Priorities in biomedical research

Indices of burden

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Black, D. A. K. and Pole, J. D. (1975). *British Journal of Preventive and Social Medicine*, **29**, 222-227. **Priorities in biomedical research: indices of burden.** The relative burden of different diseases is a legitimate component in the consideration of priorities for biomedical research. Simple prevalence statistics do not directly reflect the different burdens on services imposed by diseases of comparable prevalence. This paper sets out for each of 54 categories of disease five indices of the burden on services, based respectively on inpatient days, outpatient referrals, consultations in family practice, sickness benefit, and loss of expectation of life. There is considerable variation in the rank-order of categories of disease, in their contribution to the five burdens; but for each burden the number of categories accounting for 50% of the total burden is not large, ranging from 3 to 9 out of the possible 54.

The definition of priorities in research is commonly arrived at by the consensus judgement of a committee, whose members consider implicitly or explicitly the importance of a field of research; the extent to which effort is already being deployed; and the scientific feasibility and interest of what is proposed. The third of these considerations can scarcely be quantified, except by a rough estimate of the odds of success or failure; and the second is likewise very largely a judgement of quality rather than of quantity. There are certainly also difficulties in estimating the first component: the 'importance' of a field of research; but in this paper we propose a quantitative assessment of the relative burden imposed on the health service and on the health of the nation by a number of broad categories of illness.

The disease categories were derived by aggregation of the much more numerous diseases listed in the *International Classification of Diseases* to yield the manageable figure of 54 categories. The categories are virtually comprehensive of established disease states, but they do not include a number of 'residual' causes of burden, listed at the foot of the table, of which the most important are 'certain causes of perinatal morbidity', 'symptoms and ill-defined conditions', and 'prophylactic procedures and medical examinations'. The categories used are virtually exclusive, with minor exceptions where diseases of particular importance—such as, breast

cancer, multiple sclerosis, and epilepsy—are itemized separately, in addition to being included in a more general category.

We have used five indices of burden, the first three being related to use of resources, the remaining two being related to morbidity and mortality:

1. INPATIENT DAYS

Derived mainly from *Hospital In-Patient Enquiry (HIPE)* Part I 1972, Table 9. Data on Psychiatry, Preconvalescent, Convalescent, Private and Staff Beds derived from Form SH3 returns.

2. OUTPATIENT REFERRALS

Office of Population Censuses and Surveys (OPCS) Morbidity Statistics from General Practice. Second National Study 1970-71, Table 18.

3. GP CONSULTATIONS

Surgery consultations, OPCS Morbidity Statistics, Table 10.

Home visits, OPCS Morbidity Statistics, Table 20. The home visits have been weighted by a factor of 4, and added to the surgery consultation rates to give a notional overall rate per 1000 population.

4. MORBIDITY

Social Security Statistics, 1973. Tables 3.82 and 3.83. Sickness and/or invalidity benefit. These figures

refer to insured persons only, so that they give an accurate picture of the cost in sickness benefit of the disease categories, but not of total morbidity.

5. MORTALITY

Registrar General's Statistical Review 1972. Table 19 and Appendix B—abridged life table.

An analysis of the tables has been made to differentiate between the major causes of resource use, morbidity, and mortality. While these are significantly different for each of the five indices used, more than half of the burden in each case is accounted for by comparatively few disease categories. This is seen at its most extreme in bed occupancy; mental illness and mental handicap alone account for about half the beds. Even in the most diverse group, that of GP consultations, half of the burden is accounted for by only nine categories of disease, and only 15 categories are found each to account for 2% or more of the total burden. The unavoidable use of rather broad categories clearly contributes to this effect—that is, the number of major causes of each type of burden is quite small; but this artefact does not account for the great discrepancy between the major causes of the different burdens considered.

For each of the five indices the major causes of burden in rank order are listed in Appendix I, and the conditions which account for over 50% of the burden are indicated. At the end of each list the percentage of the total burden accounted for by all the conditions listed is given, and the percentage of the burden not accounted for by the 54 disease categories used. The tabulation on which the analysis has been based is shown in Appendix II. In general, the categories in the two appendices are the same, but in some instances—for example, digestive diseases—the original categories have been pooled, when excessive subdivision in the list of 54 disease conditions seemed to be introducing bias.

Comment on lists of this type is clearly an arbitrary matter, but some points may be worth making on the individual lists, and in general.

COMMENT ON INDIVIDUAL LISTS

INPATIENT DAYS

The outstanding feature, already well-recognized, is the preponderant place of mental illness and mental handicap in hospital bed-occupancy. This preponderance would be less in terms of resource-cost, either in finance or in manpower, and this would also apply to the third major cause of bed-occupancy, convalescence from cerebrovascular episodes. The proportion of 'high-cost' or 'acute' beds in the case

of the other eight conditions listed would be substantially higher. The omission of respiratory diseases from the ranking is something of an artefact, as if summated they would aggregate 3·80%, distributed rather evenly over the categories 'respiratory infection', 'bronchitis and asthma', and 'other respiratory disease'.

Although 'bed-occupancy' is a better index of the use of hospital resources than is 'discharges + deaths', it too contains bias, in that 'short-stay' conditions, such as attempted suicide, impose a more intensive burden in assessment and care than does chronic illness, which accounts for a higher proportion of bed-occupancy.

OUTPATIENT REFERRALS

Largely in consequence of the relatively smaller burden imposed by mental illness, the outpatient work of the hospital sector is more varied than the inpatient work. This is crudely indicated by the '50% load' being made up of eight conditions in place of only three for the inpatient load, and it applies also to GP consultations.

If all bone and joint conditions were summated, they would top the list. Similarly, if respiratory disorders were summated, they would come fourth in the list. Artefacts of this type indicate that these lists are not appropriate for drawing fine conclusions, only for a 'broad-brush approach'.

Attention may be drawn to skin disorders, which account for only 0·76% of bed-occupancy, but come high in both outpatient referrals and GP consultations. Moreover, the figures given for 'skin diseases' are an underestimate, since bacterial and viral infections of the skin are categorized as 'infections', not as 'skin diseases'.

GP CONSULTATIONS

Comparison of this list with the previous one (outpatient referrals) gives some information on the pattern of hospital referrals. For example—a relatively small proportion of GPs' work load in relation to respiratory disorders is passed on by reference to hospital; whereas the 2% of GP consultations due to neurological disorders accounts for 9·82% of the patients whom they refer to hospital outpatients.

DAYS ON SICKNESS BENEFIT

This is a better index of 'cost' to the community than it is of morbidity, since it omits the non-employed and non-insured population, who also suffer morbidity, and indeed account for a large part of it. Respiratory disorders account for more than one-fifth of this burden.

'MORTALITY'

In spite of the weighting against them arising from the use of 'loss of life expectancy', the major causes of mortality are still those which operate predominantly in the later decades of life. A notable exception to this is the appearance of 'accidents and suicides' relatively high in the list.

GENERAL COMMENT

There are several reasons why only very broad indications of priority can be drawn from this material. One such reason is the imperfection of both the data and the analysis. Another lies in the different types of burden which have been evaluated; emphasis on the hospital burden alone would be different on the two different criteria of bed-occupancy and outpatient work; and the burden on primary care is different again. Moreover, the indices based on use of resources would suggest priorities different from those based on 'need', as reflected in morbidity and mortality. Both the possibility and the propriety of making a value-judgement between resource-saving, the avoidance of suffering, and the prolongation of life are open to question. Within each of the indices used, there is an implied objective which is worth pursuing; but there is no critique for ranking these objectives in order. A further point of substance is that there are conditions which cause much suffering, but which account for only a very small part of resource-usage, morbidity, and mortality. For example—the highest percentage of any of the indices of burden accounted for by eye diseases is only 1.28% (GP consultations); ear diseases, including deafness, reach their highest percentage of only 2.60% on the same index. Yet these are conditions of undeniable importance.

Two further, rather more theoretical, incentives to caution in using this analysis may be mentioned. The data available inevitably reflect what is being done with existing resources, and what is happening to people; we cannot however assume that 'whatever is, is right'. The second point, a familiar one, is that a clear service need for research cannot be equated with the likelihood of that research being profitable; the problems involved may be clearly insoluble, there may be a lack of skilled workers, there may be stultification of research by either a lack or a superfluity of suitable patients.

These are real difficulties, but they should not be made an excuse for abandoning the attempt to define priorities for biomedical research, derived from service needs. For these reasons, the priorities so defined are not the only priorities to be considered in directing research; and even within their own

framework, they can only be relative, and not absolute. In other and simpler words, there can be no health problem which carries no priority.

If a priority list is to be useful, it should be reasonably simple and manageable. We have therefore considered only those categories which fall in the list of conditions which together cause at least 50% of the burden represented by at least one index; and after each category, we have indicated the index, or indices, concerned. Equally crudely, we have averaged the burden relating to each condition under all five indices, to derive a rank order. Since there are three indices related to resource use, and only two related respectively to morbidity and mortality, this introduces some bias, but probably no greater than any other way of handling the data.

Category	Indices Mainly Affected*	Percentage of Total Burden
Mental illness and handicap ..	1, 2, 3, 4	13.60
Respiratory disease ..	3, 4	13.47
Ischaemic heart disease ..	4, 5	6.59
Bone and joint disease ..	2, 3, 4	6.38
Accidents and suicide ..	2, 3, 4	6.25
Neoplasms ..	5	6.08
Digestive disorders ..	2, 3, 4	4.56
Neurological disorders ..	2	4.11
Cerebrovascular disease ..	1, 5	3.74
Skin diseases ..	2, 3	2.55
Urogenital disease ..	2	2.31
		69.64

* Where more than one index number is given for a category, the number corresponding to the most severely affected index is in italics. The indices are numbered as in Appendix 1, i.e.:

1. Inpatient days
2. Outpatient referrals
3. General-practitioner consultations
4. Days of sickness-benefit
5. Mortality, as loss of life-expectancy

To anyone familiar with the diversity of clinical practice this list may seem a rather cumbrous way of quantitating the obvious, but there is at least one way in which it fails to do so. By the artefact of separating ischaemic heart disease and cerebrovascular disease, not to mention other disorders of blood vessels, it seriously underestimates the role of vascular degeneration in causing morbidity and death. It may also be noted, however, that the conditions in this list account collectively for 70% of the total burden, on the five indices used.

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APPENDIX I

RANK ORDER OF CATEGORIES OF DISEASE, ACCORDING TO FIVE TYPES OF BURDEN

For each list, a double line is drawn below the conditions which cause 50% of the total burden. Under each list is given the percentage of total burden accounted for by the conditions listed; and the percentage of total burden due to causes other than classifiable disease, described as 'unaccounted burden'.

	Percentage of Total Burden
1. <i>Inpatient days</i>	
Mental illness	31.31
Mental handicap	15.19
Cerebrovascular disease	4.86
Malignant neoplasms	4.18
Digestive disorders	3.80
Child-birth	3.69
Accidents and suicide	3.44
Peripheral vascular disease	2.43
Neurological disorders	2.14
Ischaemic heart disease	2.11
Other cardiac diseases	2.06
Cumulative burden of ranked categories	75.21
'Unaccounted burden'	6.31
2. <i>Outpatient referrals</i>	
Neurological disorders	9.82
Accidents and suicide	7.84
Bone and joint disease (other than arthritis)	6.87
Digestive disorders	6.72
Skin diseases	5.90
Urogenital disease	5.50
Mental disorders	3.96
Arthritis and rheumatism	3.72
Peripheral vascular disease	3.70
Respiratory infections	3.70
Bronchitis and asthma	3.63
Cumulative burden of ranked categories	61.36
'Unaccounted burden'	17.32
3. <i>GP consultations</i>	
Respiratory infections	16.03
Mental disorders	7.73
Bronchitis and asthma	5.07
Skin diseases	4.84
Accidents and suicide	4.63
Digestive disorders	4.05
Arthritis and rheumatism	3.99
'Other heart disease'	3.06
'Other bone and joint disease'	2.79
Ischaemic heart disease	2.63
Ear diseases	2.60
Hypertension	2.48
Neoplasms	2.40
Peripheral vascular disease	2.25
Neurological disorders	2.00
Cumulative burden of ranked categories	66.55
'Unaccounted burden'	15.94
4. <i>Days of sickness benefit</i>	
Bronchitis and asthma	11.46
Mental disease	9.55
Accidents and suicide	8.81
Arthritis and rheumatism	7.22
Respiratory infections	7.17
Ischaemic heart disease	5.73
Digestive disorders	5.73
Neurological disorders	5.16
'Other bone and joint disease'	3.64
Other respiratory disease	2.82
Hypertension	2.56
Peripheral vascular disease	2.36
Cumulative burden of ranked categories	72.21
'Unaccounted burden'	10.27
5. <i>Mortality (loss of life expectancy)</i>	
Ischaemic heart disease	21.51
Neoplasms	20.63
Cerebrovascular disease	10.68
'Other cardiovascular disease'	8.74
Respiratory infections	7.11
Accidents and suicide	6.51
Bronchitis and asthma	4.10
Peripheral vascular disease	3.39
Congenital anomalies	3.17
Digestive disorders	2.48
'Other respiratory disease'	1.54
Neurological disorders	1.41
Hypertension	1.30
Rheumatic heart disease	1.27
Cumulative burden of ranked categories	93.84
'Unaccounted burden'	5.54

ICD No	Category of Disease	Inpatient Days	
		Nos	%
000-009	Intestinal infection	970	0.27
010-019	Tuberculosis	2 513	0.69
020-039	Other bacterial infection	1 608	0.44
040-083	Viral and rickettsial infection		
Rdr 000-136	Other infectious diseases		
090-099	Sexually transmitted disorders	15 287	4.18
140-209	Neoplasms—malignant		
210-239	Neoplasms—benign and unspecified		
240-246	Thyroid disease	2 625	0.72
250	Diabetes mellitus	421	0.11
251-258	Other endocrine disorders	3 195	0.87
260-279	Nutritional and metabolic disorders	1 465	0.40
280-289	Blood diseases	1 872	0.51
290-299	Psychoses	114 575	31.31
300-309	Neuroses		
310-315	Mental handicap		
320-358	Neurological disorders	55 571	15.19
340	Multiple sclerosis	7 849	2.14
345	Epilepsy	1 225	0.33
360-379	Eye diseases	1 055	0.29
380-389	Ear diseases	2 789	0.76
390-398	Rheumatic heart disease	882	0.24
400-404	Hypertension	956	0.26
410-414	Ischaemic heart disease	1 397	0.38
420-429	Other diseases of heart and blood vessels	7 703	2.11
430-438	Cerebrovascular disease	7 534	2.08
440-458	Other diseases of peripheral circulatory system	17 791	4.88
460-486	Respiratory infections	8 874	2.42
490-493	Bronchitis, emphysema, and asthma	4 955	1.36
510-519	Other respiratory diseases	4 740	1.29
520-529	Diseases of mouth including teeth	4 202	1.14
530-537	Oesophagus, stomach, and duodenum	402	0.11
540-543	Appendicitis	2 024	0.56
550-553	Hernia	1 966	0.54
560-569	Intestinal disease	2 747	0.75
570-577	Biliary tract, liver, and pancreas	550	0.15
Rdr 520-577	Other digestive diseases	1 919	0.53
580-584	Nephritis	4 307	1.17
590-595	Urinary tract infection	411	0.11
591-594, 596-599	Other diseases of urinary system	294	0.08
600-602	Prostatic disease	1 738	0.47
603-607	Other diseases of male genital organs	1 699	0.46
610-611	Breast (excluding malignant neoplasm)	612	0.17
612-629	Gynaecological disorders	239	0.07
630-639	Disorders of pregnancy	4 284	1.17
640-645	Abortions	2 220	0.61
670-678	Delivery and puerperium	1 231	0.34
760-761	Perinatal and post partum care without abnormality	13 496	3.69
680-709	Skin diseases	416	0.11
710-718	Arthritis and rheumatism	2 789	0.76
720-738	Other bone and joint disease	7 163	1.96
740-759	Congenital anomalies	4 774	1.30
E 800-949	Accidents	2 910	0.80
E 950-959	Suicides	12 603	3.44
		—	—
		342 848	93.69
	<i>Residual</i>		
	Certain causes of perinatal morbidity	2 119	0.58
	Symptoms and ill-defined conditions	10 524	2.88
	Adverse effects of chemical substances	894	0.24
	Complications of surgical procedures and medical care	544	0.15
	Other injuries and reactions	1 687	0.46
	Persons without current complaint or sickness	282	0.08
	Pre-convalescent, convalescent, staff, and private patients	7 026	1.92
	Prophylactic procedures and other medical examinations	—	—
	Total	365 924	100.00

* Per 1000 of population

HEALTH BY DIAGNOSTIC CATEGORY

Resource Use				Morbidity		Mortality				
Outpatient Referrals		GP Consultations		Sickness Benefit Days		Life Years Lost				
Rates*	%	Rates*	%	Nos*	%	Nos	%			
0.11	0.13	51.1	1.02	3 667	1.35	46 538	0.55			
0.13	0.15	4.0	0.08	2 387	0.88	23 455	0.28			
0.05	0.06	13.4	0.27	155	0.06	8 091	0.10			
1.07	1.24	85.2	1.70	3 150	1.16	2 128	0.03			
0.59	0.69	67.8	1.35	} 1 041	0.38	25 846	0.31			
0.17	0.20	0.7	0.01			1 890	0.02			
1.88	2.19	120.3	2.40	} 1 535	0.57	1 736 057	20.63			
2.47	2.87	11.9	0.24			28 203	0.34			
0.36	0.42	15.5	0.31	Included in other endocrine nutritional and metabolic disorders						
0.49	0.57	35.8	0.72	2 359	0.87	68 595	0.81			
}	0.32	}	0.92	}	1 185	}	41 261			
	0.44		0.51		0.45		26 157			
	0.72		0.84		3.46		0.31			
2.68	3.12	334.3	6.68	16 509	6.09	}	22 182			
1.30	1.51	21.4	0.43	553	0.20		0.26			
}	8.44	}	2.00	}	13 990	}	118 675			
	0.51		0.59		63.9		1.28	3 327	1.23	1.41
1.07	1.24	130.0	2.60	1 279	0.47	}	19 624			
0.11	0.13	9.1	0.18	1 087	0.40		Included in neurological disorders			
0.81	0.94	123.9	2.48	6 934	2.56	106 765	1.27			
0.84	0.98	131.7	2.63	15 551	5.73	109 630	1.30			
0.53	0.62	153.0	3.06	5 410	1.99	1 810 725	21.51			
0.34	0.40	75.4	1.51	3 350	1.24	314 604	3.74			
3.18	3.70	112.5	2.25	6 392	2.36	899 086	10.68			
3.12	3.63	802.1	16.03	19 454	7.17	285 373	3.39			
0.70 excludes emphysema	0.81	}	253.8	}	}	}	598 243			
2.08	2.42						31 082	11.46	344 953	4.10
Included in other digestive diseases							7 653	2.82	129 411	1.54
				527	0.19	Included in other digestive diseases				
1.00	1.16	58.8	1.17	8 652	3.19	48 102	0.57			
0.18	0.21	10.0	0.20	1 044	0.39	6 811	0.08			
1.59	1.85	18.3	0.37	2 769	1.02	41 457	0.49			
}	3.01	}	2.31	}	}	}	112 715			
								1.652	0.61	0.52
0.01	0.01	2.4	0.05	Included in other diseases of urinary system						
}	1.01	}	1.52	}	}	}	44 546			
								0.42	0.53	0.57
}	4.73	}	0.82	}	}	}	54 645			
								0.48	0.58	0.65
2.53	2.94	90.5	1.81	1 557	0.58	}	10 314			
0.10	0.12	5.7	0.11	3 192	1.18			Included in diseases of urinary system		
0.44	0.51	13.2	0.26	}	}	}	}			
0.44	0.51	90.4	1.81					220	0.08	1 224
—	—	—	—	234	0.09	4 066	0.05			
5.07	5.90	242.4	4.84	1 217	0.45	—	—			
3.20	3.72	199.7	3.99	4 640	1.71	4 843	0.06			
5.91	6.87	139.6	2.79	19 585	7.22	}	36 139			
0.62	0.72	6.2	0.12	9 868	3.64			0.43		
}	6.74	}	4.63	}	}	}	}			
								316	0.12	266 642
				23 897	8.81	450 991	5.36			
				—	—	96 608	1.15			
71.09	82.68	4 206.8	84.06	243 341	89.73	7 946 595	94.42			
0.02	0.02	1.8	0.04	9	—	399 045	4.74			
7.32	8.51	436.3	8.72	27 866	10.27	70 904	0.84			
—	—	—	—	—	—	—	—			
—	—	—	—	—	—	—	—			
—	—	—	—	—	—	—	—			
7.56	8.79	359.5	7.18	—	—	—	—			
85.99	100.00	5 004.4	100.00	271 216	100.00	8 416 544	100.00			