

# MEDICAL PRACTICE

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## For Debate . . .

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### Medical research output 1973-81: a romp\* around the United Kingdom research centres

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#### Abstract

In order to measure output of medical research in the United Kingdom, the computerised database of *Excerpta Medica* was used to count the number of publications emanating from each centre of research based on a medical school in 1973-81. Data were amalgamated for the first four years (1973-6) and the final four years (1978-81) and the two sets of data were compared. Eight centres showed a substantial change (20% or more) between the first and second periods. In London three medical schools showed an increase in output and one showed a decrease in output. Elsewhere Leicester, Nottingham, and Southampton schools showed an increase and Bristol showed a decrease. The overall contribution of Cambridge did not increase over the decade but the proportion of clinical papers among those produced at Cambridge did increase.

There are deficiencies in this type of exercise as all articles are treated equally, but probably some of these problems could be overcome in a more sophisticated analysis. Some measure of weighting of the importance of each paper needs to be devised.

\*Research Output by Measuring number of Publications.

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#### Introduction

It is difficult to measure research output, and we have not been able to find any recent attempts to do so in respect of medical research in the United Kingdom. In education<sup>1</sup> and psychology,<sup>2,3</sup> the number of times published articles are cited and the number of articles published in journals have been used as indicators of research productivity. These techniques have also been applied to universities as a whole,<sup>4</sup> and it has been argued that university departments can "usefully be evaluated using (such) objective measures."<sup>5</sup> There is evidence that publication rates of departments are well correlated with other measures of academic success and esteem.<sup>4,5</sup>

The School of Clinical Medicine at Cambridge University was planned to place a considerable emphasis on research.<sup>6</sup> In particular, it was hoped that the school would nurture the investigative spirit and abilities of scientists seeking to complement their existing qualifications with a medical one. As part of an evaluation project charged with examining all aspects of the new school and its course,<sup>7</sup> we wished to see to what extent an environment orientated towards research has been created—how the research output of Cambridge relates to that of other centres, how it is changing, and whether the proportion of papers from clinical departments is rising.

Of the two measures of published research output—the number of times articles are cited and the number of articles published—the citation count has the advantage that it includes some indication of the perceived value of papers: in general, presumably, the more they are quoted, the "better" they are. It has the disadvantage that it is readily open to manipulation by authors by excessive, mutual, or self citation. Moreover, the medical coverage of the available citation index (*Science Citation Index*) is not as broad as that of the two principal specialist medical databases (*Index Medicus*, *Excerpta Medica*); it is expensive to use, and oft quoted well known bad papers could

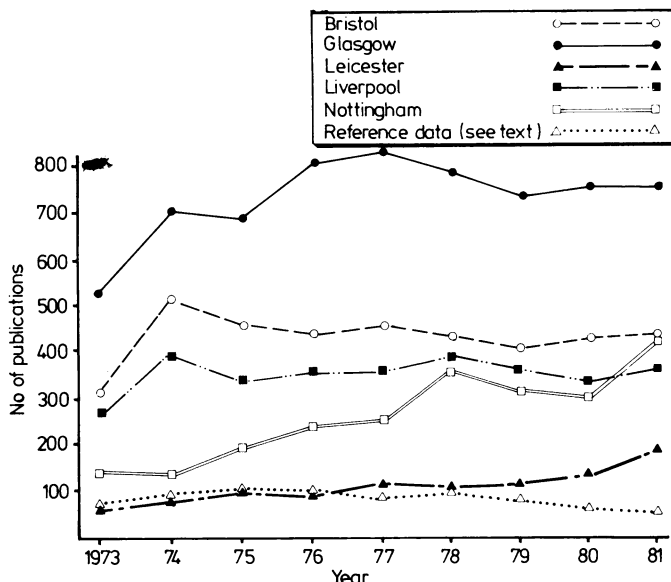
distort results. We therefore decided to do a romp—to count the annual number of published research papers from each United Kingdom medical centre from 1973 to 1981, using one of these medical databases.

## Method

The database of *Excerpta Medica* indexes articles from 3500 biomedical journals all over the world. The computer files are available on line for the period August 1973 onwards and contain records of about 2 000 000 periodical articles. *Excerpta Medica* is the major European indexing service for medical literature and produces 44 abstracts journals. It has strong European coverage and the information on the first author's institutional address and country is presented in a standardised form.

The other major on line index to medical literature, "Medline," covers a longer time (1966 onwards) but has disadvantages for our purposes in that the information on addresses is not standardised and can be searched for only from 1979.

We therefore used the *Excerpta Medica* database for our study and examined publications appearing in 1973-81, the information for 1982 still being incomplete at the time of our search (May 1983). The database was searched on the DataStar host in Switzerland.



Examples of annual publication rates 1973-81.

The number of papers published each year from each centre of research based at a medical school outside London was established by searching the "institution" heading of the computer record of every paper indexed. This gives the institutional address of the first author. Papers from UK medical schools, related research institutes—for example, the Medical Research Council, Agricultural Research Council—hospitals, health authorities, health centres, and general practitioners' surgeries with the address of a city with a university medical school—"Aberdeen," "Belfast," "Cambridge," etc—were accepted. Those from commercial laboratories were suppressed, as were those from non-medical universities—for example, Strathclyde—and other institutes of higher education, so as to enhance comparability between centres. Papers emanating from institutions in cities outside the UK—for example, Cambridge, Massachusetts; Sheffield, New South Wales—were excluded by specifying unique country codes for the home countries and the United Kingdom. Thus the number of centres outside London indicates the output of a medical school together with that of associated clinical and research facilities, such as MRC units, in the same city.

London, with its many schools, hospitals, and research institutes is more complicated: other than principal teaching hospitals, affilia-

tions are complex. This forced an alternative and more specific approach to medical schools. Papers were counted for each medical school and were accepted only if they came from the medical school or teaching hospital by name. Other hospitals were thus excluded. Figures for the London schools and the other UK centres were therefore obtained on different bases and should not be compared: the figures for London represent an underestimate of publications compared with the non-metropolitan centres. The two sets of data are presented below separately.

To assess and minimise the number of false positive findings, the addresses of a sample of 100 papers from each institution were examined: any unacceptable ones were suppressed in the search. As a result, we estimate that the proportion of false positives is now less than 1%. It is not possible to estimate the number of papers missed by this approach: so far as we are able to establish, it is a small number, missed mainly because of incompetent coding—for example, "London, Germany." It should be noted that the institution to which a paper is ascribed is that to which the first author lists his affiliation.

To estimate the proportion of papers from Cambridge coming from preclinical departments, clinical staff, and research institutes, the addresses of a sample of 100 papers emanating from Cambridge were examined for each year under study (and also 1982—though incomplete, a sample of papers could be drawn).

## Results

The table gives in the first column the total number of publications for each centre over the nine year period, with each of the two groups of centres placed in overall rank order. The annual publication rates were found to be fairly consistent over the period of study, but subject to a substantial amount of "noise"—see examples in the figure. (This figure gives also some reference data, being the average annual output from three substantial university centres without medical schools—Hull, Reading, and Brighton.) As a result, annual percentage and rank order were not used to evaluate trends: data were amalgamated for the first four years (1973-6) and the final four years (1978-81) and the resultant two sets compared. The table shows these data.

The final columns of the table indicate trends, differences between the two sets of data. Firstly, the proportion of the total number of papers in a group produced by each centre in 1978-81 is shown, expressed as a percentage of the equivalent proportion for 1973-6. Secondly, any change in each centre's rank order is given.

An arbitrary criterion for substantial change might be whether a centre's share had changed by more than 20% between the two periods. On this basis eight centres showed changes: in London, Charing Cross, the Royal Free, and St George's medical schools showed an increase and St Mary's showed a decrease; elsewhere Leicester, Nottingham, and Southampton schools showed an increase and Bristol showed a decrease.

Of the 100 Cambridge papers examined for each year in 1973-82, the number coming for each of these years from hospital and medical school clinical departments was: 17, 8, 14, 19, 29, 13, 32, 27, 24, 26. The 87 clinical papers from the 1973-7 sample represent a mean annual percentage of 17.4% of the Cambridge output; whereas the 122 clinical papers from the 1978-82 sample represent 24.4% of the Cambridge output—a significantly greater proportion ( $\chi^2=6.99$ ;  $df=1$ ;  $p<0.01$ ).

## Discussion

Some systematic bias may have been operating against some centres, but we cannot think of any. Such a bias would not explain change over time, the theme of this paper. Moreover, some validity for the methodology is crudely established by changes shown by the new general medical schools—Leicester, Nottingham, and Southampton—all of which show an upward trend.

Possible reasons for changes may form a focus for discussion of these findings. Downward trends in some of the centres outside London are in part caused by the establishment of the new schools. This does not apply to London, which has, during the period in question, undergone the trauma of the Flowers report (on the rationalisation of medical education within London University). In interpreting the data, it should be

Research output of centres, 1973-81, showing trends. Centres listed in overall rank order separately for London and rest of United Kingdom

Centres	Total publications 1973-81	% Of total in each group	Overall rank in group	% Of papers 1973-6 in each group	Rank 1973-6	% Of papers 1978-81 in each group	Rank 1978-81	Changes	
								Proportion 1978-81	Change in rank
								Proportion 1973-6 (%)	
<i>London medical schools</i>									
UCL/UCHMS	3369	15.4	1	17.0	1	13.9	1	82	0
King's	2494	11.4	2	11.1	3	11.4	2	102	+1
St Bartholomew's	2434	11.1	3	11.5	2	10.9	3	95	-1
Guy's	2163	9.9	4	9.3	5	10.4	4	112	+1
The Middlesex	2090	9.5	5	9.9	4	9.5	5	96	-1
St Thomas's	1726	7.9	6	7.2	8	8.2	6	113	+2
The London	1712	7.8	7	8.3	6	7.3	8	88	-2
St Mary's	1591	7.2	8	8.1	7	6.3	10	78	-3
Royal Free	1494	6.8	9	6.0	9	7.4	7	124	+2
St George's	1131	5.2	10	3.8	11	6.5	9	168	+2
Charing Cross	965	4.4	11	3.8	12	4.9	11	131	+1
Westminster	778	3.5	12	4.0	10	3.3	12	82	-2
<i>Rest of UK</i>									
Cambridge	6862	10.2	1	10.5	1	10.0	1	95	0
Glasgow	6582	9.8	2	10.0	3	9.4	3	94	0
Edinburgh	6553	9.7	3	10.5	2	9.2	4	87	-2
Oxford	6298	9.3	4	9.1	4	9.4	2	104	+2
Manchester	5048	7.5	5	7.2	6	7.8	5	108	+1
Birmingham	4972	7.4	6	7.8	5	7.0	6	89	-1
Bristol	3924	5.8	7	6.4	7	5.4	7	69	0
Newcastle	3274	4.9	8	4.9	9	4.6	9	94	0
Leeds	3252	4.8	9	4.6	10	5.1	8	112	+2
Liverpool	3220	4.8	10	5.1	8	4.5	11	89	-3
Wales	3123	4.6	11	4.6	11	4.6	10	100	+1
Sheffield	2913	4.3	12	4.4	12	4.3	13	96	-1
Nottingham	2355	3.5	13	2.5	16	4.4	12	177	+4
Southampton	2183	3.2	14	2.8	15	3.7	14	134	+1
Aberdeen	2116	3.1	15	3.2	13	3.0	16	95	-3
Belfast	2090	3.1	16	3.2	14	3.2	15	101	-1
Dundee	1682	2.5	17	2.3	17	2.6	17	117	0
Leicester	959	1.4	18	1.1	18	1.7	18	158	0

noted also that Westminster Medical School is, uniquely, only a clinical school.

Although the overall contribution of Cambridge to published research did not increase over the decade, the proportion of clinical papers among those produced by Cambridge did increase. This will be encouraging to those responsible for establishing the clinical school.

We recognise that the methods used have their weaknesses. No account is taken of the weight or importance of a paper or its subsequent influence; ascribing a paper to the institution of its first author, though even handed, could conceivably affect the results, especially if he or she has moved since undertaking the research; and research reports, review articles, and "opinion" (editorials, unreviewed reports,<sup>8</sup> and letters) are treated equally. Approximately 94% of papers indexed are research reports, 2% are review articles, and 4% are "opinion." The policy of *Excerpta Medica* with respect to letters—probably the majority of the 4%—is to index them qualitatively: "a significant amount of information," and not just opinions, must be included. This results in fairly comprehensive coverage of letters in the principal journals—for example, *BMJ*, *Lancet*, *Nature*, *New England Journal of Medicine*.

Some of these problems could probably be overcome in a more sophisticated analysis. The annual reports of medical schools are not universally comprehensive, as most of them are compiled by means of internal questionnaires and are consequently unreliable, but their use could provide a helpful back up to establish true institutional affiliations. More importantly, though, some measure (or measures) of weighting of the importance of each paper needs to be devised. Straightforward citation counts are unsatisfactory, but it should be possible to devise a weighting statistic based on the average annual number of citations of all articles in a journal—the so called "impact factor" of the journal<sup>9</sup>—and the journal's publication to rejection ratio.

We also readily acknowledge that our data pay no attention

to the financial resources of the various institutions and their affiliates or to their age and size. In any attempt to assess the "value for money" of research, these would need to be controlled for.<sup>10</sup> This was beyond our competence. In times of increasing cost consciousness, such evaluations will come: universities should attempt to develop more sophisticated criteria of research output and other primary functions on which these studies may be based.

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