

## **Prosthetic limb use in Australia 1981-1985 under the Free Limb Scheme**

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### **Abstract**

A study has been made of data on 19,421 prosthetic limbs prescribed for 12,143 Australians under the Free Limb Scheme in the years 1981-1985. These prostheses consisted of 18,119 legs and 1,302 arms. The mean age of the lower limb prosthesis user was 52.8 and the upper limb prosthesis user 31.3 years. Males outnumbered females by 3 to 1 in the upper limb prosthesis users, and 2.8 to 1 with lower limb prosthesis users. Below-knee prostheses, patellar-tendon-bearing and thigh-lacing prostheses, made up 58.7% of all prostheses prescribed in the time span. Below-elbow prostheses were the commonest upper limb prostheses with children being the most frequent users. Comparisons with other studies of large number of prosthesis users show an older mean age in Australia and more below-knee prosthesis users than in American studies.

### **Introduction**

The Free Limb Scheme was introduced into Australia in 1973. This scheme provides prosthetic limbs at no cost to Australian residents except for those people who are covered by insurance for industrial or motor-vehicle accidents. No major study has previously been carried out on the Australian population of prosthesis users. Large studies of amputees and their fitting with prostheses have been made in the USA by Glattly (1964), and Kay and Newman (1975). Glattly found a predominance of above-knee amputees among the lower limb prosthesis users. Twelve years later Kay found that the number of below-knee amputees presenting for prosthetic fitting had increased to 53.9%. The experience of

Australian staff running prosthetic clinics is described by R. Jones (1977) who stated that in Australia, most amputees who have lost their lower limbs have suffered this amputation due to peripheral vascular disease. In another paper it was shown that below-knee amputation was more common than above-knee amputation. Katrak and Baggott (1980).

The current study looks at data in a five year period from 1981-1985 on individuals and the prostheses prescribed through the Free Limb Scheme administered by the Department of Veterans Affairs.

### **Method**

To receive a prosthesis under the Free Limb Scheme, an amputee is seen by a medical specialist recognized by the Department of Veterans Affairs who gives the patient an official prescription for the prosthesis. Data from this prescription is processed and entered into a mainframe computer. Data for the years 1981-1985 was made available for analysis by the Veterans Affairs Department. Parameters which were available for sorting were the individual file number, date of birth, postcode, date of prescription, prescribing clinic, sex, limb and type of prosthesis. Causes of amputation were not coded in the data.

### **Results**

In the years 1981-1985 there were 19,421 prostheses prescribed for 12,143 people: 18,119 lower limb and 1,302 upper limb prostheses. The age and sex distribution of these two groups is shown in Figures 1 and 2. The mean age of the lower limb prosthesis user was 52.77 years. (S.D.22); the mean age of upper limb prosthesis users was 31.3 years. (S.D.20.2). Males outnumbered females in each age group of prosthetic users except in the 80+ group

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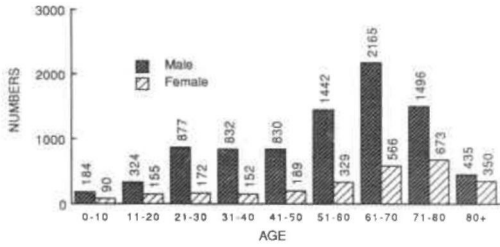


Fig. 1. Lower limb prosthesis users (1981-1985).

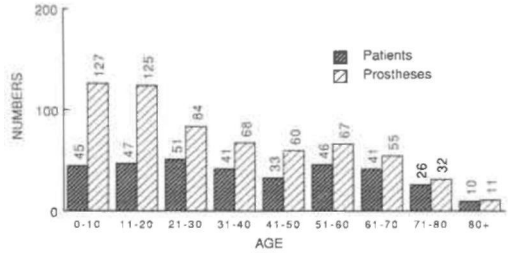


Fig. 3. Syme's prosthesis users (1981-1985).

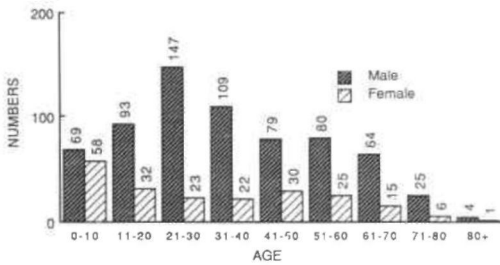


Fig. 2 Upper limb prosthesis users (1981-1985).

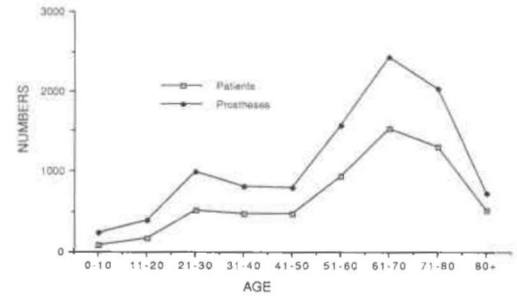


Fig. 4. PTB prosthesis users (1981-1985).

where females were almost as numerous as males (1.2 males to 1 female). The prevalence of prosthesis use in Australia in this time span was 80 per 100,000.

*Lower limb prosthesis use*

The Veterans Affairs coding for prosthesis type distinguishes between hip-and knee-disarticulation prostheses, the various above- and below-knee prostheses and Syme's prostheses. The category 'other', contains prostheses which are unusual, such as partial foot prostheses, special sockets or anomalous prostheses. Details of the foot used or of knee joints are not included. Figure 1 shows that in the years 1981 to 1985 there were 8,585 male and 2,676 female lower limb prosthesis users—a ratio of 3.2 males to 1 female. The distribution of people and the types of prostheses are shown

Table 1. Lower limb patients and prostheses

Prosthesis	n People	n Prostheses	Use in 5 years
Syme's	340	629	1.85
P.T.B.	5,982	9,961	1.67
Thigh lacer	861	1,448	1.68
Knee disartic	243	348	1.43
AK suction	1,078	1,605	1.49
AK non-suction	1,690	2,225	1.32
Hip disartic.	108	140	1.30
Other	822	1,522	1.85
Temporary	137	241	1.76
Total	11,261	18,119	1.61

in Table 1. In looking at the different types of prostheses it can be seen that Syme's prostheses are prescribed most frequently for actively growing children in the 0-10 year age group, (Fig. 3). The greatest number of patients receiving Syme's prostheses is in the 11-20 year age group. This difference is because the small child grows and needs a new prosthesis more frequently than an older person. The child with a Syme's may grow to become a PTB prosthesis user as the limb undergoes relative shortening. This is shown by the decline in numbers of Syme's users after the age group 11-20.

The total of below-knee amputees can be calculated by combining those people using patellar-tendon-bearing prostheses and those using thigh lacing prostheses. This gives a total of 6,843 people or 60.8% of all lower extremity amputees. The number and age distribution of the users of patellar-tendon-bearing prostheses and the number of prostheses supplied are shown in Figure 4. They are used by all age groups. The mean age of the PTB prosthesis users was 58.1 years.

There were 861 people who received 1,448 thigh-lacing prostheses. Figure 5 shows the age distribution of the users and the prostheses supplied. The number of recipients steadily increased with age to reach a peak of 203 in the 61-70 age group. The 243 people who received

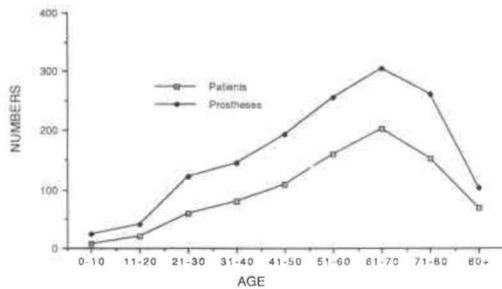


Fig. 5. Thigh lacing prosthesis users (1981-1985).

348 kneec-disarticulation prostheses were 2% of all lower extremity prosthesis users. With above-knee prostheses there are two variants of socket design; suction and non-suction sockets. The distribution by age and number of patients and prostheses are shown in Figures 6 and 7. The distribution of the AK suction socket prosthesis users is quite different from that of the non-suction socket. The mean age of suction socket users is 45 years, and non-suction socket users 59.2 years. Although the non-suction socket users use less prostheses in a five year period (1.32) than suction socket users (1.49), this difference is not statistically significant.

The coding for hip-disarticulation prostheses includes both Canadian, bucket, diagonal sockets and hemipelvectomy prostheses. The infrequent use of this prosthesis can be seen from Table 1.

The 241 temporary prostheses were used for initial gait training to obtain stump shrinkage prior to fitting with a definitive limb. They are mostly made by the physiotherapy staff and not usually shown in the Free Limb Scheme.

Unclassified lower limb prostheses include all those prostheses which are not easily amenable to classification e.g. partial feet prostheses, and

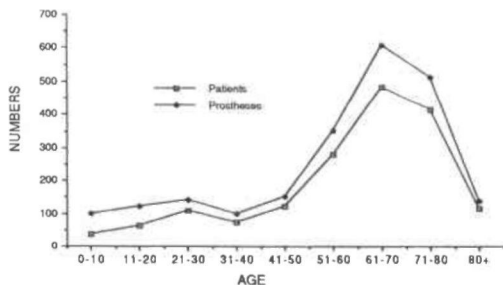


Fig. 6. AK non-suction socket prosthesis users (1981-1985).

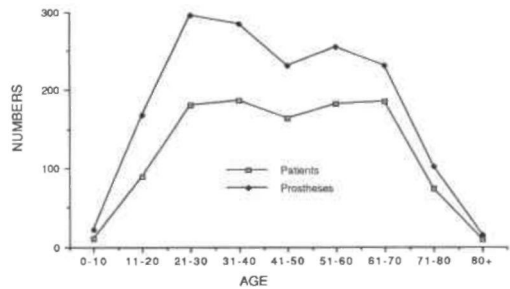


Fig. 7. AK suction socket prosthesis users (1981-1985).

the extension boot prostheses used in children. Because this group contains unspecified prostheses, no valid comments can be made regarding it.

#### Upper limb prosthesis use

During the five year period, 882 patients, 670 males and 212 females used 1,302 prostheses. These data give a ratio of 1.5 prostheses per patient and a male/female ratio of 3.2 to 1. In contrast to the lower extremity prosthesis user the person who uses an upper limb prosthesis is young. The mean age is 34.3 years, and the mode falls in the age group 21-30. The usage and numbers of individuals then falls steeply, until at the age of 80+ years only five people are identified who used six prostheses in a five year period.

The distribution of people and types of prostheses is shown in Table 2. Below-elbow prosthesis users are the largest single group, comprising 52.4% of all upper limb users. Figure 8 contains the details of below-elbow prosthetic prescriptions. Children aged 0-10 years were the most frequent recipients of this prosthesis (175 prescribed).

Above-elbow prostheses users are the next most frequent group. They formed 26.6% of upper extremity users, with a mean age of 34.7 years. Figure 9 shows that most above-elbow prosthesis users are children and adults under 30 years of age. There were 1.4 prostheses

Table 2. Upper limb prosthesis use

Prosthesis	n People	n Prostheses	n/person
Shoulder disartic.	48	58	1.2
Above-elbow	235	337	1.4
Elbow-disartic.	5	6	1.2
Below-elbow	462	713	1.5
Wrist-disartic.	108	145	1.3
Other	24	43	1.8
Total	882	1,302	1.5

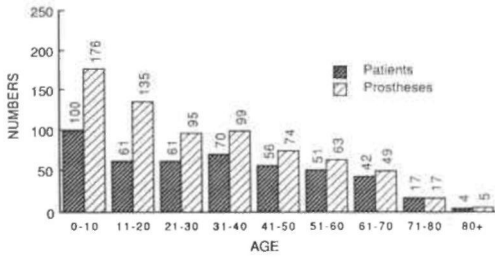


Fig. 8. Below-elbow prosthesis users (1981-1985).

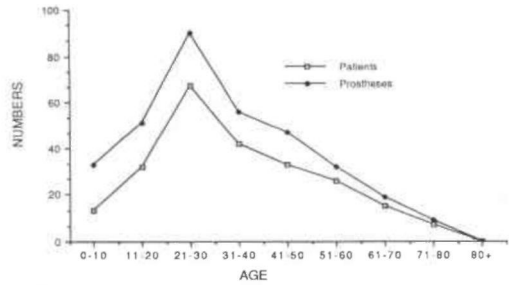


Fig. 9. Below-elbow prosthesis users (1981-1985).

prescribed per individual in the five year period. Shoulder-disarticulation prostheses formed 5.4% of upper limb prosthesis users. Wrist-disarticulation/partial hand prostheses were used by 108 people. Greatest usage occurred in the age groups 11-20 and 21-30. Only 43 limbs prescribed for 24 patients were not specifically classified in the five year period. The lack of specific limb classification appeared to occur when the limb classification system had been modified.

### Discussion

No study has previously been published on the overall supply of artificial limbs in Australia. Studies of large numbers of prosthesis users in the USA have been made by Glatly (1962), Davies et al (1970), and Kay and Newman (1975). Outside of USA, major studies have been published from India by Narang and Jape (1982) and Hong Kong by Chan et al., (1984). The studies by Davies, Narang and Chan are prevalence studies which are similar to the present study. The American studies would be expected to have greater similarities to Australian studies as disease incidence (McGrath and Hill, 1982) and trauma occur in similar patterns, whereas both are different in Asia.

The mean ages of upper limb users, 33 years, and lower limb users 55.4 years, are older than the earlier reported American studies (Glatly, Davies and Kay). It reflects ageing of the Australian population with an increased incidence of vascular disease. Because this is a prevalence study, the traumatic amputees would be expected to lower the mean age of the study as they live a normal life span and continue to use lower limb prostheses. However the largest cohort of traumatic amputees, the World War I and World War II

veterans, are now at least sixty years old and so increase the mean age. Young traumatic amputees whose limb replacements are paid for by work or motor vehicle insurance are not part of this study, and there is no central data bank for this group of people.

The sex distribution of upper and lower limb prosthesis users are the same, being 3.2 males to 1 female. The differing causes of amputation, trauma in young males and malignancy in both sexes of the young increase the number of male prosthesis users, both in lower and in upper limb.

Of the 19,421 prostheses supplied in the five year period, 93.3% were lower limb prostheses. Below-knee prostheses, either patellar-tendon-bearing or thigh-lacing prostheses comprised 58.7% of all prostheses prescribed. Above-knee prostheses were 19.7% of all prostheses prescribed.

The ratio of below-knee to above-knee users was 2.5 to 1. This is because vascular amputations are now more likely to be below-knee amputations in all states of Australia, except in Western Australia. Above-knee amputees who are elderly may not have the fitness to learn to use a prosthesis. Those who have learned to use a prosthesis may not necessarily continue to use it because it is easier to use crutches or a wheelchair (Katrak and Baggott, 1980). All these factors decrease the prevalence of above-knee prosthetic users.

Syme's prostheses are commonest in childhood where they are used for the congenitally limb deficient child. The Syme amputation is performed as a treatment method for certain congenital abnormalities. As the child grows the amputated limb grows less. It was noted from examining the data on individual children that frequently the child who was initially prescribed a Syme's

prosthesis, later received a patellar-tendon-bearing prosthesis. This may explain some of the decline in prescription numbers and individuals after the age of twenty. In adults, the Syme amputation is used mostly after trauma (Herring, 1986). The decline in the occurrence of this amputation with age shown in Figure 9 concurs with the age decline in traumatic amputations.

Patellar-tendon-bearing prostheses are the preferred prostheses for 87.4% of below-knee amputees. Thigh-lacing prostheses are used by only 12.6% of below-knee users. The decline in numbers of PTB users in the young adult age group may have two explanations. The young adult who has had a below-knee amputation from malignancy may well die from that cause and so reduce the prevalence of people in this age group. The person who has lost a limb through trauma at work or motor vehicle accident is covered by insurance and so the prosthetic prescription often, but not always, does not show up in the Free Limb Scheme. In Australia the average life of a prosthesis is three years. Davies et al (1970) in their study found an average prosthesis lasted seven years.

Knee-disarticulation prostheses are an infrequent prosthetic prescription in Australia. Knee disarticulations are performed either to correct a congenital anomaly or for trauma. The peak occurrence at 31–40 demonstrates the non-vascular cause of this amputation.

With above-knee-prostheses, suction sockets are used most commonly by young fit people. This is confirmed by the finding that people in the 21–30 year age bracket are the commonest users. It is surprising that suction limbs continued to be prescribed and used in moderate numbers until the age of 80. This occasional use of a suction limb in an old person reflects its prescription initially when they were very much younger. The life of a suction limb is shown as three to four years. The non-suction above-knee prosthesis is prescribed relatively infrequently until after the age of 50.

Hip disarticulation prostheses are very energy costly to use (Fischer and Gullickson, 1978). This is one factor leading to these prostheses having the lowest usage for lower limb prostheses.

Upper limb prostheses have been shown to be infrequently used in Australia. This may

relate to either the infrequency of upper limb amputation or to the dissatisfaction experienced with upper limb prostheses. It has been shown that below-elbow prosthesis use is commonest in children. This is because below-elbow limb deficiency is the commonest congenital upper limb defect in children (Krebs and Fishman, 1984). The number of individuals using prostheses declines steadily thereafter, except for a very small rise in the age group 31–40. Above-elbow prostheses and users are the second largest group of upper limb users. This prosthesis is used most by people in the age group 21–30—the peak period for trauma. There are also a few congenital limb deficient children. Shoulder disarticulation prostheses are so hot to wear and so hard to use, that they are very infrequently prescribed. If prescribed, they are often used only once and then discarded. This can be seen from the fact that in five years, 48 people received 58 prostheses. Wrist disarticulation/partial-hand prosthesis users form 12% of upper limb users. People who have suffered this loss will frequently receive a prosthesis initially, try it and discard it; not using a second one. Some however, will find a prosthesis valuable and continue to use it.

### Conclusion

An analysis has been made of data on 19,421 prostheses prescribed for 12,143 Australians under the Free Limb Scheme. The mean age of prosthesis users is older than is shown from studies of large numbers of prosthesis users in the U.S.A., Hong Kong or India. A predominance of males of 3.2 to 1 in both lower and upper limb prosthesis users has been shown. The prostheses prescribed were for the lower limb in 93.3% of cases. There are more below-knee users in this study than in other studies of large numbers of prosthesis users. Patellar-tendon-bearing prostheses were the commonest below-knee prosthesis. Young above-knee adults use suction prostheses most frequently. Children were the predominant users of Syme's and below-elbow prostheses. In the five year period the patients in the study were on average prescribed 1.5 lower limb prostheses, and 1.6 upper limb prostheses. The Free Limb Scheme provides an important service to Australian citizens.

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