

PATIENT POPULATION AND OTHER ESTIMATES OF PROSTHETICS AND ORTHOTICS IN THE U.S.A.

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Because of the way health services are delivered in the United States, no accurate figures are available concerning the orthopaedic patient population, treatment methods, and other information that would be useful to administrators, clinicians, and research groups.

In July 1969 the Committee on Prosthetics Research and Development (CPRD) collected information that permitted certain estimates concerning amputees and orthotic patients in the U.S.A. (1). This article, compiled in May 1973, updates the 1969 effort. Further searching for more accurate information has emphasized that only rough estimates can be made, especially in orthotics.

PROSTHETICS

NUMBER OF AMPUTEES

The best sources of information on the total number of amputees in the country are the household interview surveys conducted by the National Center for Health Statistics (NCHS)². For the time periods 1963-1965 (7), 1965-1967 (8), 1969 (8), and 1971 (8), these surveys resulted in estimates of 257,000, 305,000, 260,000, and 274,000 amputees respectively in the civilian, non-institutional population. Taking an average of these figures and guessing at the number of amputees in military and Veterans Adminis-

tration hospitals, convalescent homes, and other institutions, brings the total to at least 300,000 or about 1.5 amputees per 1000 population³. This figure corresponds quite well with statistics from Great Britain.

The NCHS surveys show that the ratio between upper-limb and lower-limb amputees is 30% to 70%.

LEVELS OF AMPUTATION

For use in estimating the distribution by level of amputation, only the results of surveys conducted by the Committee on Prosthetic-Orthotic Education (CPOE) in 1961-1963 (3) and 1965-1967 (2) are available (Table 1).

These surveys consisted of contacts solely with prosthetics facilities and include only those amputees showing up for prosthetic treatment. The 1961-1963 study consisted of data only from the initial fitting of patients for a given period. The 1965-1967 study consisted of data from all patients fitted at a selected number of prosthetics facilities for a given period. The first study involved approximately 12,000 cases; the latter, about 4,000. Since not all amputees wear prostheses, the CPOE surveys obviously do not yield a complete picture. Therefore, it seems appropriate to show the distribution by level of amputation in upper- and lower-limb groups (Table 2).

The results of the two surveys are quite similar. The noticeable change is the reversal in numbers of above-knee and below-knee amputations. Presumably this is because of the benefits of immediate postsurgical prosthetic management and improved methods of elective surgery allowing greater length to be saved. A repeat of the 1961-1963 survey is currently underway as a cooperative effort of CPRD-CPOE and the American Orthotic and Prosthetic Association (AOPA).

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³Based on a population of 200,000,000.

Level of Amputation	1961-1963 CPOE Survey		1965-1967 CPOE Survey	
Shoulder	1.1%		0.6%	
Above-Elbow	3.7		3.2	
Elbow	0.3	14.5%	0.4	13.5%
Below-Elbow	8.6	Upper-Limb	7.7	Upper-Limb
Wrist/Hand	0.8		1.6	
Hip	1.8		1.3	
Above-Knee	44.1		35.2	
Knee	1.1	85.5%	1.3	86.5%
Below-Knee	36.8	Lower-Limb	46.4	Lower-Limb
Ankle/Foot	1.7		2.3	
TOTAL	100 %		100 %	

TABLE 1

Level of Amputation	1961-1963 CPOE Survey	1965-1967 CPOE Survey
Upper-Limb		
Shoulder	8%	5%
Above-Elbow	26	23
Elbow	2	3
Below-Elbow	59	57
Wrist/Hand	5	12
TOTAL	100%	100%
Lower-Limb		
Hip	2	2
Above-Knee	52	41
Knee	1	1
Below-Knee	43	53
Ankle-Foot	2	3
TOTAL	100%	100%

TABLE 2

AMPUTEES BY AGE

There are several sets of figures available from which amputees can be broken into age groups. One useful breakdown is given in Table 3. Taking an average of these figures gives about 10%, 60%, and 30% in the under 21, 21-64, and 65-and-over age groups respectively.

USE OF PROSTHESES

It has long been a rule of thumb that 50% of

arm amputees and 75% of leg amputees wear prostheses. These estimates are reinforced by a 1969 NCHS survey (10) which cites the use of 46,000 upper-limb prostheses and 126,000 lower-limb prostheses or 52% and 76% of the arm and leg amputees respectively in that survey of the civilian, non-institutional population.

A 1964 NCHS survey (9) of homes for the aged and chronically ill estimated 2,100 artificial limbs being used by residents.

MANPOWER

Records at the American Board for Certification (ABC) office indicate that there are 395 certified prosthetists and 235 certified prosthetist-orthotists for a total of 630 certified prosthetists (including 1972 examinees). Therefore, the ratio of amputees to certified prosthetists is 300,000/630 or 476/1 and the ratio of artificial limbs to certified prosthetists is 203,000/630⁴ or 322/1. From a CPOE manpower survey (14) and other indications from the field, additional qualified prosthetists are needed.

ORTHOTICS

NUMBER OF ORTHOTIC PATIENTS

The total number of orthotic patients is difficult to estimate because orthotic treatment is usually more complicated than prosthetic treatment and because records are not kept in a way so this information is accessible. A list of various

⁴Assuming 50% upper-limb and 75% lower-limb usage.

Age*	1961-1963	1965-1967	1963-1965	1965-1967	1969	1971
	CPOE Survey			NCHS Survey		
Under 21	12%	12%	7%	7%	14%	7%
21-64	60	59	62	58	55	65
65 & over	28	29	31	35	31	28
TOTAL	100%	100%	100%	100%	100%	100%

*In some cases interpolation of given statistics has been used to arrive at figures for some of the age groups.

TABLE 3

neuromuscular dysfunctions for which orthotics is commonly part of the treatment scheme is given in Table 4. We have insufficient knowledge

at present to arrive at the total number of orthotic patients from this table showing neuromuscular dysfunctions or from surveys or records in the

Neuromuscular Dysfunction	Estimated Patient Population
Paralysis/Paresis of Upper Limb(s)	172,000 ⁵
Paralysis/Paresis of One Lower-Limb	330,000 ⁵
Hemiplegia/Hemiparesis	340,000 ^{5, 6}
Paraplegia	77,000 ⁵ -200,000 ⁷
Quadriplegia	38,000 ⁵
Cerebral Palsy	153,000 ⁵ -750,000 (12)
Spina Bifida	27,500 (12)
Multiple Sclerosis	500,000 (12)
Muscular Dystrophy	200,000 (12)
Osteogenesis Imperfecta	10,000-30,000 (13)
Parkinson's Disease	1,000,000 (12)
Disabling Arthritis	2,201,000 ^{8, 9}
Upper-Limb Deformity	819,000 ⁵
Lower-Limb Deformity	2,916,000 ⁵
Spinal Deformity	1,135,000 ⁵

TABLE 4

⁵All figures for paralysis and deformity are averages of the statistics from the NCHS household interview surveys of 1963-1965 (7), 1965-1967 (8), 1969 (8), and 1971 (8).

⁶In reference (11) the National Institute for Neurological Diseases and Stroke estimates that there are 2,000,000 total cases of stroke (CVA—cerebrovascular accidents) in the U.S.A. However, there is no way to arrive at the number of hemiplegic and hemiparetic people from this estimate.

⁷In reference (12) the National Paraplegic Foundation guesses there are 125,000 to 200,000 paraplegic

people in the U.S.A.

⁸The NCHS survey reported in reference (5) estimates that due to arthritis and rheumatism there are 3,248,000 people with limitation of activity and 1,541,000 people with limitation of mobility among the civilian, non-institutional population.

⁹The Social Security Administration survey reported in reference (4) estimates that among the civilian, non-institutional population between ages 18-64 there are 2,201,000 people with major disabling arthritis and rheumatism causing limitation of work.

field. Thus, the best estimate now is the rule-of-thumb ratio 10 to 1 of orthotic patients to amputees, which gives about 3,000,000 orthotic patients or 15 per 1,000 population.

USE OF ORTHOSES

NCHS surveys of 1958-1959 (6) and 1969 (10) showed 695,000 and 1,102,000 braces respectively being used in the civilian, non-institutional population. A 1964 NCHS survey (9) of homes for the aged and chronically ill estimated 5,400 braces being used by residents.

MANPOWER

Records at the ABC office indicate that there are 515 certified orthotists and 235 certified prosthetist-orthotists for a total of 750 certified orthotists (including 1972 examinees). Therefore, the ratio of potential orthotic patients to certified orthotists is roughly 3,000,000/750 or 4,000/1 and the ratio of actual braces to certified orthotists is roughly 1,107,000¹⁰/750 or 1,476/1. From a CPOE manpower survey (14) and indications from the field, additional qualified orthotists are in serious demand, especially in view of the large number of patients and the changing practice of orthotics away from the use of metal toward the use of plastics and new fabrication methods.

COST OF SERVICES

In fiscal year 1972 the Veterans Administration (VA) spent about \$5,106,000 for prosthetic services (15). From the CPOE surveys of 1961-1963 and 1965-1967, it was estimated that the VA paid for 12.7% and 14.3% respectively of the prostheses in the country. (With Medicare going strong, the lower figure probably is more accurate now.) Therefore, we can extrapolate that \$5,106,000/12.7% or roughly \$40,000,000 was spent in fiscal year 1972 for prosthetic services in the U.S.A.

If we assume that the ratio of certified prosthetists to certified orthotists is proportional to the cost of prosthetic and orthotic services, then \$40,000,000 $\times$ 750/630 or \$48,000,000 was spent for orthotic services in fiscal year 1972. Consequently, a total of roughly \$40,000,000 + \$48,000,000 or \$88,000,000 was spent on prosthetic and orthotic services.

EXPENDITURES IN RESEARCH

Actual funding figures obtained from the VA and Department of Health, Education, and Welfare (including both the Social and Rehabilitation Service and the Maternal and Child Health Service) and estimates of funding from various other sources show a total of \$5,709,000 spent on research (including design, development, and evaluation) in prosthetics and orthotics during calendar year 1972. This figure is \$5,709,000/\$88,000,000 or about 6½% of the total spent on services:

Cost of Prosthetic and Orthotic Services	\$88,000,000
Expenditures on Prosthetics and Orthotics Research	\$ 5,709,000
Percentage of Research to Services	6½%

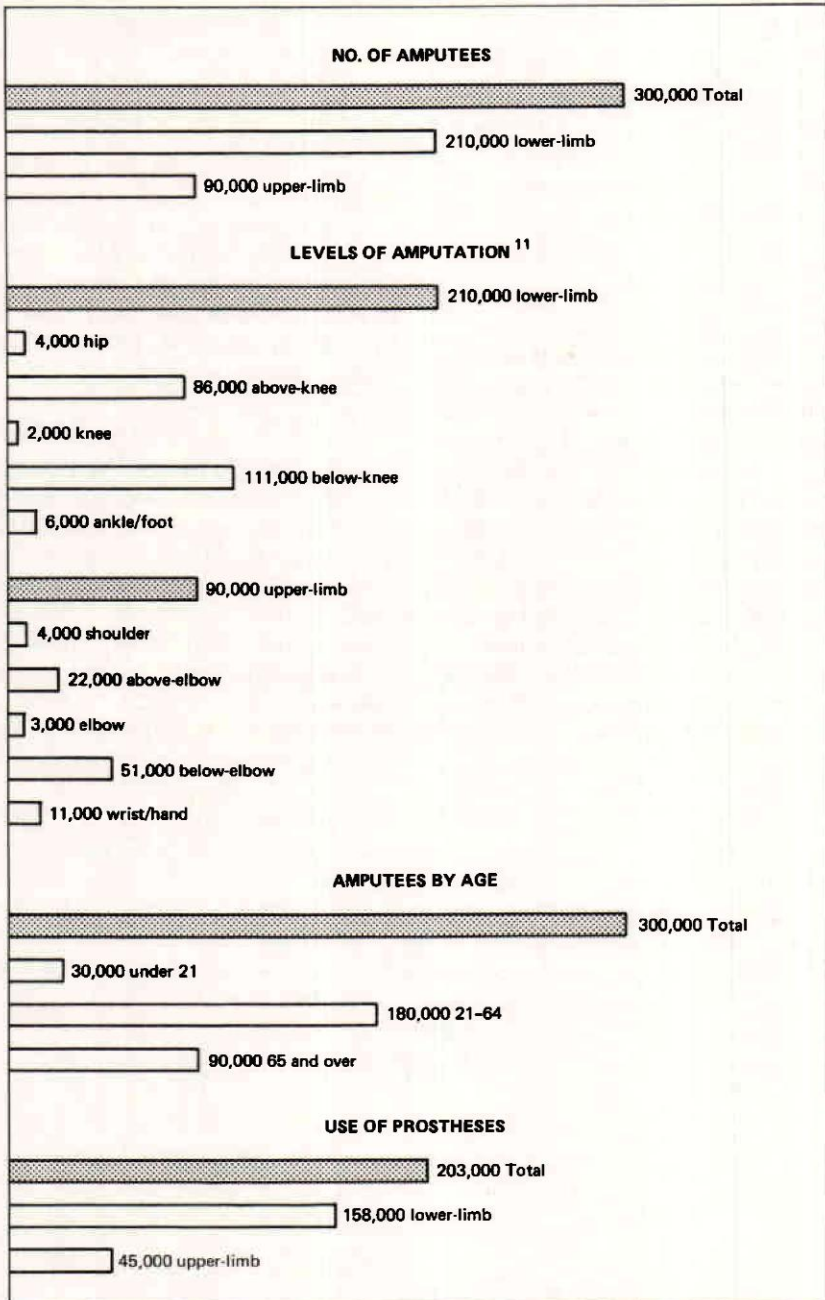
TABLE 5

¹⁰1,102,000 in the civilian, non-institutional population (10) plus 5,400 in the institutional population (9).

SUMMARY

Figures 1 and 2 provide a graphical summary of the information presented on prosthetic and

orthotic estimates. Figure 3 provides a graphical display of information only partly presented in the text on the numbers of certified personnel in prosthetics and orthotics over the years.



¹¹Based on 1965-1967 CPOE survey percentages (2).

Figure 1. Estimates in Prosthetics.

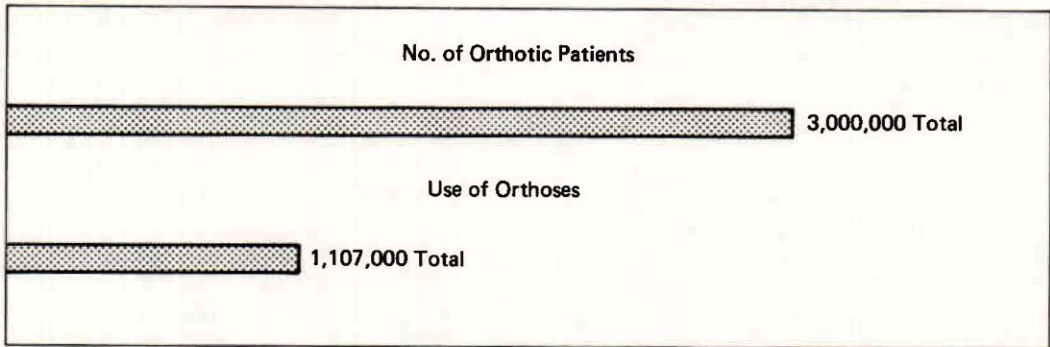


Figure 2. Estimates in Orthotics.

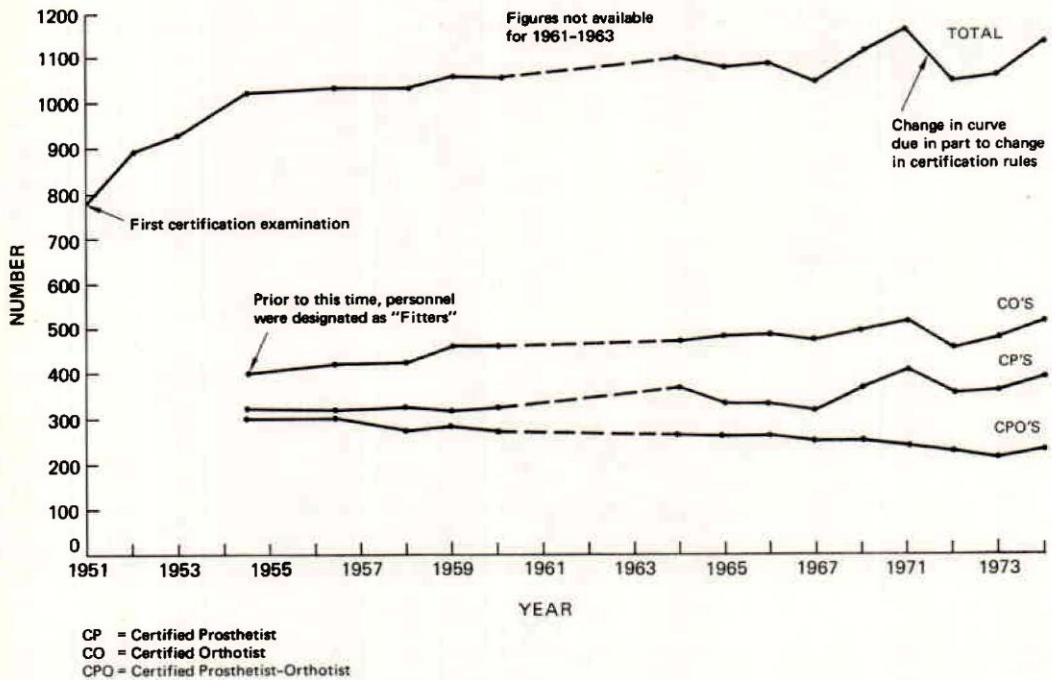


Figure 3. Manpower in Prosthetics and Orthotics¹²

¹²These figures were obtained from the ABC registries for the years shown.

REFERENCES

1. Committee on Prosthetics Research and Development, *Rehabilitation Engineering—A Plan for Continued Progress, Appendix D*, National Academy of Sciences, April 1971.
2. Davies, Elizabeth J., Barbara R. Friz, and Frank W. Clippinger, *Amputees and Their Prostheses*, *Artif. Limbs*, 14:2:19-48, Autumn 1970.
3. Glattly, Harold W., *A Statistical Study of 12,000 New Amputees*, *Southern Med. J.*, 57:1373-1378, November 1964.
4. Haber, L.D., *Epidemiological Factors in Disability, I. Major Disabling Conditions, Report No. 6, Social Security Survey of the Disabled, 1966*, Office of Research and Statistics, Social Security Administration, Washington, D.C., 20005, February 1969.
5. National Center for Health Statistics, *Chronic Conditions and Limitations of Activity and Mobility—United States—July 1965-June 1967* (Publication Series 10, No. 61), January 1971.
6. National Center for Health Statistics, *Distribution and Use of Hearing Aids, Wheelchairs, Braces and Artificial Limbs—United States—July 1958-June 1959* (Publication Series B, No. 27), June 1961.
7. National Center for Health Statistics, *Prevalence of Selected Impairments—United States July 1963-June 1965* (Publication Series 10, No. 48), November 1968.
8. National Center for Health Statistics, *Unpublished figures*.
9. National Center for Health Statistics, *Use of Special Aids in Homes for the Aged and Chronically Ill—United States—May-June 1964* (Publication Series 12, No. 11), December 1968.
10. National Center for Health Statistics, *Use of Special Aids—United States—1969* (Publication Series 10, No. 78), December 1972.
11. National Institute of Neurological Diseases and Stroke, *Neurological and Sensory Disabilities: Estimated Numbers and Cost, Public Health Service Publication 1427, Revised 1971*, National Institutes of Health.
12. National Paraplegic Foundation, *Fact Sheet—1972*.
13. Osteogenesis Imperfecta Foundation, *Unpublished estimate that includes infants to young adults*.
14. Perry, J.W., and B.R. Friz, *Manpower Survey, Orth. and Pros.*, 23:207-226, December 1969 and 24:30-39, March 1970.
15. Veterans Administration Prosthetic and Sensory Aids Service, *Unpublished figure*.