”

SHORTCOMINGS OF PLANNING POLICIES

The impact of health planning on the number and distribution of CT scanners is difficult to determine in the absence of efficacy criteria. For example, even with regulation, the rate of diffusion of CT scanners has accelerated since their introduction in 1973. What production schedules might have existed in the absence of regulation are, of course, not known. But there is no basis for judging whether current levels of production are too high or too low.

The National Health Planning Act may not have been in effect long enough to affect the pattern of installation of CT scanners. However, State certificate-of-need laws and section 1122 agreements have been in effect longer. Taken together, these planning laws do not explain the differences in the number of CT scanners among States.

Throughout the entire country, only the District of Columbia lacked guidelines or legislation that applied to scanners in June **1976** (table 10). During the reference period, Missouri had statewide planning criteria for CT scanners. Of the other 10 areas with the highest concentration of scanners, Nevada, Colorado, and Florida had both certificate-of-need laws and section 1122 agreements. The remainder of this group of States had either a certificate-of-need law or a section 1122 agreement that covered CT scanners.

Among the 10 States with the lowest ratios of scanners to population in June **1976,** Mississippi, New Hampshire, New Mexico, and North Carolina did not have a certificate-of-need law. Neither did Wyoming, the only State without a scanner.

Nonetheless, all of these States had **section 1122** agreements.

This simple correlation may be misleading however, since at least 4 of the **30** States with certificate-of-need laws as of June 1976 did not cover CT scanners. Georgia and Illinois did not cover purchases of equipment; Ohio's law, which had not been implemented, did not specify coverage; and California's initial law covered only hospital beds (497).

In addition, the rate of State approvals of capital expenditures under section 1122 has been over 90 percent (85). Without further information, the effectiveness of planning cannot be judged by the extent to which it either prevents or encourages resource development.

Thus, the first shortcoming of public policy is that concepts essential for implementing plans and regulations are not defined. In particular, planners are seriously handicapped by the lack of appropriate medical indications for use of CT scanners, matters that hinge on efficacy. A population's need for CT scanning services cannot be adequately estimated without this information.

The best indications for use of particular neurodiagnostic procedures consider specific disease categories **(62,23).** However, defining acceptable medical practice for use of CT scans is in the early stages. Thus, diagnostic protocols have not yet been widely accepted for use of CT scanners. Without a protocol, the frequency with which physicians use CT scans as a complementary or as a substitute procedure is unknown (564,264).

In lieu of appropriate medical indications, present rates of use of CT scanners are incorporated into planning targets. Since the CT scanner is still a new technology, current experience with it is not likely to be representative of long-term experience. For example, familiarity gained over time with the technology can increase its use by physicians. Improvements in design for handling patients, which raise the potential productivity of the machine, could also increase average future use. On the other hand, obsolescence may decrease future rates of use. To date, no suitable planning indicators for CT scanners are available. In light of this finding, adherence to rigid planning targets may be unsound.*

The second shortcoming of Federal health planning policy is that regulations do not apply uniformly to all purchases of CT scanners. Offices of private physicians, whether for individual or group practice, are exempt from the certificate-of-need provisions of P.L. **93-641 and** from those of section 1122. These exemptions encourage the location and ownership of scanners in private practices, despite any efforts of planning agencies to the contrary.** In Ohio and Florida, for example, physicians have leased space from hospitals in order to install privately purchased machines. In these States, such arrangements are not subject to review by planning agencies. When a hospital in Miami was denied permission to purchase a scanner, a physician on the hospital staff purchased a machine, installed it in an adjoining office building, and made it available to the patients in the hospital **(256).*****

*There are indications that the Department of Health, Education, and Welfare supports more flexibility in the planning process. The Department endorses periodic review and revision of the standards proposed in the National Guidelines as experience with their use accumulates.

**Besides the laws' exemptions of private medical practices, the investment tax credit gives providers an incentive to install scanners outside of hospitals, The credit lowers the effective cost of a CT scanner to physicians in private offices as opposed to nonprofit hospitals.

***Final regulations of the National Health Planning Act prohibit leasing arrangements that have the intent of circumventing review. Intent, however, is difficult to prove under the law.

Current State certificate-of-need laws also usually exempt from review expenditures for facilities, equipment, or services by private physicians. Only seven States—Colorado, Connecticut, Hawaii, Iowa, Minnesota, Virginia, and Wisconsin—review acquisitions by private physicians. Massachusetts, New York, and Vermont are considering extending their laws, An expansion by the States of the minimum type of facilities covered under the provisions of P.L. 93-641 would not conflict with the law (498). These initiatives are often supported by a variety of organizations, including Blue Cross (71) and the Institute of Medicine **(258).**