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The population of users of upper limb prostheses attending the Oxford Limb Fitting Service

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Abstract

There is no central database that records the changing provision of prostheses in the United Kingdom. Experience suggests there have been some shifts in the population, particularly in the past decade. Because the detailed records of these changes are contained in the patients' medical records it is difficult to assess the substance of these data except on an individual basis; the larger picture requires the sifting of a centre's or many centres' data. This paper describes the analysis of one such set of records at the Oxford Limb Fitting Centre. It relates the profile of the population that attends the centre to the general population, and compares the information with that obtainable from other sources. The possible causes for the findings are discussed.

Introduction

Prostheses and related care are provided over many years. Patients may change geographic area, treatment form and medical team, many times. Their medical records often bear testimony to the changes that the individual and the prosthetic service have undergone. However, there is no central repository in the United Kingdom for detailed information concerning the limb deficient population. The information is spread throughout the service, in the localised databases for different aspects of the subjects' life. For example, the number of a certain type of prosthesis supplied in the area and its time of use is probably best found in the records of the supplier of the prosthesis and it is therefore commercially sensitive data. Some national data were previously available in the Amputation Statistics for England, Wales and Northern Ireland (Ministry of Health, 1967; Ministry of Health and Social Security, 1968-1979 and 1980-1988), but this ceased to be collected in 1989. So figures for the national population of prosthesis users are now difficult to obtain. In addition, there is no requirement to record any limb deficiencies at birth, and other sources of information, such as disability grants, do not report much details (McDonnell *et ai,* 1988). Therefore, the review of the population (whether locally or nationally) can only be achieved by reviewing the records of individual patients. This is one such review.

A second purpose for this audit was to establish if there were any patterns of prosthetic usage in the region. There are many factors that dictate if a person will use or reject a prosthesis. Though it is impossible to predict precisely why a person will find a prosthesis unhelpful, when a new design of prosthesis is contemplated it is important to gather as much information about use patterns as possible, in order to create a design that is widely acceptable. The study of the records of the user population of this particular centre formed part of a knowledge acquisition phase of a project to design an advanced prosthetic hand under the European Union's TIDE initiative (Technology Initiative for the Disabled and Elderly). It was made in the spring of 1992 in order to assess the utilisation of the service by patients, as well as

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in preparation for a more detailed survey of the active user population attending the centre (Kyberd *et al, in preparation).* The population studied is that which attended the Oxford Limb Fitting Centre in the Nuffield Orthopaedic Centre, National Health Service Trust, Oxford, UK.

As this was an audit of the records from the Oxford Limb Fitting Centre, the data derived corresponds only to this sub-group of the limb deficient population of the UK and generalisations should be made with caution. These patients were targeted because the aim of this audit was to gather information prior to the design of a prosthesis.

Method

A list of the names of all the individuals who are recorded as receiving upper limb prosthesis care from the centre was obtained from computer records. No other details are retained on computer. The individual records were read and specific details were recorded:

- age;
- gender;
- cause and level of loss;
- type of appliance supplied, both the current device and previous systems;
- estimated level of usage.

For the purposes of the survey, the date of last contact was recorded. The approximate level of use of their principal prosthetic arm was judged from the frequency of the requests to maintain or service the arm and its components. A small number of records (7) was untraceable. These are not included in any of the following statistics. Periodically, the files of the centre are reviewed and reminders are sent to all patients who have not had any contact with the centre. This reminder includes a brief questionnaire in an attempt to find out why no contact has been made. This may provoke a simple written reply or a request for an appointment. In either eventuality a reply was counted as positive contact.

The data obtained were analysed and compared with findings from other studies.

Centre population

The catchment area for the centre was, at the time, the Oxford Regional Health Authority (ORHA). The ORHA comprises approximately 2.58 million individuals (1.29m males, 1.29m females) (Oxford Regional Health Authority, 1991). The centre's region can be considered to be representative of the population of the United Kingdom as a whole as it has a balance of urban and rural areas. It draws individuals from Oxfordshire and Berkshire, much of Buckinghamshire as well as areas in Wiltshire and Northamptonshire. For the purposes of this survey this will be referred to as *The Oxford Area.* Patients are referred to the centre where they are assessed by the medical, therapy and

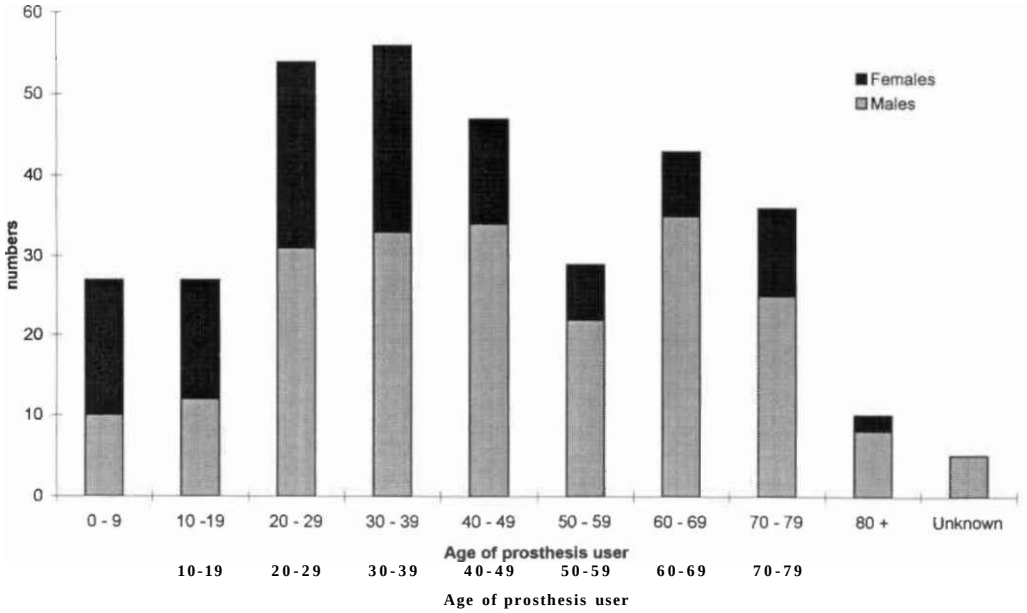

Fig I. The profile of the age of the population of individuals attending the Oxford Limb Fitting Centre

Table 1, Total numbers of individuals listed for the Oxford Area limb fitting service.

Population	334	100%	plus 7 untraceable
Adult male	197	59%	
Adult female	93	28%	
Under 16s	44	13%	

prosthetic staff. Routine maintenance is carried out by contracts to the NHS. This may be carried out on attendance at the centre, or they may use the free postal service.

Results

Population

In February 1992 the Oxford Limb Fitting Centre had 341 patients listed as having attended the centre, Table 1 outlines the proportions.

The profile of the ages of the population is shown in Figure 1, arranged in intervals of ten years. It shows a similar number of patients for the first two decades, increasing for the individuals of working age and decreasing then on, with an additional peak in the years 60 to 80, when many would have been active during World War Two.

It is interesting to compare these with the available statistics of the entire regional population. The number for each age interval is normalised by dividing it by the total population in the region who are of the same age (data from Oxford Regional Authority (1991)) (Fig. 2). This gives the proportion of the population that are users of limbs and attend the centre. The result was a modest trend (^=0.45). The gradient of 1.2 x 10^{7} shows that there appears to be only a small increase in the prevalence of prosthesis use with age.

Cause of loss

If the cause of loss is divided into the two broad categories of congenital and traumatic, it can be seen that the male population is dominated by traumatic amputations, of which more are right sided (Fig. 3). Of the males with congenital losses a left side bias is observable, similar to other studies (McDonnell *et al,* 1988). The left bias in the congenital losses is shown in the female population, although there are far fewer traumatic losses. The larger number of females with a congenital loss is highly significant (pj0.005, [Chi squared]) compared with the male population. This finding differs from other studies (McDonnell *et al,* 1988).

Date of last contact

Figure 4 shows the date of the last contact an individual person made with the centre. A working definition for the 'active' population of users employed at the centre is that they have made contact with the centre at some point in the past two years. This definition was adopted for the study. Over 50% of the patients are therefore 'active'.

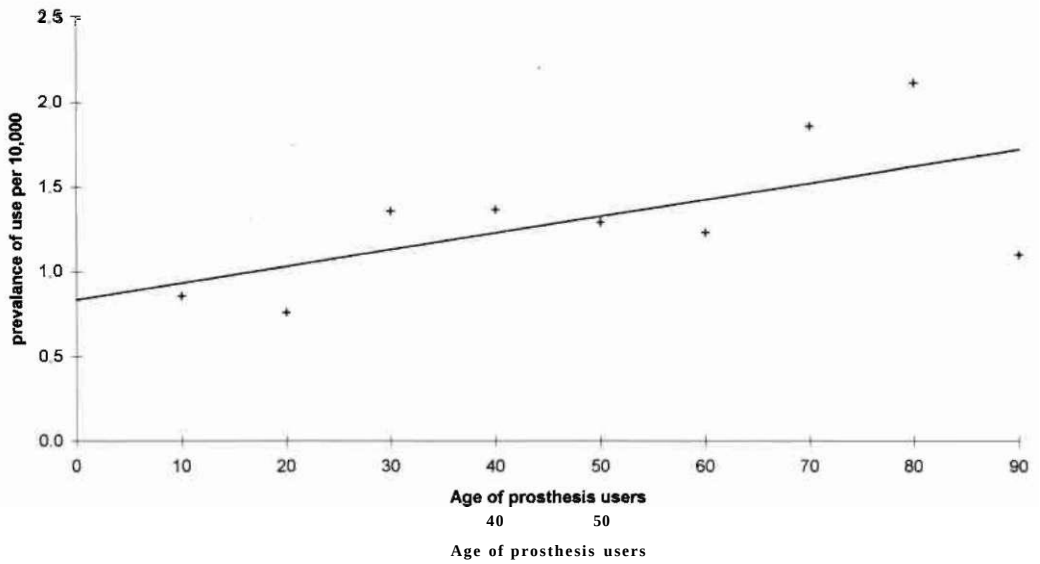

Fig. 2. Age profile of the audit population normalised by the total numbers of individuals in the same age categories within the *Oxford Area.*

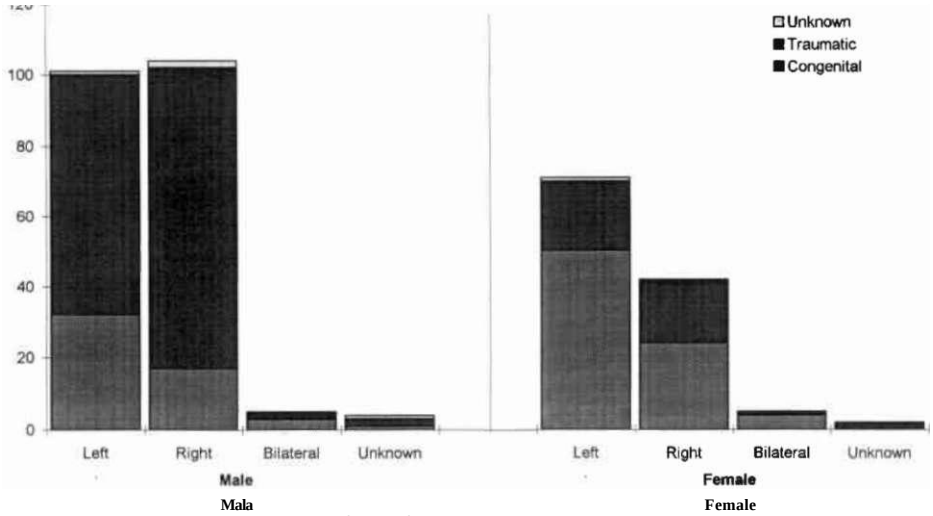

Fig. 3. The cause of loss of upper limbs within the audit population

Principal type of prosthesis

Table 2 indicates the types of prosthesis that were used by the population. The categories are: cosmetic, working (including mechanical hands, split hooks, 'C hooks) with myoelectric hands as a separate category. One category was judged to be the device each person principally used. This selection was based on the frequency of replacement/repair of the various devices the person was supplied with. For the entire recorded population the numbers of users of cosmetic and working hands are similar (133 to 162), if the active criteria are applied the number of working prostheses becomes proportionally higher.

Level of loss

Table 3 shows that in the population studied the largest single group are those with a trans-radial absence (163, 49%). The division of active and non-active users shows that there is no particular bias towards one group or level. In addition Table 4 shows a comparison with studies made at other centres.

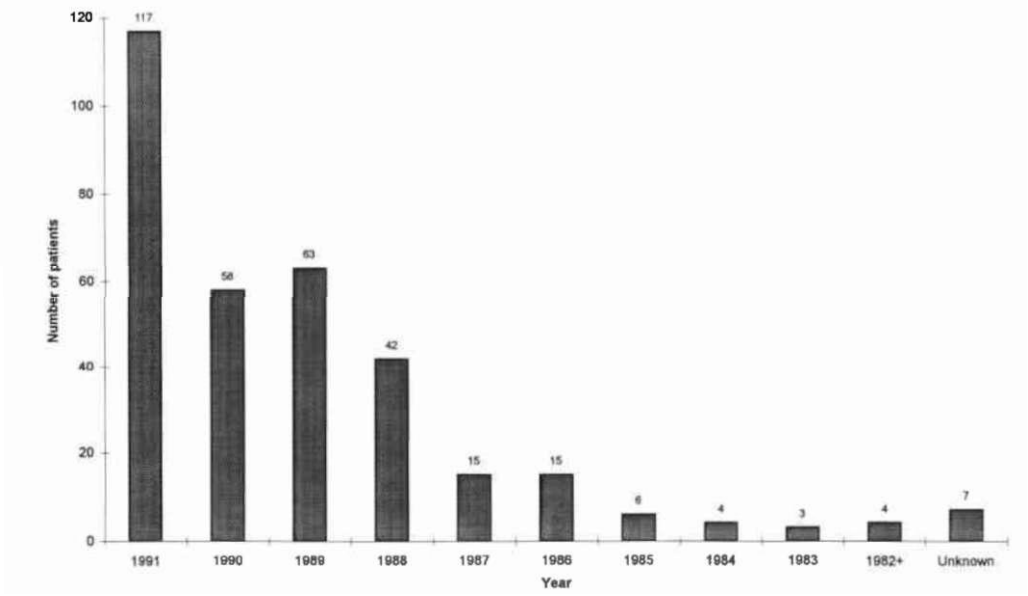

Fig. 4. Year of last contact of persons attending the Oxford limb fitting service

Table 2. Types of principal prosthesis used, showing the proportions of users related to their most recent year of attendance.

Type	2 Years	4 Years	Total
Cosmetic	65	44	133
Working	91	45	162
Myelectric	9	4	13
Unknown	8	11	26

Table 3. The levels of loss of the centre's population with the proportions of the most recent attendances shown.

Level	2 Years	4 Years	Total
Trans-humeral	55	28	97
Trans-radial	88	49	163
Partial hand	32	27	71
Unknown	0	1	3

Discussion

Population

A comparison between the patient group and the population of the region shows only a small increase in the prevalence of prosthesis use with age (the gradient represents a rate of only 1 in 810,000 per year) and there appears to be no major increase with advancing years. This contrasts strongly with amputations of lower limbs. The dominant cause of lower limb loss over the age of 50 is related to vascular problems, which generally increase with age, and so a similar graph for these patients would probably show an increasingly steep curve. By contrast, the upper limb amputations are more often caused by work and recreational activities; this is also likely to explain the gender profile.

The gradient of the normalised population is a measure of the change in the number of individuals who choose to use the service; the increase with age is slight. This measure includes those who recently suffered an amputation plus others who may not have wanted to use the service before, minus those who have stopped using the service.

The straight line fit for the data crosses the y-axis at 7.4 x 10 \ This represents the population of individuals at the age of zero, i.e those with congenital absences. This suggests a ratio of 1 in 3,500.

Cause of limb loss

The bias towards the male population, with the greatest numbers being right side from traumatic amputation agrees with other studies. This distribution reflects the tendency for a greater proportion of males to undertake more dangerous work and leisure activities. The bias towards the left side within the congenital losses again is in agreement with other studies (McDonnell *et al,* 1988). However, the larger numbers of females with congenital loss on both left and right sides differs from other studies. It is not clear why this should occur. Once again these figures only reflect the losses that can benefit from prosthesis provision.

Date of last contact

The definition of an active user is an individual who has made contact with the centre in the past two years (this includes 50% of all patients); 80% of individuals made contact in the previous 4 years. According to Fraser (1993) Addenbrookes Disability Service Centre (DSC) considers three years to be the point that defines their active users, if this is taken for

Table 4 Comparision of the percentage of the levels of loss between the *Oxford Area* population and of other surveys The data for losses at the shoulder are not availble in two surveys, this will tend to increase the proportion at the next highest loss.

Level	Fraser (1993)	Burroughs and Brook (1985)	Silcox et al (1993)	Atkins and and Meier (1988)	Burger and Marincek(1994)	Oxford (1994)
Shoulder disarticulation	8	21		5	1	0
Trans-humeral	33	14	25	23	21	29
Trans-humeral	33	52	68	60	65	49
Hand/wrist	25	14	7	12	13	21

Oxford, then 238 persons (73%) are included.

The term 'active' is not intended to assess if the device is passive or active, simply if the prosthesis is used sufficiently to require replacement/repair. It is accepted that upper limb usage is a variable activity and some individuals will return much less frequently although they remain successful users of their devices. The difference in the use profiles of such devices may have a bearing on the time between repairs.

Principal types of prosthesis

There appears to be little difference in number between those issued with cosmetic and working prostheses (48% to 40%). When the active user definition is applied the balance shifts towards the working devices (52% to 37%). By four years the balance between the two groups mimics that for the total population (48% to 40%). This is consistent with the idea that the 'active' users would appear to employ their working prosthesis more often and so the components will wear out more quickly and thus need replacing earlier.

Level of loss

The comparison of these data obtained from the Oxford population with those derived from other surveys conducted in developed countries in the past 15 years shows a broad agreement; The variation in survey findings is less in the categories which have many individuals (i.e. trans-radial loss) and more in the extremes which are both rarer and less well served by current prosthetic technology (e.g. shoulder disarticulation level). Some of the data are derived from surveys of the users of prostheses so, for example, persons with a partial hand loss may not be included in such surveys. Indeed this could suggest that the data from the Oxford Area population are more representative of the genuine population as this sample is of all the users of the centre whether they employ a prosthesis or not.

Overall population

The population attending the Oxford limb fitting centre is not atypical compared with other groups. In the present economic climate with reductions in resource allocation it is important to know what population is likely to derive most benefit from the healthcare services. This investigation attempts to provide some data to aid the informed planning of upper limb provision.

A larger male population is also found elsewhere, for both congenital and acquired loss (Royala *et al,* 1974; Gregory-Dean, 1991). This is hardly surprising as it is likely to be due to the combined contributions of the individuals' lifestyle/occupation to the traumatic cases. Congenital absence is domination by left trans-radial absences (McDonnell *et al.,* 1988). From these data the comparison of the proportions of gender, type of loss, side and type of prosthesis used shows a dominance of users in favour of male, traumatic loss, right sides and working prosthesis.

The overall numbers of myoelectric hands fitted to adults are small. The provision of myoelectric hands to adults has become routine only recently. In the initial stages of their introduction the provision was made at a few expert centres, such as Queen Mary's Hospital in Roehampton, London. Thus, some of those who were attending Roehampton may well be continuing to attend those clinics rather than switching to Oxford when it began to offer the service.

The figures for new attendees at centres throughout the country show a real trend downwards over the last 20 years (Chappell, 1992). The causes for this trend are unclear. As there is no evidence to suggest that the number of congenital deformities has changed appreciably, the reasons for the reduction can either be due to: (i) the improved medical treatment following trauma, or (ii) that fewer people are being referred to the service. One further possible reason for the fewer traumatic injuries is the decline in heavy industry in the United Kingdom in the past generation, exposing fewer individuals to risk of injury:

McDonnell *et al.* (1988) attempts to derive a measure of rate of congenital absence from a variety of reports from developed countries. From UK government statistics they suggests a range from 1 in 8,400 to 1 in 10,000; McDonnell derived from this a figure of 1 in 9,400. From the Oxford population normalised by age (Fig. 2) the zero offset of 7.3 x 10' corresponds to a congenital absence rate of around 1:13,500 for the Oxford data. This is between 20 and 40% lower than the above estimates. As there has not been a legal

requirement for birth abnormalities to be recorded, it is possible that a number are not included in the derived figure. In addition, the level of absence is not recorded in the statistics so the higher reported rate may include many persons with a partial digit absence. Therefore the figure derived in this study is more likely to be a measure of the rate of absence for individuals that can use prosthetic services.

Conclusions

The population of users of upper limb prostheses attending the Oxford limb fitting centre reflects similar trends to those found at other centres throughout the world. The largest single group is men with right-side trans-radial, traumatic losses. However, in contrast with other studies, the larger group of people with congenital absences is female.

The distribution of cosmetic and working prosthesis is evenly spread over the entire population, but users of working prostheses tend to return to the centre more frequently.

There appears to be little increase in the proportion of the number of amputations with age which results in an increase in prosthetic use. In addition, the rate of congenitally produced abnormalities requiring use of a prosthesis are in the region of one in 13,500 live births.

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