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Speed Presentations

Does academic output correlate with better mortality rates in NHS trusts in England?

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SUMMARY

Objective: To establish whether there is an association between academic output and mortality rates for National Health Service (NHS) trusts.

Methods: Hospital standardized mortality ratios were obtained from Dr Foster hospital report cards. The Medline database of biomedical citations was queried to establish the number of citations credited to each NHS trust and constituent hospitals from 2006 to 2010. Admissions totals for NHS trusts for 2009–2010 were obtained from Hospital Episode Statistics Online. The number of citations per admission was calculated and used as an indicator of academic output as this reflects the workload of the trust.

Results: Spearman's rank analysis was performed to identify any correlation between citations per admission and the inverse of four types of mortality rate: high-risk conditions, $r = 0.20$ ($P = 0.01$); low-risk conditions, $r = -0.06$ ($P = 0.46$); deaths after surgery, $r = 0.193$ ($P = 0.019$); and overall mortality, $r = 0.291$ ($P < 0.01$).

Conclusion: The results of this preliminary study demonstrate a significant correlation between academic output and mortality rates. The correlation coefficients are small, but the findings of this study encourage further debate.

Introduction

The importance of academic medicine and research has always been emphasised in medicine. Recently, the National Health Service (NHS) has publicly expressed the importance of research in *The Handbook to the NHS Constitution*,[1] and stated that 'All NHS organizations must play their full part in supporting health research,' in the most recent *Operating Framework for the NHS in England*.[2] The NHS has also developed organizations such as the National Institute for Health Research, and encouraged strategic health authorities to support innovation and aid in developing research opportunities within the NHS.

Academic medicine has a responsibility for maintaining and producing high standards of health care. Doctors (both in training and who have completed training) are encouraged to publish academic work in order to further medical expertise and also as part of professional development. It has become mandatory for many training specialities.

However, this does raise the question as to whether doctors and institutes that are involved in academic medicine and research have better outcomes for their patients. The

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more specific question of whether the academic output of an institute or trust affects patient care has only been studied once in the literature. Pons *et al.*[3] looked at in-hospital risk-adjusted mortality for acute myocardial infarction and congestive heart failure in 50 acute Spanish public hospitals, to compare a weighted citation ratio. There were a number of exclusion criteria including at least five citable papers per year in the field of heart disease. Pons *et al.* found a low-to-moderate negative correlation between risk-adjusted mortality and the weighted citation ratio: −0.43 (95% confidence interval −0.17 to 0.63) for congestive heart failure and −0.37 (95% confidence interval −0.10 to −0.59) for acute myocardial infarction.

Since the Bristol inquiry, there has been increasing accountability of health care to the public.[4] Dr Foster Health is an NHS performance monitor available to the public. It has become a joint venture with the Department of Health and the Dr Foster Unit at Imperial College London. Dr Foster Health annually publishes *The Hospital Guide* and hospital report cards. These reveal adjusted mortality rates and more specific data regarding stroke, orthopaedic care, urological care and the recording of safety incidents.[5]

Dr Foster Health uses hospital standardized mortality ratios (HSMRs), which were first described in 1999 in the NHS[6] and have since been used internationally.[7] The data for calculation of HSMRs are gathered from Hospital Episode Statistics Online[8] and are collected quarterly. The HSMR itself is the ratio of the actual number of deaths in a hospital to the expected number of deaths for that hospital for conditions accounting for 80% of deaths. Adjustments are made for the case mix in terms of: age group; sex; emergency or elective admission; primary diagnosis number of emergency admissions in the previous year; post code of patient admission to a palliative care speciality; and comorbidity in terms of a Charlson index.[9]

Methods and materials

A retrospective observational study was undertaken to compare the number of citations for each individual acute hospital NHS trust in England with HSMRs. Citation numbers were obtained from the Medical Literature Analysis and Retrieval System Online database (Medline), which is maintained and provided by the US National Library of Medicine (http://www.nlm.nih.gov/). It contains bibliographic information from many healthcare-related academic journals.

Medline was queried using the Internet-based library search facility available within Endnote X2 (Thomson Reuters, New York, NY). This facility was used to identify the number of citations credited to each of the 147 NHS trusts in England and their affiliated hospitals/practices between 2006 and 2010.

The admissions totals for each NHS trust in England between 2009 and 2010 were obtained from Hospital Episode Statistics Online.[8] All information was recorded on a Microsoft Excel (Microsoft Corp., Redmond, WA, USA) spreadsheet. The number of citations per admission for each NHS trust was calculated (total number of admissions for 2009–2010 divided by the total number of citations for 2006–2010) and used as an indicator of academic output as this reflects the workload of the trust. The number of citations per admission was ranked along with the inverse of the four types of mortality rate.

HSMRs were obtained from the Dr Foster hospital report cards.[5] These were given in the following categories:

- Overall mortality rate (HSMR) compares the actual number of deaths in a trust against the expected number.
- Mortality from high-risk conditions compares the actual number of deaths in a trust against the expected number for five of the 56 conditions that compromise the HSMR (heart attack, pneumonia, stroke, congestive heart failure and fractured neck of femur).
- Mortality from low-risk conditions is the mortality ratio from conditions which have a death rate of 0.5% or less, such as vasectomy or tonsillectomy.
- Deaths after surgery are the mortality ratios of surgical patients that had a secondary diagnosis of internal bleeding, pneumonia or a blood clot and subsequently died.

Spearman's rank analysis was used to analyse the results. Statistical analyses were performed using Statistical Package for the Social Sciences Version 11.0 (SPSS Inc., Chicago, IL, USA).

Results

From 2006 to 2010, 37,510 citations were listed on Medline for all 147 NHS acute hospital trusts in England. The total numbers of citations per year are shown in Table 1.

HSMRs were obtained from Dr Foster hospital report cards.[5] The inverse of these ratios was calculated so that higher values would correspond to better mortality rates.

Spearman's rank analysis was performed to identify any correlation between citations per admission and the inverse of four types of mortality rate: high-risk conditions, $r = 0.20$ ($P = 0.01$); low-risk conditions, $r = -0.06$ ($P = 0.46$); deaths after surgery, $r = 0.193$ ($P = 0.019$); and overall mortality, $r = 0.291$ ($P < 0.01$). The top 10 NHS trusts by citations per admission are shown in Table 2.

Table 1 – Citations on Medline by year for National Health Service trusts in England.

	2006	2007	2008	2009	2010
Citations (*n*)	7081	7533	7518	7555	7823

Table 2 – Top 10 citations per admission for National Health Service trusts in England.

Rank	NHS trust	Citations on medline (2006–2010)	Admissions (2009–2010)	Citations per admission
1	Oxford Radcliffe Hospitals	2685	153,783	0.0175
2	Cambridge University Hospitals	2131	129,034	0.0165
3	Guy's and St Thomas'	1996	122,136	0.0163
4	Royal Free Hampstead	1157	87,528	0.0132
5	Imperial College Healthcare	2184	171,954	0.0127
6	King's College Hospital	1165	111,003	0.0105
7	St George's Hospital	951	92,609	0.0103
8	Southampton University Hospitals	1178	122,516	0.0096
9	Barts and the London	752	94,059	0.0080
10	Central Manchester University Hospitals	1047	132,375	0.0079

Discussion

This preliminary study shows a significant, albeit weak, correlation between overall mortality rates and academic output in NHS trusts in England.

Why should we think that the academic output of an institution or trust affects, or is correlated with, better patient outcomes or mortality rates? A hypothesis would be that institutions that are publishing more frequently have healthcare staff that are more involved in academic medicine and the latest guidelines and practices. Some work has been undertaken to compare patient outcomes in healthcare settings involved in research compared with those that are not.

Several studies have compared patient care between institutions that take part in clinical trials and institutions that do not. Majumdar *et al.* compared discharge prescribing of patients with certain trial-approved cardiac medications in institutes that had taken part in the trial with institutes that had not, and found no significant difference between the two.[10] A later trial by the same group showed that patients had better outcomes and adherence to guidelines for non ST-segment elevation acute coronary syndrome in hospitals that had participated in related trials, compared with hospitals that had not.[11] Clarke and Loudon performed a systematic review looking at further similar studies, and at the 'trial effect' of care of patients being treated by institutes or physicians involved in clinical trials. They found that there was greater adherence to guidelines, greater use of evidence and better outcomes, but were unable to come to definite conclusions on improvements in patient health.[12]

The present study found a lower correlation than Pons *et al.*[3] and their work with heart disease risk-adjusted mortality ratios and weighted citation ratios. This may be due to the selection and exclusion criteria used by Pons *et al.*, and the different methodologies utilised. Pons *et al.* studied 50 acute Spanish public hospitals, all of which had more than 30 cases of acute myocardial infarction and congestive cardiac failure per year, and published at least five citable papers per year in the field of cardiac disease. Pons *et al.* also used a complicated method to calculate weighted citation ratios, using several bibliometric measurements and calculating the *h* index[13] for each institution. The Spanish National Citation Report was analysed for all publications related to cardiovascular disease, and this in itself only includes documents that are considered to be citable.

With the current rise in clinical governance and the era of guideline-led medicine, there could be an argument that, due to transparency and communications within the NHS, such differences in care between hospitals should be less significant and would overpower any differences in academic output between trusts and institutions. There may be some benefit in comparing academic output for individual years and respective mortality rates, and extending this to previous years. However, this does raise problems due to the relatively limited data from Dr Foster Health, and the difficulty of publication dates in relation to when the research/academic work was actually performed.

The accuracy of HSMRs has been questioned previously.[9,14,15] The difference between other standardized mortality ratios has given rise to the term 'constant risk fallacy'. This is the assumption that risk is constant across all organizations or units for comparison. It is thought that methods used to adjust risk for different case mixes do not, in fact, do so and hence increase the bias and unreliability of the results.[14]

HSMRs have also been accused of showing weakness to different admission, diagnostic behaviour and coding practices in the NHS. The idea that death rates should reflect the quality of hospital care was raised into question by Black, who stated that different regions and socio-economic groups have different options for end-of-life care, and this would affect the HSMR.[15] Aziz *et al.* recently criticized the accuracy of Hospital Episodes Statistics data and HSMRs in a surgical setting, but emphasized the need for improvement in quantifying surgical outcomes and performance.[9] This general view to strive for an increasingly accurate method to measure the quality of care is shared with others.[15]

Only Medline was searched for citations for each trust. Other databases such as EMBASE were not reviewed. Sampson *et al.* looked at the significance of searching either database for meta-analysis, and found that there was a risk, albeit small, of influencing bias on the search results.[16] Wilkins *et al.* looked at EMBASE vs Medline for family medicine searches, and reported that EMBASE found nearly twice as many citations as Medline; however, they could not guarantee the quality of the citations.[17] This idea deserves further study.

Dr Foster Health has more specific data on orthopaedics, stroke, patient experiences and the delivery of measures to prevent patient harm (e.g. venous thromboembolism prophylaxis).[5] These data could be compared more specifically with the academic output from each trust that is related to that speciality. This may remove any bias towards certain trusts having centres of academic excellence for specialities, giving an umbrella effect to the less academic specialities within a trust. However, this potential effect in itself is another avenue for investigation.

Conclusion

This study found weak correlation between the academic output of a trust and their mortality rates. However, as a method, it could be developed and modified to allow more detailed analysis of specific departmental and speciality academic/research output and their respective morbidity and mortality data using information sources such as Dr Foster Health. The results of this could shape and influence the importance and role of academia in general medical and speciality training.

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Competing interests

None declared.

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