

# Cardiac Diagnostic and Surgical Facilities in the United States

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SINCE the publication of the report of the first successful surgical intervention in a congenital cardiac malformation, surgical techniques have evolved rapidly in this area of cardiac disease. The development of diagnostic techniques, apparatus, and instruments has been equally rapid. Historically, techniques and apparatus have been developed in the large teaching and research centers. As techniques were perfected, the flow of patients to these centers increased. Then, as the centers completed the training of more personnel, additional centers were established and staffed.

Before 1961 there was some discussion of the advisability of establishing in the smaller communities additional diagnostic and surgical facilities not affiliated with teaching and research centers. Several major considerations were voiced: the volume of potential patients, cost of installation and maintenance of adequate facilities, and the workload of a cardiac surgical team that insures maximal safety for the patients (1-3).

In 1961 definitive information about the cardiac diagnostic and treatment facilities in this country was lacking. The number and geographic distribution of centers were not known; there was no information on their equipment or the procedures they could and did perform; the institutional sponsorship and affiliation of facilities had not been ascertained; the speciali-

ties included in the various teams and the training and experience of team members had not been listed; the volume of work done at centers either in numbers of patients seen and treated or distributions of diagnoses, procedures employed, and treatments instituted was unknown; also missing was exact information of the results of current practices.

Without reliable current information about these items, planning for future cardiac diagnostic and treatment facilities must be intuitive or expeditious, leading to waste, inequities, and inadequate patient care. To answer some of these questions, a study was undertaken to identify all institutions that perform diagnostic or surgical services, or both, for congenital heart disease patients and to establish the workload of these institutions for one calendar or fiscal year. This is a report of the study.

## Method

The inquiry was limited to cardiac catheterization, angiocardiology, open and closed heart surgery facilities, and inquiry about their workloads for both congenital and acquired heart disease. The American Hospital Association assisted by providing addressed mailing labels for all institutions which are members of the association or are included in its annual census. The questionnaire was addressed to the administrator, director, medical director, or proprietor of institutions in the contiguous 48 States and the District of Columbia.

The four basic questions in the single-page questionnaire (form A) were whether the institution had facilities for (a) cardiac catheterization, (b) angiocardiology, (c) closed heart

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surgery, and (d) open heart surgery. If the answer to any of these was "yes," the date when the procedure was first performed was requested. Institutions answering "no" were asked if they expected to provide this facility by January 1962. Other information sought was the position or title of the person completing the form, the institution's type of ownership and control, type of care and specialization, number of beds, total inpatient admissions for 1960, and affiliation with a medical school. The questionnaire was accompanied by a form letter explaining the purpose of the study and a return envelope.

Form A was mailed out in the early summer of 1961; in the early fall, a second form A was sent to nonresponding hospitals.

As a second step in the data collection, a second questionnaire, form B, was developed to ascertain the workload for the calendar or fiscal year 1961. Form B was sent to all institutions indicating on form A that they had one or more facilities as well as those institutions indicating that they expected one or more facilities to be in operation by January 1962.

The number of patients studied in the diagnostic facilities and number receiving surgery during calendar or fiscal 1961, categorized by the diagnoses of congenital or acquired heart disease, was requested on form B. Again, an accompanying form letter explained the purpose of the questionnaire and the study. To assure maximal returns, three followup mailings requested cooperation in filling out the second form. Hospitals providing residencies in thoracic surgery received a special appeal for cooperation, sent to the director of the program, or if the name of the surgeon in charge was known, personal appeals were sent to him.

At the time of the mailing of form B, a special attempt was made to obtain information from a group of hospitals failing to respond to form A. This group had been judged likely to be providing one or more of the four facilities on the basis of an analysis of the characteristics of the hospitals replying to form A and reporting one or more of the four services. Hospitals offering one or more services tended to have more than 100 beds. Further, special-purpose hospitals—prison hospitals, infirmaries attached to boarding schools and colleges,

orthopedic, maternity, eye, ear, nose, and throat, rehabilitation, mental retardation, and psychiatric institutions as well as convalescent and nursing homes and infirmaries attached to old age homes—tended to lack the four services. After classifying all hospitals not responding to form A by number of beds and specialization, there remained 376 institutions likely to offer one or more of the services under investigation. These 376 were approached again and asked to complete both forms if applicable at this time. For this group there were several followup requests to obtain maximal response from all hospitals judged likely to provide the services.

### Response

There were 6,988 institutions on the original mailing list, and 5,340 eventually returned the first questionnaire. Of the 1,648 not responding, 1,550 were judged, by the criteria outlined previously, unlikely to provide any of the four services, while 98 were judged likely to provide one or more services. The 98 represent a 4 percent nonresponse rate of the 2,717 hospitals either reporting services or judged likely to provide services.

In addition to these 98 nonrespondents, 65 hospitals which had replied affirmatively to form A failed to respond to form B. These 65 represent 6 percent of the 1,052 hospitals which had reported one or more services on form A (table 1).

*Assessment of nonresponse.* Only 3 of the 5,340 responding hospitals refused to give the desired information. A great number not only completed the forms but expressed interest in the study. Many hospitals reported great difficulty in collecting the desired information because of lack of clerical staff, and indeed for this reason some took well over half a year to complete the form. Some reported that their present record systems did not permit collection of the desired data, but they supplied the best information available by their judgment. Several added that they had changed their record-keeping systems so that in the future they could supply such information. In short, the study met with a surprisingly good reception, and while this reaction cannot be quantified, it leads to confidence that the returns were completed

with interest and as great a degree of accuracy as possible. Some of the 98 hospitals failing to send form A and some of the 65 failing to send form B eventually supplied the requested information, but sent it too late for inclusion in the tabulations. Further, no particular bias was apparent in the regional distribution of the nonreporting hospitals. It can be assumed, therefore, that the findings were not distorted in any particular direction by nonresponse and simply represent an unknown but certainly not large random underreporting.

*Accuracy of the data.* It must be borne in mind that the data are based solely on the reports from the responding institutions. It proved impossible within the scope of the study to develop any systematic verification procedures. Whenever discrepancies appeared between information on forms A and B, a letter was sent asking for clarification. Thus, 32 hospitals originally reporting one or more services on form A stated on form B that no such services were available. These discrepancies occurred mostly among hospitals with fewer than 100 beds and replies to inquiries indicated that the terms "cardiac catheterization" and "electrocardiography" had been confused. In

**Table 1. Response of hospitals to survey and distribution by number of beds of institution, United States, 1961**

Response	Total	Number of beds <sup>1</sup>		
		Less than 100	100 or more	Unknown
Responded to form A.....	5, 340	2, 700	2, 619	21
Had 1 or more services.....	1, 052	94	958	-----
Reported 1961 workload.....	987	82	905	-----
Did not report 1961 workload.....	65	12	53	-----
Reported no services.....	4, 288	2, 606	1, 661	21
No response to form A.....	1, 648	-----	-----	-----
Not likely to provide services.....	1, 550	1, 224	240	86
Likely to provide services.....	98	-----	98	-----
Total.....	6, 988	3, 924	2, 957	107

<sup>1</sup> According to 1961 American Hospital Association Directory.

a few instances, small hospitals reported providing only open heart surgery. Answers to followup letters established that these reports were clerical errors of reporting open instead of closed heart surgery.

A few discrepancies remained unclarified, and it was decided to present the data as given even though reclassification might have been justified. All were very small units reporting surgery only and are administratively independent parts of larger medical complexes with both diagnostic and surgical services provided by other units that also reported in the survey.

### Geographic Classification

As the data were processed it became apparent that only large geographic units of reporting would yield meaningful overall presentation. Consequently, each hospital was classified in two ways.

Location in one of the following nine Bureau of the Census regions:

1. New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.
2. Middle Atlantic: New Jersey, New York, Pennsylvania.
3. East North Central: Illinois, Indiana, Michigan, Ohio, Wisconsin.
4. West North Central: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.
5. South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia.
6. East South Central: Alabama, Kentucky, Mississippi, Tennessee.
7. West South Central: Arkansas, Louisiana, Oklahoma, Texas.
8. Mountain: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming.
9. Pacific: California, Oregon, Washington.

The hospitals were also classified by location within 1 of the 212 Standard Metropolitan Statistical Areas or outside of an SMSA (4). This Bureau of the Census designation may be interpreted as an urbanized area with a certain density of population, economically interdependent, and possessing a core city of at least 50,000 population. Occasionally an SMSA overlaps State boundaries and the States overlapped are in different census regions. In such instances hospitals and populations concerned were assigned to the region which included the largest propor-

tion of the total population of the SMSA. These adjusted population figures so obtained are used throughout this report.

For example, the Columbus, Ga., SMSA has a population of 217,985. Of these, 171,634 reside in the Georgia portion, and 46,351 live in Alabama. All hospitals in the SMSA were assigned to the Columbus, Ga., Standard Metropolitan Statistical Area. Georgia belongs to the fifth census region and Alabama to the sixth region, and both the hospitals and the 46,351 population in the Alabama portion of the SMSA were included in the fifth region.

### Number of Facilities Reported

A summary of the number of hospitals by type of information reported concerning the four facilities follows.

Type of facility	Reported—	
	Facility only	Facility and workload
Cardiac catheterization.....	27	513
Angiocardiology.....	37	649
Open cardiac surgery.....	21	327
Closed cardiac surgery.....	48	777

Only the data from hospitals replying to both questionnaires, that is, those supplying workload information, can be considered "hard," since data derived only from replies to form A may represent overreporting of an undeterminable size. Further, although there is additional information about services begun since January 1962 it is fragmentary. Addi-

tional facilities reported as functioning then included 16 catheterization laboratories, 29 angiocardiology laboratories, and 12 open and 14 closed cardiac surgical facilities. These totals of additional facilities are based solely on reports from hospitals volunteering the information on the second form.

It was decided to use only the figures obtained by first inquiry and confirmed by the second form. This decision results in understatement of facilities available, but it seems justified because of the gain in reliability of the data.

Table 2 shows the distribution of the facilities by the nine census regions with ratios of facilities per 1 million population of each region. For each facility, the Pacific Region's ratio is highest and the East South Central Region's is lowest. The East South Central Region encompasses Appalachia, and therefore the low ratios are perhaps not surprising. The high ranking of the Pacific Region may be surprising if one recalls that medical schools and their affiliated hospitals tend to be the leaders in medical innovation, and one might justifiably expect higher ratios of facilities to population along the eastern seaboard with its larger number of medical schools.

The ratios are used solely to permit regional comparisons. Nothing in the literature gives a firm basis for calculating incidence rates of congenital heart disease, and there is even less data to permit calculation of numbers of patients in need of catheterization, angiocardiology, or either open or closed cardiac sur-

**Table 2. Regional distribution of cardiac diagnostic and surgical facilities and ratios per 1 million population, United States, 1961**

Region	Adjusted population	Catheterization laboratories		Angiocardiology laboratories		Open cardiac surgery		Closed cardiac surgery	
		Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio
New England.....	10, 509, 367	40	3. 80	41	3. 90	23	2. 19	60	5. 70
Middle Atlantic.....	34, 109, 741	111	3. 22	151	4. 38	73	2. 12	163	4. 73
East North Central.....	35, 867, 968	83	2. 24	102	2. 75	46	1. 24	128	3. 46
West North Central.....	15, 808, 254	40	2. 52	45	2. 84	26	1. 64	59	3. 72
South Atlantic.....	26, 154, 439	73	2. 77	95	3. 61	41	1. 56	101	3. 84
East South Central.....	11, 870, 047	19	1. 60	26	2. 18	14	1. 18	38	3. 19
West South Central.....	16, 951, 255	44	2. 55	55	3. 19	35	2. 03	62	3. 60
Mountain.....	6, 855, 060	21	3. 05	29	4. 21	15	2. 18	37	5. 37
Pacific.....	20, 339, 105	82	4. 02	105	5. 15	54	2. 65	129	6. 32
Total.....	178, 465, 236	513	2. 57	649	3. 25	327	1. 64	777	3. 89

**Table 3. Regional distribution of facilities among hospitals offering four services and proportion of facilities in hospitals with less than four services, United States, 1961**

Region	Hospitals with 4 services	Catheterization laboratories		Angiocardiology laboratories		Open cardiac surgery		Closed cardiac surgery	
		Region total	Percent in hospitals with less than 4	Region total	Percent in hospitals with less than 4	Region total	Percent in hospitals with less than 4	Region total	Percent in hospitals with less than 4
New England.....	22	40	45	41	46	23	4	60	63
Middle Atlantic.....	70	111	37	151	54	73	4	163	57
East North Central.....	41	83	51	102	60	46	11	128	68
West North Central.....	24	40	40	45	47	26	8	59	59
South Atlantic.....	39	73	47	95	59	41	5	101	61
East South Central.....	13	19	32	26	50	14	7	38	66
West South Central.....	31	44	30	55	44	35	11	62	50
Mountain.....	13	21	38	29	55	15	13	37	65
Pacific.....	50	82	39	105	52	54	7	129	61
Total.....	303	513	41	649	53	327	7	777	61

gery (5-11). These ratios are entirely relative, therefore, and do not indicate whether the entire U.S. population is adequately provided with these four services or whether certain regions have enough, too much, or not enough services.

### Range of Services

Aside from establishing the sheer numbers of each facility in the country, it is of interest to discover the frequency with which all four are available within one institution and how often they occur singly or in other combinations of less than all four.

If an institution providing all four services is defined as a center capable of performing comprehensive diagnostic and surgical services for congenital cardiac patients, 303 such completely equipped centers were in operation during 1961. It is assumed that such a center can handle any emergency that might arise during diagnostic procedures and that it can provide the gamut of surgical techniques necessitated by the range of congenital heart disease diagnoses now amenable to surgical intervention, so that the patient would receive the best correction within current possibilities. Also, any unforeseen complications arising could be handled immediately because skills and equipment would be available instantly.

Table 3 shows the regional distribution of the four facilities and whether they are located in a fully equipped center. The table was limited to two categories of institutions since the presentation of all the permutations of facilities results in so much detail that no clear picture emerges.

Aside from the 303 fully equipped centers, there were in the 48 States 210 additional catheterization laboratories, 346 angiocardiology facilities, 24 open heart surgical facilities, and 474 hospitals offering closed cardiac surgery. The number of fully equipped centers was much larger than anticipated. Equally surprising were the large total numbers of the various facilities reported.

During the planning stage, consultants representing private practice, teaching institutions, and State, Federal, and voluntary health agencies had been approached. They estimated there were about 50 fully equipped centers and an additional 300 to 400 partially equipped facilities, presumably casefinding and referral units, in other institutions.

Further, it should be emphasized that while the hospitals had been informed that the study was interested in facilities for congenital cardiac patients, form A inquired as to the presence or absence of the four facilities and did not ask the hospitals what type of cardiac patients were given services. Consequently, institutions that

reported facilities but stated that they were used for patients with vascular disease rather than for the diagnosis and treatment of heart diseases were classified as having "no facilities." For example, angiocardiology of the aorta was not considered as a service for cardiac patients. Thus, the institutions counted in this report clearly stated that they indeed served cardiac patients.

### Procedures Performed During 1961

The surprising number of facilities reported in the study does not indicate that there are enough, too many, or too few facilities to serve the entire population of the country. Because overcrowded facilities would indicate that there is unmet need and unevenly used ones may indicate that some regions have too much, others too little, and so on, the quantity of procedures, or work performed, during the year was studied.

The second questionnaire asked for the number of procedures performed rather than the number of patients served by each facility. While it is probably safe to assume that each surgical procedure represents one unduplicated patient, this assumption is not possible for diagnostic procedures. We do not know the amount of duplication that occurs as a patient is referred from a purely diagnostic facility to a fully equipped center for surgery. Equally unknown are the numbers of patients who receive only cardiac catheterization or only angiocardiology

**Table 4. Number of procedures reported for four types of services, United States, 1961**

Procedure	Total <sup>1</sup>	Procedures for heart disease	
		Con-genital	All other
Catheterization.....	30, 654	16, 416	11, 443
Angiocardiology.....	18, 095	9, 197	5, 767
Open cardiac surgery.....	8, 792	5, 736	2, 601
Closed cardiac surgery.....	8, 448	4, 226	3, 455

<sup>1</sup> Totals are larger than sum of procedures for congenital and all other heart disease since some hospitals reported totals only.

or those that underwent both procedures when the hospital provides both. Some hospitals stated that they perform both almost automatically; others indicated by the numbers mentioned in their reports that this would not be true for their institutions.

A further point in examining the data on volume of work performed is that the category "all other" heart disease includes noncongenital or acquired heart disease, trauma repair such as the suturing of stab wounds, open-chest cardiac massage, and installation of pacemakers. Since the study was primarily concerned with congenital heart disease facilities, no attempt was made to ask the responding hospitals to differentiate between patients with acquired heart

**Table 5. Regional distribution of cardiac diagnostic and surgical procedures and ratios per 100,000 population,<sup>1</sup> United States, 1961**

Region	Catheterizations		Angiocardio-graphies		Open cardiac surgery		Closed cardiac surgery	
	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio
New England.....	1, 933	18. 4	1, 065	10. 1	535	5. 1	606	5. 8
Middle Atlantic.....	7, 157	21. 0	3, 966	11. 6	1, 691	5. 0	1, 697	5. 0
East North Central.....	4, 681	13. 0	2, 966	8. 3	1, 372	3. 8	1, 504	4. 2
West North Central.....	7, 490	15. 8	2, 210	14. 0	831	5. 3	724	4. 6
South Atlantic.....	4, 402	16. 8	2, 788	10. 7	1, 159	4. 4	1, 358	5. 2
East South Central.....	1, 463	12. 3	912	7. 7	362	3. 0	339	2. 9
West South Central.....	2, 533	14. 9	1, 001	5. 9	772	4. 6	527	3. 1
Mountain.....	1, 218	17. 8	482	7. 0	380	5. 3	524	7. 6
Pacific.....	4, 777	23. 5	2, 705	13. 3	1, 690	8. 3	1, 166	5. 7
Total.....	30, 654	17. 2	18, 095	10. 1	8, 792	4. 9	8, 448	4. 7

<sup>1</sup> See table 2 for adjusted populations used in calculations of ratios.

disease and emergencies. This point will be discussed subsequently in examining the workloads of hospitals providing only closed cardiac surgery.

Most hospitals could differentiate work done for congenital and "all other" heart disease patients, a few could supply only total figures, and a smaller number could supply only estimates but stated that at least one procedure was performed. Thus, the figures reported are an understatement, but it seems reasonable to assume that this understatement was minimal.

A total of 30,654 cardiac catheterizations, 18,095 angiocardiographies, and 8,792 open heart and 8,448 closed heart surgical procedures were performed in the 48 States during 1961 (table 4). More of the procedures reported were performed for congenital than "other" heart disease patients. Exceptions exist for closed heart surgery; in three regions more

"other" than congenital patients were treated by closed surgery.

A regional comparison with population ratios shows that, just as for ratios of facilities regionally available (table 2), the East South Central Region has among the lowest ratios for the four procedures, and the Pacific Region leads in catheterizations and open heart surgery but not in the other two procedures (table 5). There seems to be no simple correlation of availability of facilities with use of facilities.

### Desirable Workloads

The literature contains no clear-cut statement concerning a minimal amount of work necessary to maintain skill levels of the cardiac diagnostic or surgical team. An editorial in *Circulation* in discussing the findings of this survey states, "The precise definition of an oc-

**Table 6. Regional distribution of facilities reporting no procedures for 1961, United States**

Region	Total facilities	Reporting no procedures		Region	Total facilities	Reporting no procedures	
		Number	Percent			Number	Percent
Cardiac catheterization laboratories				Open cardiac surgical facilities			
New England.....	40	7	17	New England.....	23	0	-----
Middle Atlantic.....	111	13	12	Middle Atlantic.....	73	10	14
East North Central.....	83	19	23	East North Central.....	46	4	9
West North Central.....	40	8	20	West North Central.....	26	2	8
South Atlantic.....	73	17	23	South Atlantic.....	41	6	15
East South Central.....	19	4	21	East South Central.....	14	2	14
West South Central.....	44	7	16	West South Central.....	35	5	14
Mountain.....	21	4	19	Mountain.....	15	2	13
Pacific.....	82	15	18	Pacific.....	54	6	11
Total.....	513	94	18	Total.....	327	37	11
Angiocardiography laboratories				Closed cardiac surgical facilities			
New England.....	41	8	19	New England.....	60	15	25
Middle Atlantic.....	151	48	32	Middle Atlantic.....	163	44	27
East North Central.....	102	37	36	East North Central.....	128	43	34
West North Central.....	45	16	35	West North Central.....	59	14	24
South Atlantic.....	95	33	35	South Atlantic.....	101	31	31
East South Central.....	26	10	38	East South Central.....	38	14	37
West South Central.....	55	19	34	West South Central.....	62	14	23
Mountain.....	29	10	34	Mountain.....	37	14	38
Pacific.....	105	33	31	Pacific.....	129	40	31
Total.....	649	214	33	Total.....	777	229	29

casional surgeon is open to discussion, but few would argue that less than one case a month can keep a team at its optimum degree of training" (12).

Neither has there been any firm statement as to the quantity of procedures needed to justify the installation and maintenance of these very expensive diagnostic and surgical facilities. However, an unspoken consensus seems to exist that some minimum of work is necessary to maintain skill (13), guarantee acceptable low levels of mortality, and insure some economic justification for the establishment and maintenance of the teams and facilities.

After consultation it was decided to set a minimum standard at 50 procedures a year simply because 50 work weeks per team per year seemed reasonable and so did 1 procedure per week. Consultants found no great difficulty in accepting this as a working standard, and interestingly enough, in giving preliminary reports on this study to various groups, this standard was never challenged.

### **Workloads Reported**

Although the data were classified into finer categories, the accompanying tables are limited to reports of "no procedures," "less than 50," "50 or more," and "cannot specify" for each of the four services.

The most striking finding of this analysis of annual workloads was the fact that every region except one had hospitals with every one of the four facilities reporting no work performed during the year under investigation (table 6). The single exception occurred in the New England Region, where every facility reported at least one instance of open cardiac surgery.

Once again, there is a rough uniformity in proportions of unused facilities among all regions. For instance, while the national proportion of unused catheterization laboratories was 18 percent, the regions showed a range from 12 percent for the Middle Atlantic to 23 percent for the East North Central and South Atlantic Regions.

Another striking finding is the apparent lack of correlation between the proportion of unused facilities and the ratio of facilities per popula-

tion. It will be recalled that the Pacific Region showed the highest ratios for all facilities and the East South Central Region among the lowest for the four facilities. It would seem entirely reasonable to expect the highest utilization rates for facilities in the areas with the fewest facilities. However, quite the reverse was reported; for angiocardiology, the East South Central Region shows the highest rate of nonutilization, and it is in the second rank of nonutilization for open heart surgery, closed heart surgery, and cardiac catheterizations. The Pacific Region appears to approach the national rates, being neither extremely high nor low in its nonutilization rates.

The New England Region might perhaps emerge as the area with the best utilization of available facilities. It ranked second for catheterization laboratories per population and third lowest for nonutilization; for angiocardiology it was fourth in availability ratios but lowest in nonutilization; for open heart surgery facilities it ranked second and was lowest in nonutilization. Finally for closed heart surgery, it ranked second in availability and third in utilization rates.

In addition to the surprising number of facilities reporting no procedures, a great number of hospitals reported fewer than 50 procedures for the year (table 7). Roughly speaking, of all facilities reporting at least one procedure for the year, half the catheterization laboratories, three-fourths of the angiocardiology facilities, three-fourths of the open cardiac and four-fifths of the closed cardiac surgical services reported fewer than 50 procedures for all diagnostic categories of cardiac patients.

To determine further the number of facilities with a low volume of work, those reporting between 1 and 9 procedures per year were isolated from the "under 50 procedures" group. Table 8 shows only the national totals for the four services, but it is clear that a considerable proportion of institutions perform less than one procedure a month.

It is interesting to speculate how many facilities reporting less than 10 procedures for 1961 would report no procedures for a previous or subsequent year, and it might not be unreasonable to classify all those reporting no procedures and those reporting less than 10 into one group



**Table 7. Regional distribution of facilities reporting at least one procedure by range of workload, United States, 1961**

Region	Regional total with cases	Under 50 procedures		50 or more procedures		Cannot specify <sup>1</sup>	
		Number	Percent	Number	Percent	Number	Percent
<b>Catheterization laboratories</b>							
New England.....	33	17	51	15	45	1	3
Middle Atlantic.....	98	53	54	41	42	4	4
East North Central.....	64	35	55	27	42	2	3
West North Central.....	32	19	59	13	41	0	-----
South Atlantic.....	56	26	46	29	52	1	2
East South Central.....	15	5	33	10	67	0	-----
West South Central.....	37	21	57	15	40	1	3
Mountain.....	17	10	59	7	41	0	-----
Pacific.....	67	32	48	32	48	3	4
Total.....	419	218	52	189	45	12	3
<b>Angiocardiology laboratories</b>							
New England.....	33	26	79	5	15	2	6
Middle Atlantic.....	103	76	74	22	21	5	5
East North Central.....	65	47	72	16	25	2	3
West North Central.....	29	24	83	5	17	0	-----
South Atlantic.....	62	42	68	18	29	2	3
East South Central.....	16	14	87	2	12	0	-----
West South Central.....	36	26	72	7	19	3	8
Mountain.....	19	14	74	4	21	1	5
Pacific.....	72	53	74	13	18	6	8
Total.....	435	322	74	92	21	21	5
<b>Open cardiac surgical facilities</b>							
New England.....	23	18	78	3	13	2	9
Middle Atlantic.....	63	45	71	12	19	6	9
East North Central.....	42	33	71	7	15	2	4
West North Central.....	24	19	79	5	21	0	-----
South Atlantic.....	35	24	69	7	20	4	11
East South Central.....	12	9	75	3	25	0	-----
West South Central.....	30	20	67	6	20	4	13
Mountain.....	13	11	85	2	15	0	-----
Pacific.....	48	35	73	11	23	2	4
Total.....	290	214	74	56	19	20	7
<b>Closed cardiac surgical facilities</b>							
New England.....	45	40	89	2	4	3	7
Middle Atlantic.....	119	101	85	9	8	9	8
East North Central.....	85	73	86	10	12	2	2
West North Central.....	45	42	93	3	7	0	-----
South Atlantic.....	70	56	80	9	13	5	7
East South Central.....	24	22	92	1	4	1	4
West South Central.....	48	40	83	2	4	6	12
Mountain.....	23	21	91	2	9	0	-----
Pacific.....	89	80	90	6	7	3	3
Total.....	548	475	87	44	8	29	5

<sup>1</sup> These facilities performed at least 1 procedure but could not specify exact numbers.

of utilization frequency. If one does this, 171 catheterization laboratories, or 33 percent of the 513, reported none or less than 10 procedures for the year; the 649 angiocardiology services included 383, or 59 percent, with such low use; the 327 open cardiac surgery services included 134, or 41 percent, low use services; and of the 777 closed cardiac surgical facilities 562, or 72 percent, reported this low use rate.

In discussing annual workloads, open and closed cardiac surgical procedures cannot be considered independently when both are offered in the same hospital since the same team or teams presumably performs both. Therefore all totals for cardiac surgery were combined in tabulating when both types were available.

Hospitals offering only one type of surgery were included in the tabulation (table 9). While a few more hospitals now reach the "50 or more" category, the majority remain in the low use categories.

#### Facilities in Smaller Population Centers

Each hospital reporting one or more facility was also classified by location within or outside 1 of the 212 Standard Metropolitan Statistical Areas. In effect, this might be expressed as serving more than 50,000 persons or serving a smaller population. Not every one of the 212 SMSA's is served by a hospital offering diagnostic or surgical facilities or both. The smaller

**Table 8. Distribution of diagnostic and surgical facilities, by range of procedures reported by facilities with at least one procedure, United States, 1961**

Facility	Total facilities	1-9 procedures		10-49 procedures		50 or more procedures		Cannot specify <sup>1</sup>	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Cardiac catheterization laboratory-----	419	77	18	141	34	189	45	12	3
Angiocardiology laboratory-----	435	169	39	153	35	92	21	21	5
Open cardiac surgery-----	290	97	33	117	41	56	19	20	7
Closed cardiac surgery-----	548	333	61	142	26	44	8	29	5

<sup>1</sup> These facilities performed at least 1 procedure but could not specify exact numbers.

**Table 9. Regional distribution of hospitals providing open or closed cardiac surgery, or both, by range of procedures, United States, 1961**

Region	Total	Range of cardiac surgical procedures										
		0	1-9	10-24	25-49	50-74	75-99	100-149	150-199	200-249	250 or more	Can-not specify <sup>1</sup>
New England-----	61	15	23	7	7	3	0	2	0	0	1	3
Middle Atlantic-----	177	51	58	22	17	7	1	6	4	1	0	10
East North Central-----	148	52	59	11	5	7	1	5	2	0	3	3
West North Central-----	63	18	20	12	6	2	1	2	0	1	1	0
South Atlantic-----	113	41	37	10	5	2	5	3	3	1	1	5
East South Central-----	40	17	14	1	2	1	2	1	1	0	0	1
West South Central-----	67	15	24	8	7	1	4	1	0	0	1	6
Mountain-----	44	17	15	4	2	2	2	1	0	0	1	0
Pacific-----	143	44	55	14	9	6	4	1	3	2	1	4
Total-----	<sup>2</sup> 856	270	305	89	60	31	20	22	13	5	9	32

<sup>1</sup> These hospitals performed at least 1 procedure but could not specify exact numbers.

<sup>2</sup> A total of 724 hospitals were in the "under 50 procedures" category, 100 in the "50 or more."

**Table 10. Distribution of diagnostic and surgical facilities by population of community served and use, United States, 1961**

Facility	Total facilities	50,000 or more population				Less than 50,000 population			
		Total	With procedures	No procedures		Total	With procedures	No procedures	
				Number	Percent			Number	Percent
Catheterization.....	513	467	387	80	17	46	32	14	35
Angiocardiology.....	649	572	399	173	28	77	36	41	53
Open cardiac surgery.....	327	305	272	33	11	22	18	4	18
Closed cardiac surgery.....	777	678	496	182	27	99	52	47	47

**Table 11. Regional distribution of hospitals with one or more facility by population of community and use, United States, 1961**

Region	Total hospitals	Total no procedures	49,999-25,000		24,999-10,000		9,999-5,000		4,999-2,500		Under 2,500	
			Total	No procedures	Total	No procedures	Total	No procedures	Total	No procedures	Total	No procedures
New England.....	8	3	1	0	1	0	3	1	1	0	2	2
Middle Atlantic.....	21	6	7	2	6	1	3	1	2	0	3	2
East North Central.....	19	14	10	6	4	3	4	4	1	1	0	0
West North Central.....	19	10	9	3	6	4	1	1	0	0	3	2
South Atlantic.....	22	9	9	4	7	0	4	3	1	1	1	1
East South Central.....	10	9	2	2	2	2	3	3	2	1	1	1
West South Central.....	10	4	5	0	3	2	2	2	0	0	0	0
Mountain.....	10	7	4	1	2	2	2	2	0	0	2	2
Pacific.....	<sup>1</sup> 12	7	3	1	4	3	1	1	2	1	1	1
Total.....	131	69	50	19	35	17	23	18	9	4	13	11

<sup>1</sup> Includes 1 hospital located in a community for which the population size could not be ascertained.

cities tend to be without services. However, hospitals in communities of less than 50,000 do report the facilities.

About twice as many of the hospitals reporting facilities but performing no procedures for the year are serving fewer than 50,000 people than those located in SMSA's (table 10). The regional distributions are not presented since they show no remarkable variations. The non-use percentages are consistently higher in the smaller population centers. There appears to be a much greater use of open heart surgical facilities than the other three types; two regions report no hospitals located in SMSA's without at least one procedure, and only two regions report facilities in smaller communities without procedures for the year.

Table 11 shows use of all facilities in these

smaller population centers. It seems to be quite limited and one speculates that the populations served do not produce enough patients to keep these facilities busy, that local patients are referred to other facilities, or that local patients are not readily diagnosed or perhaps not given the same medical care that patients with similar cases receive in the metropolitan areas. The current data do not permit answering this question. However, the individual States, except for Arizona, participate in the Children's Bureau's programs for crippled children through State health departments and provide financial assistance for the children deemed to warrant these diagnostic and surgical procedures (14, 15). Infant mortality due to congenital heart defects throughout the country does not seem to show much variation between

metropolitan and nonmetropolitan areas (16). As a rough index of incidence, this does not account for the discrepancies in workloads reported. Accordingly, these explanations of nonutilization seem unlikely.

**Hospitals with Less than Four Services**

It seemed clear while analyzing the data that hospitals reporting only closed heart surgical facilities represented a special group and should be treated separately. This decision was made for several reasons. First, many of these hospitals volunteered, and many stressed, that they performed closed cardiac surgery solely in an emergency and that they were reporting only trauma repairs and cardiac massage. Further, they volunteered that these instances were rare and that years might elapse without a single case. Other hospitals reported that they would perform only pacemaker installations and would not consider any other cardiac surgery,

except perhaps trauma repair and cardiac massage. A total of 191 hospitals reported only closed cardiac surgery, and while not all volunteered information that they considered themselves as emergency facilities, it seems reasonable to classify all of them in this category, especially in view of the workloads they report.

Of the 191 such hospitals, 140 were located in Standard Metropolitan Statistical Areas while 51 served smaller populations (table 12). Altogether, 100 reported no procedures for the year.

In the non-SMSA's, besides the 51 hospitals reporting only closed cardiac surgery, 80 others reported varying combinations of facilities. They consisted of 22 offering all 4 services, 34 providing 1 or 2 diagnostic services, and 2 which provided only surgical services. Both were smaller units of larger medical complexes. The remaining 22 offered both diagnostic and surgical facilities.

**Table 12. Regional distribution of hospitals providing only certain facilities, by population of community served and use, United States, 1961**

Region	Total facilities	50,000 or more			Less than 50,000		
		Total	With procedures	No procedures	Total	With procedures	No procedures
Only closed cardiac surgery							
New England.....	18	17	12	5	1	0	1
Middle Atlantic.....	29	23	8	15	6	4	2
East North Central.....	42	29	15	14	13	3	10
West North Central.....	19	10	6	4	9	3	6
South Atlantic.....	17	11	7	4	6	4	2
East South Central.....	15	9	4	5	6	1	5
West South Central.....	7	4	2	2	3	2	1
Mountain.....	11	7	5	2	4	1	3
Pacific.....	33	30	14	16	3	0	3
<b>Total.....</b>	<b>191</b>	<b>140</b>	<b>73</b>	<b>67</b>	<b>51</b>	<b>18</b>	<b>33</b>
Only diagnostic facilities							
New England.....	7	5	0	5	2	1	1
Middle Atlantic.....	27	21	6	15	6	3	3
East North Central.....	25	22	9	13	4	1	3
West North Central.....	13	9	3	6	4	1	3
South Atlantic.....	14	8	4	4	6	0	6
East South Central.....	6	2	0	2	4	0	4
West South Central.....	4	2	1	1	2	0	2
Mountain.....	5	1	1	0	4	1	3
Pacific.....	17	15	5	10	2	0	2
<b>Total.....</b>	<b>119</b>	<b>85</b>	<b>29</b>	<b>56</b>	<b>34</b>	<b>7</b>	<b>27</b>

**Table 13. Number and percentage of procedures performed by fully equipped centers and by other hospitals reporting at least one procedure, United States, 1961**

Procedure and type of hospital	Total hospitals	Number procedures reported	Percent of total performed by centers	Range of percentages for 9 census regions
Catheterization	419	30,654	90	86-99
Centers	288	27,533		
All others	131	3,121		
Angiocardiology	435	18,095	88	80-97
Centers	272	15,882		
All others	163	2,213		
Open cardiac surgery	290	8,792	98	94-100
Centers	275	8,579		
All others	15	213		
Closed cardiac surgery	548	8,448	86	82-92
Centers	273	7,240		
All others	275	1,208		

Another interesting pattern of use emerges when one examines diagnostic facilities. There were 119 such hospitals providing either catheterization or angiocardiology or both (table 12). Of these, 36 reported 1 or more procedures for the year, while 83 reported none. This finding does not seem to substantiate current use of diagnostic facilities as local screening, case-finding, and referral units. The concept of a network of such services is implied in the number of "diagnostic only" services, but the services appear to be little used. It would seem rather that patients needing diagnosis and surgery are sent directly to fully equipped centers.

#### Fully Equipped Centers

Examination of the workload reports of facilities in the 303 fully equipped centers showed that not all services performed at least 1 procedure. Only 288 performed 1 or more catheterizations, 272 at least 1 angiocardiology, 275, open surgery, and 273, closed surgery. However, they did account for a large proportion of the total 1961 workloads (table 13).

In the 48 contiguous States, 90 percent of all cardiac catheterizations, 88 percent of the angiocardiology, 98 percent of the open cardiac surgery, and 86 percent of the closed cardiac surgery were performed in these fully equipped centers. The regional statistics for

each service show a uniform picture and a national pattern emerges, indicating that most patients who receive diagnostic and surgical services are treated in fully equipped centers. The proportion of procedures performed for the year in these centers is much greater than the proportion of available facilities they represent.

Workloads of all facilities, including those with all four services, in population centers of less than 50,000 comprised a small proportion of the totals. Apparently completeness of facilities alone is not enough to attract a volume of patients. A more significant factor is the location of the facility. Those in smaller communities performed 5.5 percent of all catheterizations reported, 5 percent of the total angiocardiology, and 5.5 percent of open and 7 percent of the closed surgical procedures (table 14).

The regional distribution is fairly uniform. It appears justified to conclude that fully equipped centers located in the metropolitan areas perform a major proportion of the annual work in the country and that, with few exceptions, fully equipped centers located in smaller communities do not contribute as much proportionately. However in the West North Central and South Atlantic Regions, very active centers in smaller communities perform a greater proportion of the regional workloads

**Table 14. Regional distribution of facilities and procedures in hospitals serving communities of under 50,000, United States, 1961**

Region	Facility <sup>1</sup>		Procedure		
	Region total	Com- munities under 50,000	Region total	Communities under 50,000	
				Number	Percent
Cardiac catheterization					
New England.....	33	4	1, 933	129	6. 7
Middle Atlantic.....	98	9	7, 157	432	6. 0
East North Central.....	64	2	4, 681	19	. 4
West North Central.....	32	4	2, 490	367	14. 7
South Atlantic.....	56	7	4, 402	695	15. 8
East South Central.....	15	1	1, 463	3	. 2
West South Central.....	37	2	2, 533	17	. 7
Mountain.....	17	1	1, 218	( <sup>2</sup> )	-----
Pacific.....	67	2	4, 777	29	. 6
Total.....	419	32	30, 654	1, 691	5. 5
Angiocardiology					
New England.....	33	4	1, 065	47	4. 4
Middle Atlantic.....	103	7	3, 966	294	7. 4
East North Central.....	65	2	2, 966	8	. 3
West North Central.....	29	5	2, 210	118	5. 3
South Atlantic.....	62	8	2, 788	315	11. 3
East South Central.....	16	1	912	( <sup>2</sup> )	-----
West South Central.....	36	3	1, 001	26	. 6
Mountain.....	19	3	482	26	5. 4
Pacific.....	72	4	2, 705	11	. 4
Total.....	435	37	18, 095	825	4. 6

than elsewhere in the country. These centers have a position of eminence in cardiac diagnosis and treatment and appear to attract an unusual number of patients, considering their location.

No tables are presented to show the proportion of the national totals of procedures performed in fully equipped centers in the smaller communities and the proportion in hospitals not fully equipped but similarly located. However, of the 1,691 catheterizations done in hospitals in non-SMSA's, 141 were in hospitals not fully equipped, or, about 0.5 percent of the national total.

For angiocardiographies, 73 of the 825 done in smaller locations were performed in noncenter hospitals, which is about 0.4 percent of the national total. No open surgical procedures were reported for these less than fully equipped hospitals in smaller communities. Of the 570

closed heart operations reported from all smaller communities, 81 were performed in non-center hospitals, and this represents not quite 1 percent of the national total.

#### **Congenital Heart Disease**

So far, this report has dealt with procedures reported for all heart disease diagnoses. For all patients, catheterization is much more frequently performed than angiocardiology even though there are more angiocardiology facilities than catheterization laboratories. Similarly, more open cardiac surgery procedures were performed for all patients than closed cardiac surgery, even though open cardiac surgical facilities are much fewer than those for closed cardiac surgery (table 4).

We now turn to congenital heart disease pa-

**Table 14. Regional distribution of facilities and procedures in hospitals serving communities of under 50,000, United States, 1961—Continued**

Region	Facility <sup>1</sup>		Procedure		
	Region total	Com-munities under 50,000	Region total	Communities under 50,000	
				Number	Percent
Open cardiac surgery					
New England.....	23	2	535	26	4.9
Middle Atlantic.....	63	5	1,691	105	6.2
East North Central.....	42	1	1,372	( <sup>2</sup> )	-----
West North Central.....	24	3	831	155	18.7
South Atlantic.....	35	5	1,159	185	15.9
East South Central.....	12	0	362	0	-----
West South Central.....	30	1	772	( <sup>2</sup> )	-----
Mountain.....	13	1	380	( <sup>2</sup> )	-----
Pacific.....	48	2	1,690	12	.7
Total.....	290	20	8,792	483	5.5
Closed cardiac surgery					
New England.....	45	3	606	26	4.3
Middle Atlantic.....	119	11	1,697	149	8.8
East North Central.....	85	4	1,504	15	1.0
West North Central.....	45	8	727	141	19.4
South Atlantic.....	70	13	1,358	213	15.7
East South Central.....	24	1	339	2	.6
West South Central.....	48	3	527	12	2.3
Mountain.....	23	3	524	4	.8
Pacific.....	89	3	1,166	8	.7
Total.....	548	49	8,448	570	6.8

<sup>1</sup> Facilities reporting 1 or more procedure for 1961.

<sup>2</sup> Hospital could not give specific numbers, but reported procedure performed during 1961.

tients and the services they received during 1961. Only reports with diagnostic breakdowns distinguishing between congenital and all other heart disease were included in the analysis, and the totals are therefore smaller. It is not known, of course, what bias this introduces. Examination of the characteristics of the hospitals which could not provide the separation by diagnostic groups showed no concentration by hospital size, regional location, or any other dominant characteristic. Thus, though one might have expected that smaller hospitals would be dominant in this group, it did not prove to be true.

As mentioned before, more of the total workload reported was for congenital heart disease patients than all other patients. Almost 60

percent of the catheterizations, 61 percent of the angiocardiographies, and 69 percent of the open and 55 percent of the closed cardiac surgery were performed for patients with congenital disease (table 15). The regional distributions show interesting variations. First, only in the Middle Atlantic and West North Central Regions are more closed cardiac procedures performed for noncongenital than congenital heart disease patients. The proportions are 48 percent and 45 percent respectively for these regions while the national percentage is 55 percent for congenital heart disease patients.

Second, in the West South Central Region many more procedures are for congenital cardiac patients than in the New England Region. However, in New England angiocardiography

seems to be reserved for congenital patients to a higher proportion than in other regions. It appears then that medical practice in the various regions is diverse, and one can only speculate on the underlying causes for this situation.

One might claim that the differential distributions indicate simply that certain regions are more advanced in the treatment of acquired heart disease while other regions are just beginning to enter this area. To test this possibility, ratios of procedures performed for congenital and "all other" heart disease patients per 100,000 population were calculated (table 16). The ratios were computed on the adjusted populations used in calculating previous ratios, and the same caveat concerning intrinsic significance applies. On the whole the regions which provided higher ratios for patients with congenital cardiac disease also produced

higher ratios for "all other" patients. This is not so for every region, and once again one can only speculate on the reasons for regional differences. Lack of facilities cannot be cited since it is clear from previous data that all regions have under-used and indeed unused facilities.

Not only is the larger proportion of all procedures performed for congenital cardiac disease patients, but the major share of all work for these patients is performed in fully equipped centers (table 17).

A comparison of the workload performed for congenital cardiac patients by fully equipped centers and noncenter hospitals shows that, while most of the two kinds of facilities handled both types of patients, the proportions of procedures for congenital cardiac disease patients were quite different. In most regions

**Table 15. Regional distribution of number and proportion of procedures for patients with congenital cardiac disease, United States, 1961**

Region	Total procedures	Congenital cardiac disease patients		Region	Total procedures	Congenital cardiac disease patients	
		Number	Per cent			Number	Per cent
Cardiac catheterization				Open cardiac surgery			
New England.....	1, 911	1, 111	57	New England.....	535	303	57
Middle Atlantic.....	6, 481	3, 468	53	Middle Atlantic.....	1, 552	952	61
East North Central.....	4, 410	2, 555	58	East North Central.....	1, 372	1, 049	76
West North Central.....	2, 108	1, 440	68	West North Central.....	821	632	77
South Atlantic.....	4, 396	2, 378	54	South Atlantic.....	1, 159	776	67
East South Central.....	1, 463	835	57	East South Central.....	363	269	74
West South Central.....	2, 061	1, 510	73	West South Central.....	772	510	66
Mountain.....	1, 098	696	63	Mountain.....	262	211	80
Pacific.....	3, 931	2, 423	62	Pacific.....	1, 502	1, 034	69
Total.....	27, 859	16, 416	59	Total.....	8, 337	5, 736	69
Angiocardiography				Closed cardiac surgery			
New England.....	1, 056	801	76	New England.....	606	327	54
Middle Atlantic.....	3, 451	2, 044	59	Middle Atlantic.....	1, 699	816	48
East North Central.....	2, 767	1, 729	62	East North Central.....	1, 265	802	63
West North Central.....	1, 267	902	71	West North Central.....	519	233	45
South Atlantic.....	2, 619	1, 379	53	South Atlantic.....	1, 276	702	55
East South Central.....	912	493	54	East South Central.....	339	198	58
West South Central.....	783	583	74	West South Central.....	527	370	70
Mountain.....	323	232	72	Mountain.....	388	196	50
Pacific.....	1, 786	1, 034	58	Pacific.....	1, 062	582	55
Total.....	14, 964	9, 197	61	Total.....	7, 681	4, 226	55



**Table 16. Diagnostic and surgical procedures per 100,000 population performed for congenital cardiac and other cardiac disease patients, United States, 1961**

Procedure	Congenital cardiac disease patients		Other cardiac disease patients	
	U.S. total	Range of 9 regions	U.S. total	Range of 9 regions
Catheterization	9.2	7.1-11.9	6.4	3.2-8.8
Angiocardio-graphy	5.1	3.4- 7.6	3.2	1.2-4.7
Open cardiac surgery	3.2	2.0- 5.1	1.5	.7-2.3
Closed cardiac surgery	2.4	3.1- 1.5	1.9	.9-2.7

NOTE: See table 2 for adjusted population figures used in calculating ratios.

**Table 17. Percentages of diagnostic and surgical procedures performed for congenital cardiac disease patients by hospitals with less than four services, United States, 1961**

Procedure	All hospitals	Hospitals with less than 4 services		
		Number	Per-cent	Range of 9 regions
Catheterization	16,416	1,215	7.4	3.0-12.0
Angiocardio-graphy	9,197	885	9.6	4.3-17.0
Open cardiac surgery	5,736	107	1.9	(1)- 3.8
Closed cardiac surgery	4,226	357	8.4	3.0-23.6

<sup>1</sup> Less than 0.1 percent.

**Table 18. Diagnostic and surgical procedures performed for patients with congenital cardiac disease by fully equipped centers and other hospitals, United States, 1961**

Procedure	Centers				Hospitals with less than 4 services			
	All patients	Congenital cardiac disease patients	Percent	Range of 9 regions (percent)	All patients	Congenital cardiac disease patients	Percent	Range of 9 regions (percent)
Catheterization	24,794	15,201	61	55-78	3,065	1,215	40	31-87
Angiocardio-graphy	12,991	8,312	64	53-81	1,973	885	45	21-74
Open cardiac surgery	8,124	5,629	69	57-85	213	107	50	0-90
Closed cardiac surgery	6,489	3,869	60	44-76	1,192	357	30	13-47

and for all four procedures, the fully equipped centers did more than half of their work with congenital cardiac patients, while for the other hospitals, the proportions of their work devoted to this patient group were 40 percent of catheterizations, 45 percent of angiocardio-graphies, and 50 percent of open and 30 percent of closed cardiac surgery. The comparable figures for the centers are given in table 18.

Again, there are exceptions and variations. The regional ranges observed for the hospitals not providing all four services are large and can be partially explained by the small numbers of procedures they perform. The fully equipped centers seem to deal with a different population than do the other hospitals, inasmuch as these centers deal with congenital heart disease patients not only in greater numbers but to a greater extent of their total workload. A possible explanation may be that work with acquired heart disease has more recently been incorporated into hospital practice and the fully equipped centers are better known for their past work with congenital heart disease. Perhaps the other hospitals have a better chance at attracting patients with acquired heart disease at this time.

### Discussion

These hospital reports show that the supply of the various services is much larger than had been anticipated. The location of the majority of the facilities validated the commonsense assumption that large hospitals in large urban centers would be most likely to provide these specialized services. Quite unexpected was the

finding that hospitals with less than 200 beds also supply these services, as was the fact that some of these hospitals were in nonmetropolitan towns.

The workloads for the four services show a large proportion reporting either no procedures performed for cardiac patients or less than 50 a year. Few centers performed one or more diagnostic procedures every working day, or 250 and more per year. A great number of the facilities are used at a rate below a minimum standard of one diagnostic or surgical procedure per week. Many hospitals provide diagnostic services only and must refer patients needing surgery to other centers. How much of the diagnostic workup is repeated routinely when such referrals take place is not known, but it appears reasonable to assume that some repetition is routine if the receiving hospitals are not acquainted with the work of the referring team.

It appears futile to attempt estimates of patient flow with the existing incidence and mortality information for congenital heart disease. Richards and associates (8) estimate an incidence of 6 per 1,000 live births and a 46 percent mortality within the first 2 years of life, and MacMahon and associates (6), an incidence rate of 3.73 per 1,000 live births and a mortality of 60 percent during the first year of life. Neither set of rates permits an estimate of the number of children born with cardiac defects who would benefit from diagnostic and surgical procedures and, in addition, the mortality rates do not take into account improvement in current rates attributable to timely surgical intervention. Even if one could arrive at some estimate of the number of persons needing diagnostic procedures or surgery, or both, one would also have to estimate repetitious procedures deemed necessary during a person's lifetime while he continues under medical supervision. Thus, to say that using Richards' rates, 25,610 children with congenital cardiac defects were born in 1961 and that 13,830 of these survived until 1963 is not very helpful in estimating numbers of procedures required for the total population using present medical standards.

An added complication is the effect of accumulating experience in the use of diagnostic tools. As a center gains experience with catheterization in diagnosing specific conditions, it

becomes possible to improve interpretation of data based on less complex diagnostic techniques so that the need for catheterization decreases proportionately in time. Therefore, an increase in catheterizations is not inevitable and the number may actually decrease (3).

The patients with rheumatic heart disease as a pool of patients for diagnostic and surgical procedures is a subject open for speculation. It seems reasonable to assume that the proportion and actual numbers of these patients should decline over the years as the result of prophylactic programs, and that, therefore, this source of patient flow should be at its peak now and for the next few years.

To speculate on future demands for diagnostic and surgical facilities for the other forms of acquired heart disease is futile since one can predict neither the conditions which will become correctable nor the proportion of persons with these conditions.

Further research is needed to delineate existing referral and patient flow patterns. Studies of records to determine the contribution of current procedures to the diagnosis and treatment of the congenital heart diseases would be of great value.

### Summary

A questionnaire survey of 6,988 hospitals in the 48 contiguous States resulted in the identification of 540 cardiac catheterization laboratories, 686 angiocardiography laboratories, 348 open cardiac surgical facilities, and 825 closed cardiac surgical facilities in 1961. No procedures were performed in 1961 by 18 percent of the cardiac catheterization laboratories, 33 percent of the angiocardiography laboratories, 11 percent of the open cardiac surgical facilities, and 29 percent of the closed cardiac surgical facilities. Reporting from 1 through 49 procedures for the year were 52 percent of the cardiac catheterization laboratories, 74 percent of the angiocardiography laboratories, 74 percent of the open cardiac surgical facilities, and 87 percent of the closed cardiac surgical facilities. The overwhelming proportion of all procedures was reported by hospitals providing all four facilities and located in large urban centers. Well over half of the procedures reported were

performed for patients with congenital rather than acquired heart disease. Further research is needed to investigate the relationship between the frequency the procedures are performed and surgical mortality and to obtain information about personnel, type of equipment, and auxiliary services available.

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## Pharmacology-Toxicology Center

A 7-year, \$17 million research and training grant to aid the University of North Carolina in establishing a new pharmacology-toxicology center has been awarded by the National Institute of General Medical Sciences, Public Health Service.

The center will be located at Chapel Hill, part of the research triangle formed by the University of North Carolina at Chapel Hill, Duke University, and North Carolina State University at Raleigh, and, later, the proposed Public Health Service National Center for Environmental Sciences.

The center's research programs in pharmacology and toxicology will include studies of the physical and chemical disposition of drugs; drug idiosyncrasy; biochemical effects of drugs and their influence on tissue morphology, particularly in the developing fetus; physiological and clinical pharmacology; and biostatistical studies.

## *Headquarters for Hemisphere Health*

### *Opens in Washington, D.C.*



THE WORLD'S oldest international health agency, the Pan American Sanitary Bureau, secretariat of the Pan American Health Organization and regional office of the World Health Organization, officially opened its new headquarters in Washington, D.C., on September 27, 1965—just 2 months short of its 63d anniversary, December 2.

The two-unit, reinforced concrete frame structure with window walls was designed to fit an odd-shaped rectangular lot. The larger unit is a crescent-shaped secretariat and the smaller a circular council chamber which seats 299 persons. A short connecting neck links the two. In the words of the building's architect, Roman Fresnedo Siri, of Uruguay: "Every building should reflect the character of the institution it houses. In this case . . . the mis-

sion is raising health standards. The columns therefore are vital. While firmly anchored to earth for a feeling of permanency, they contribute, along with the high-rising fins, to the symbolic lifting of the structure."

The first milestone in the development of the building came in March 1960 when the U.S. Government donated a \$1.1 million site as a gift. In 1961 and 1962, the W. K. Kellogg Foundation of Battle Creek, Mich., awarded grants totaling \$5 million that paid most construction costs of the building. The Foundation has stipulated that repayments by organization member governments over the next 20 years be spent on education, training, nutrition, and water programs in the Western Hemisphere; thus, in effect, putting the money back into health projects.

The staff of the Pan American Health Organization, which in 1902 included only a "handful" of people and now totals close to 1,000 public health experts and other international civil servants (300 in the United States and about 700 in Latin America), will be housed in the 9 office floors of the secretariat building.

