Social Science & Medicine 73 (2011) 535–539

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Short report

Physician-leaders and hospital performance: Is there an association?

Amanda H. Goodall [a,b,c,*]

[a] IZA Institute for the Study of Labor, Schaumburg-Lippe-Str. 5-9, 53113 Bonn, Germany
[b] Visiting Fellow, Cass Business School, UK
[c] Associate Fellow, University of Warwick, UK

ARTICLE INFO

Article history:
Available online 6 July 2011

Keywords:
Leadership
Hospitals
Physicians
Professional managers
USA

ABSTRACT

Although it has long been conjectured that having physicians in leadership positions is valuable for hospital performance, there is no published empirical work on the hypothesis. This cross-sectional study reports the first evidence. Data were collected on the top-100 U.S. hospitals in 2009, as identified by a widely-used media-generated ranking of quality, in three specialties: Cancer, Digestive Disorders, and Heart and Heart Surgery. The personal histories of the 300 chief executive officers of these hospitals were then traced by hand. The CEOs are classified into physicians and non-physician managers. The paper finds a strong positive association between the ranked quality of a hospital and whether the CEO is a physician or not ($p < 0.001$). This kind of cross-sectional evidence does not establish that physician-leaders outperform professional managers, but it is consistent with such claims and suggests that this area is now an important one for systematic future research.

Introduction

In the past, hospitals were routinely led by doctors. That has changed. In the United Kingdom (UK) and the United States (US), most hospital chief executive officers (CEOs) are non-physician managers rather than physicians (Darzi, 2009; Falcone & Satiani, 2008; Halligan, 2008; Horton, 2008). Of the 6500 hospitals in the US, only 235 are led by physicians (Gunderman & Kanter, 2009). It has been suggested that placing physicians into leadership positions can result in improved hospital performance and patient care (Candace & Giordano, 2009; Darzi, 2009; Dwyer, 2010; Falcone & Satiani, 2008; Halligan, 2008; Horton, 2008; Stoller, 2009). The UK has recently established five Academic Health Science Centres (AHSCs). Their mission is to bring the practice of medicine closer to research – in the hope that innovative science can more quickly be translated into clinical procedures (Smith, 2009). Physician leadership was also prioritized in the 2008 National Health Service (NHS) review (Darzi, 2008,2009; Horton, 2008). Some outstanding American medical facilities – for example the Cleveland and Mayo Clinics – have explicitly introduced leadership training (e.g. Stoller, Berkowitz, & Bailin, 2007), and management and leadership education is being incorporated into medical degrees (Fairchild, Benjamin, Gifford, & Hout, 2004; Stern & Papadakis, 2006); this is supported by a new literature that focuses on the key competencies required to be an effective physician-leader (Chaudry, Jain, McKenzie, & Schwartz, 2008; Stoller, 2008).

Currently, however, there are no empirical studies that assess the physician-leadership hypothesis that hospitals perform better when they are led by doctors (see Dwyer, 2010 for a review of the literature on medical managers). To establish a clear relationship between leadership and organizational outcomes is challenging because many of the conditions required for an unambiguously causal analysis cannot be met. This paper provides an empirical inquiry. It looks at the leaders currently being hired by hospitals and examines the question: are CEOs in hospitals ranked higher typically physicians or non-medical managers?

The wealthiest and most prestigious hospitals arguably have the widest choice of leadership candidates. If it can be shown that hospitals positioned higher in a widely-used media ranking are more likely to be led by medical experts rather than managers, this is one form of evidence that physician-leaders may make effective CEOs.

A related study, although not concerned explicitly with leadership, is Yasaitis, Fisher, Skinner, & Chandra, 2009, which influenced this paper's choice of title.

Data and methods

The paper identifies the CEOs in the top ranked hospitals in America – determining whether those hospitals situated higher in

* IZA Institute for the Study of Labor, Schaumburg-Lippe-Str. 5-9, 53113 Bonn, Germany. Tel.: +44 (0) 7962 211317.
E-mail address: amanda@amandagoodall.com.

0277-9536/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.socscimed.2011.06.025

the league table are more likely to be headed by physician-leaders or professional managers. To do this, one particular quality ranking is used, namely, the league tables produced by US News and World Report's "Best Hospitals" 2009.

The study constructs a dataset on CEOs in the top-100 hospitals in the three specialties of Cancer, Digestive Disorders, and Heart and Heart Surgery.

Data

The US News and World Report (USNWR) ranking is designed to inform consumers about where to seek treatments for serious or complex medical problems. Media-generated league tables cannot be viewed as entirely reliable measures of quality; nonetheless, using rating systems as heuristic devices to assess healthcare providers has become common in the US (Schneider & Epstein, 1998) and it has been shown to influence consumers' behavior (Pope 2009).

This study uses the USNWR classification because it is one of the most established. Its Index of Hospital Quality (IHQ) incorporates a number of empirical measures and over the years serious attempts have been made at consistency. The underlying methodology for the ranking was developed by the National Opinion Research Center at the University of Chicago, which compiled the league tables from 1993 to 2004. In 2005, Research Triangle Institute (RTI) International started producing the ranking. RTI states that, despite some refinements and additions, the methodology is approximately the same as in earlier years. (RTI's introduction to the 2009 rankings methodology can be found in the web-accessible version of this paper in Appendix A).

In the 2009 USNWR ranking, 4861 medical facilities are assessed across 16 specialties. Of the sixteen, twelve of the specialties are rated using IHQ scores. These twelve include: Cancer, Diabetes and Endocrine Disorders, Digestive Disorders, Ear, Nose and Throat, Geriatric Care, Gynecology, Heart and Heart Surgery, Kidney Disorders, Neurology and Neurosurgery, Orthopedics, Respiratory Disorders, and Urology. For the remaining 4 – Ophthalmology, Psychiatry, Rehabilitation, and Rheumatology – just physicians' reputational score is used by USNWR. Only hospitals evaluated using IHQ scores are considered in this study.

The American Hospital Association (AHA) Annual Survey Database is the main source of information for each medical facility assessed by USNWR. To qualify for ranking in a given IHQ-driven specialty, every hospital is required to pass through two stages of eligibility. The first set of criteria oblige hospitals to either be a member of the Council of Teaching Hospitals (COTH), be affiliated with a medical school (American Medical Association or American Osteopathic Association), to have at least 200 hospital beds set up and staffed or, finally, to have available at least four of eight important key technologies (for example, a cardiac intensive care unit, or endoscopic ultrasound) and have at least 100 hospital beds set up and staffed. Stage 2 of the eligibility process requires hospitals to demonstrate that they can successfully treat and discharge a specified number of complex cases in a given specialty. Of the 4861 medical facilities initially assessed by USNWR in 2009, 1859 hospitals were deemed eligible for analysis in at least one of the IHQ-driven specialties.

Three areas of healthcare performance are reflected within the IHQ quality scores: structure, process, and outcomes. These are described in Table 1. 'Structure' is assigned 30% of the IHQ total score. It refers to the resourcing of patient care, such as, for example, the number of nurses, available technologies and patient services. 'Outcomes' is a measure of mortality rates 30 days after admission for the IHQ-driven specialty. The mortality rates are risk-adjusted to control for the severity of a patient's illness, their age and other factors. 'Process' is about the delivery of care; it incorporates diagnosis, treatment and prevention. The process component draws on survey data from board-certified physicians who assign a reputation score in their field of medicine. Finally, a 'patient-safety index' is included. This measure incorporates factors such as safety and "freedom from accidental injury", and the practice of up-to-date medical procedures. The Outcomes and Process measures each account for 35% of overall IHQ scores, which includes 5% weight allocated to patient-safety (distributed between outcomes and process).

No single general ranking exists in the USNWR tables. Instead, the top-50 hospitals are identified in each of the 16 specialist fields and published in U.S. News & World Report. In addition, there is an extra and more selective ranking of 'Honor Roll' hospitals – those that performed well in at least 6 of the 16 specialties. Twenty-one institutions made it on to this elite list in the 2009 Honor Roll.

The data in this paper cover the top-100 hospitals in the three specialist fields of Cancer, Digestive Disorders, and Heart and Heart Surgery. These three fields were chosen because they are assessed using IHQ scores and they represent ailments that are believed to be important and relatively common among the general population.

In this study the top-50 ranked hospitals in each of the three IHQ-driven specialties are taken from the 2009 USNWR ranking. To identify the second 50 (which creates the top-100 tables in this

Table 1
Construction of the dependent variable - Index of Hospital Quality (IHQ).[a]

Structure 30% Weight	Outcomes 35% Weight	Process 35% Weight
✓ Availability of key technologies (15 technologies linked to specialty fields). ✓ Volume index (number of medical and surgical discharges). ✓ Nurse staffing –intensity of outpatient and inpatient, and level of excellence. ✓ Presence of a trauma center. ✓ Patient services index (e.g. presence of an Alzheimer's center,fertility clinic, etc.). ✓ Have at least one specialist in criticalcare medicine.	✓ Mortality rates 30 days after admission for all IHQ-driven specialties.It is calculated using a risk-adjusted method which includes: Volume of cases; Severity of illness; and a specialty-specific risk-adjusted mortality calculation. ✓ Patient-safety index includes: "freedom from accidental injury", the practice of modern medical procedures and safety. This accounts for 5% of total score and is tied to both Outcomes and Process.	Reflects physicians' decisions made in the hospital setting, such as:✓ Choices about admission ✓ Diagnostic tests ✓ Course of treatment ✓ Choice of medication ✓ Length of stay. This information is acquired through a survey of randomly selected board-certified specialist physicians in each specialty field.

[a] The weights add to 100%. This information has come from "America's Best Hospitals" 2009 methodology produced by Research Triangle Institute (RTI) International. IHQ scores are assigned to the 12 specialty fields that are data-driven: Cancer, Diabetes and Endocrine Disorders, Digestive Disorders, Ear, Nose and Throat, Geriatric Care, Gynecology, Heart and Heart Surgery, Kidney Disorders, Neurology and Neurosurgery, Orthopedics, Respiratory Disorders, and Urology. 1859 US hospitals out of a total of 4861 were assessed by UNSWR in at least one specialty and ranked.

paper), this study ranked all the remaining hospitals by their IHQ scores, which were listed on the USNWR website. This generated a ranking of top-100 hospitals.

Next, data were collected on each hospital CEO. To do this, the study used hospitals' websites, and on some occasions personal contact with institutions (in the form of a request for the name of the CEO). Each chief executive officer was classified into one of two categories – physician-leaders, and leaders who are non-physician managers. To qualify as a physician-leader, by this study's criterion, a CEO must have been trained in medicine (MD). Some information was available about the extent to which MD-trained leaders in the dataset had been career physicians. Most MD chief executive officers reported that they had clinical experience. Consistent information was not available on the level or number of years of clinical experience that each CEO had obtained. There were three nurses among the CEOs in the sample, and they were categorized as non-physicians.

The data used in this paper were acquired through public sources – USNWR's website and from hospital websites – so that for this study no further ethics approval was necessary.

Analysis

To establish whether hospitals higher in the USNWR rankings are more likely to be led by physicians, the study uses *t*-tests and regression equations. It does this for the top-100 hospitals in each of three medical fields; the statistical results are presented in the form of tables and a bar diagram.

Table 2 reveals how IHQ hospital-quality scores are distributed across the top-100 hospitals in each of the three fields in this study: Cancer, Digestive Disorders and Heart and Heart Surgery. For Cancer, for example, the mean of the IHQ scores in the sample is 28.0 (whereas for each of the three specialties, the maximum feasible score is normalized at 100) and the standard deviation is 12.6. There are 51 physician-leaders among this set of 100 CEOs. Thirty-three are in the top-50 hospitals, and 18 lead hospitals in the lower 50 group. Of the 100 leaders, 15 of the CEOs are female.

For the other two specialties, there are, respectively, 34 physician-leaders in the top-100 hospitals in Digestive Disorders, and 37 in Heart and Heart Surgery.

IHQ scores do not follow a normal distribution. With a sample of 100 observations, however, there can be expected, by the Central Limit Theorem, to be no major bias to later results.

Findings

Fig. 1 depicts the mean hospital-quality scores – for the separate fields of Cancer, Digestive Disorders, and Heart and Heart Surgery – for physician-headed and manager-headed hospitals. In each of the three cases, the mean IHQ score of hospitals where the Chief Executive Officer is a physician is greater than the mean score of the hospitals where the CEO is a professional manager. For example, the mean IHQ hospital-quality score of the Cancer hospitals led by physicians is 31.63 (SD = 16.29) while the mean quality score of Cancer hospitals led by non-physician managers is 23.61 (SD = 4.18).

Table 3 depicts the relationship more formally. The regression equations reveal that the presence of a physician-CEO is associated at the $p < 0.001$ level with an extra 8 to 9 hospital-quality points (as measured by an IHQ scale). In size, that is equivalent to approximately two-thirds of 1 standard deviation in IHQ hospital quality. The explanatory power of Table 3's equations is modest. For Cancer hospitals, for example, the R-squared is 0.09.

For the field of Cancer, a variable for the size of hospital, the number of beds, was checked as one possible confounding factor. The mean number of beds per hospital is 652 (SD = 361). This variable always entered with a coefficient insignificantly different from zero and did not alter the coefficient on the physician-leadership variable.

If the analysis is re-run with hospitals ranked in an ordinal way instead of being allocated an actual IHQ score, the statistical relationship continues to hold ($p < 0.001$). It might be feared that a handful of hospitals of all-round quality is what drives the study's result; however, if the sample is restricted to those hospitals that appear only once in any of the three rankings, and the ranked position of each hospital is correlated with whether the leader is a physician, the relationship still holds. Although this latter check is not ideal because it necessarily omits observations, it shows, encouragingly, that the pattern remains strong when the hospitals that perform the best across more than one category are removed (i.e. it is not just the best, or the same, hospitals driving the results in the three specialties).

Finally, it is of interest to study the USNWR so-called 'Honor Roll'. Within this selective group of the highest-ranking hospitals, the majority of CEOs – 16 out of 21 – are physicians. Among Honor Roll hospitals, USNWR quality scores are graded differently; they vary on a scale from a maximum score of 30 to a minimum score of 7. The mean hospital IHQ quality score for the Honor Roll sample is 17.0 (SD = 7.22). Among these hospitals run by physicians, the mean IHQ score is 18.38 (SD = 7.37); the mean score of Honor Roll hospitals led by managers is 12.60 (SD = 5.03).

Table 2
Distribution of the Index of Hospital Quality (IHQ) scores for the top-100 hospitals in the specialties of cancer, digestive disorders, and heart and heart surgery.[a]

	Cancer	Digestive disorders	Heart and heart surgery
Maximum IHQ score	100	100	100
Minimum IHQ score	19.3	16.6	20.3
Mean IHQ score	28.0	22.0	25.8
Standard deviation	12.6	11.2	11.2

[a] The top-50 in each of the twelve IHQ-driven specialties is published in USNWR. To identify the second 50 (which creates the top-100 data in this paper), this study ranked all the remaining hospitals by their IHQ scores, which are available on the USNWR website. This generated a ranking of top-100 hospitals.

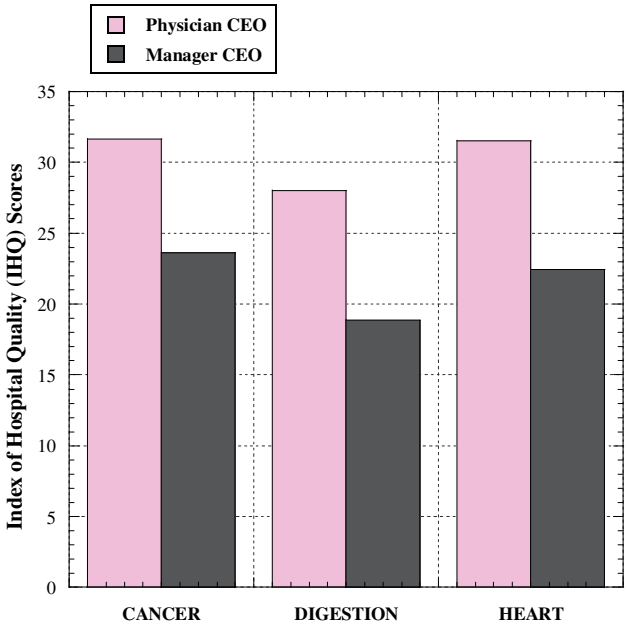

Fig. 1. Mean Index of Hospital Quality (IHQ) Score of Hospitals Led by Physician CEOs and Manager CEOs in Three Specialty Fields

Table 3
Regression equations for IHQ hospital-quality in the fields of cancer, digestive disorders, and heart and heart surgery.[a]

	1	2	3
	The top-100 hospitals in the field of cancer	The top-100 hospitals in the field of digestive disorders	The top-100 hospitals in the field of heart and heart surgery
Hospital led by a physician[b]	8.02*** (3.34)	9.19*** (4.21)	9.06*** (4.21)
Adjusted R^2	0.09	0.15	0.14
Constant	23.61	18.85	22.44
	$n = 100$	$n = 100$	$n = 100$

The dependent variable is an IHQ hospital-quality score. The independent variable is a (1,0) dummy variable.
Coefficients are shown with t-statistics in parentheses; ***$p < 0.001$; **$p < 0.01$.
These estimates are cross-section associations.
[a] Data from US News and World Report 'Best Hospitals' 2009.
[b] This is a variable where 1 = Physician-leaders; 0 = Non-Physician-leaders.

Discussion

This study's results are cross-sectional associations and use one particular hospital-quality ranking. This means they have important limitations. The findings do not prove that doctors make more effective leaders than professional managers. Potentially, they may even reveal a form of the reverse – assortative matching – in that the top hospitals may be more likely to seek out MDs as leaders and vice versa. Arguably, however, the better hospitals will have a wider pool of CEO candidates from which to choose, because of the extra status and wealth that they attract. This makes the fact established in this paper an interesting one. The study's results show that hospitals positioned highest in the USNWR ranking have made judgments that differ from those hospitals lower down: on average they have chosen to hire physician-leaders as CEOs.

In the literature, vigilance about reliance on USNWR rankings is reported; some authors are more condemning (e.g. Halasyamani & Davis, 2007; McGaghie & Thompson, 2001) than others (e.g. Wang et al., 2007; Philibert, 2009; Souba, 2008). Philibert suggests (citing Schneider & Epstein, 1998, and Hannan, Stone, Biddle, & DeBuono, 1997) that 'the "America's Best Hospitals" rankings are valued by institutions and enjoy greater public recognition than more "scientific" sources of information on clinical quality available to patients and referring physicians' (2009, p. 178). Nevertheless, she points to Halasyamanti and Davis (2007), who contrast performance rankings based on adherence to clinical guidelines using Medicare program's 'Hospital Compare'. Medicare's 'Hospital Compare' is produced by the U.S. Department of Health and Human Services, and, like the USNWR ranking, it is designed to inform the public about the care offered to adult patients for a range of medical treatments in their local hospitals. Halasyamanti and Davis (2007) found an imperfect correlation for cardiac diagnoses and respiratory disorders between the highest-ranked hospitals in USNWR and those in 'Hospital Compare'. Philibert's (2009) main criticisms of the USNWR rating are that prestigious institutions stand to gain the most; high-profile hospitals can attract more qualified clinicians and this does not necessarily translate into a better learning environment; and in the USNWR ranking too much emphasis is placed on specialized medical services instead of prevention and health maintenance (Philibert, 2009, p. 183).

Discrepancies between rankings and other hospital-quality measures highlight the difficulty for researchers. In the UK there are disagreements about the two most commonly used hospital-performance indicators: the NHS's Care Quality Commission and Dr. Foster Research (see Thompson, 2009).

Cross-sectional analyses can only be suggestive of causality. The results in this paper are consistent with complementary evidence on the role of 'expert leaders' that is emerging from other (non-medical) areas – summarized for example in Goodall (2006, 2009a,b); Goodall, Kahn, & Oswald, 2011). Goodall argues that experts have the advantage that they have acquired a deep intuitive knowledge about the core business of their organizations and this may help with decision-making and institutional strategy. Falcone & Satiani (2008) suggest that a physician-leader who has spent years as a medical practitioner has acquired integrity that implies "walking the walk" (2008, p. 92) which, they argue, enhances a leader's credibility. Physician-leaders who have greater credibility may act as role models for medical staff and their presence may help hospitals to attract talented medical personnel. However, such explanations are merely suggestive; the mechanisms are not properly understood. The next, and vital, step for researchers is to design longitudinal inquiries into the possibility that physician-leaders improve the (later) performance of American hospitals. Other important variables, such as a CEO's tenure and the level and number of years of clinical experience that each CEO had obtained, could also be included. If it can be shown that physician-leaders improve hospital performance, then the ensuing empirical question to be addressed is why and how this happens – by examining the transfer processes through which hospitals are influenced by their leaders' actions.

Conclusion

There has been much discussion in the USA, and increasingly in the UK, about the relative merits of having physicians and non-physician managers in leadership positions. Yet no evidence has been published one way or the other. Given the difficulty of creating objective hospital performance measures, it is necessary to be cautious in empirical work. This paper does not establish that physicians make more effective leaders when compared with professional managers; but it starts the empirical process. It finds – in each of three disciplinary fields – that hospitals positioned higher in the US News and World Report's "Best Hospitals" ranking are led disproportionately by physicians.

Acknowledgments

For valuable discussions, I thank: Nick Bloom, the late Yvonne Carter, Julian Le Grand, Paul Nightingale, Andrew Oswald, Devin Pope, Jenny Simpson, Stephen Smith, James Stoller and Steven Thornton. For helpful comments on the paper I am grateful to Peter Davis, Senior Editor, and three anonymous reviewers. Thanks also to the Leverhulme Trust for funding my research fellowship.

Appendix. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.socscimed.2011.06.025.

References

America's Best Hospitals. (2009). *Methodology and ranking, produced by Research Triangle Institute (RTI) international*. available at http://www.rti.org/pubs/abhmethod_2009.pdf.

Candace, I., & Giordano, R. W. (2009). Doctors as leaders. *British Medical Journal, 338*, b1555.

Chaudry, J., Jain, A., McKenzie, S., & Schwartz, R. W. (2008). Physician leadership: the competencies of change. *Journal of Surgical Education, 65*, 213–220.

Darzi, A. (2008). *High quality care for all: NHS next stage review final report*. London: Department of Health.

Darzi, A. (2009). A Time for revolutions — the role of physicians in health care reform. *New England Journal of Medicine, 361*, e8.

Dwyer, A. J. (2010). Medical managers in contemporary healthcare organisations: a consideration of the literature. *Australian Health Review, 34*, 514–522.

Fairchild, D. G., Benjamin, E. M., Gifford, D. R., & Huot, S. J. (2004). Physician leadership: enhancing the career development of academic physician administrators and leaders. *Academic Medicine, 79*, 214–218.

Falcone, B. E., & Satiani, B. (2008). Physician as hospital chief executive officer. *Vascular and Endovascular Surgery, 42*, 88–94.

Goodall, A. H. (2006). Should research universities be led by top researchers, and are they? *Journal of Documentation, 62*, 388–411.

Goodall, A. H. (2009a). Highly cited leaders and the performance of research universities. *Research Policy, 38*, 1079–1092.

Goodall, A. H. (2009b). *Socrates in the boardroom: Why research universities should be led by top scholars*. Princeton and Oxford: Princeton University Press.

Goodall, A. H., Kahn, L. M., & Oswald, A. J. (2011). Why do leaders matter? A study of expert knowledge in a superstar setting. *Journal of Economic Behavior and Organization, 77*, 265–284.

Gunderman, R., & Kanter, S. L. (2009). Educating physicians to lead hospitals. *Academic Medicine, 84*, 1348–1351.

Halasyamani, L. K., & Davis, M. M. (2007). Conflicting measures of hospital quality: ratings from "Hospital Compare" versus "Best hospitals". *Journal of Hospital Medicine, 2*, 128–134.

Halligan, A. (Jul 7 2008). Aidan Halligan on why Darzi needs clinical leadership. *Health Services Journal*.

Hannan, E. L., Stone, C. C., Biddle, T. L., & DeBuono, B. A. (1997). Public release of cardiac surgery outcomes data in New York: what do New York state cardiologists think of it? *American Heart Journal, 134*, 1120–1128.

Horton, R. (2008). The Darzi vision: quality, engagement, and professionalism. *The Lancet, 372*, 3–4.

McGaghie, W. C., & Thompson, J. A. (2001). America's best medical schools: a critique of the U.S. news and world report rankings. *Academic Medicine, 76*, 985–992.

Philibert, I. (2009). Can hospital rankings measure clinical and educational quality? *Academic Medicine, 84*, 177–184.

Pope, D. G. (2009). Reacting to rankings: evidence from "America's best hospitals". *Journal of Health Economics, 28*, 1154–1165.

Schneider, E. C., & Epstein, A. M. (1998). Use of public performance reports. *Journal of the American Medical Association, 279*, 1638–1642.

Smith, S. K. (2009). The value of academic health science centres for UK medicine. *The Lancet, 373*, 1056–1058.

Souba, W. W. (2008). Rankings. *Journal of Surgical Research, 148*, 109–113.

Stern, D. T., & Papadakis, M. (2006). The developing physician — becoming a professional. *New England Journal of Medicine, 355*, 1794–1799.

Stoller, J. K. (2008). Developing physician-leaders: key competencies and available programs. *Journal of Health Administration Education, Fall*.

Stoller, J. K. (2009). Developing physician-leaders: a call to action. *Journal of General Internal Medicine, 24*, 876–878.

Stoller, J. K., Berkowitz, E., & Bailin, P. L. (2007). Physician management and leadership education at the Cleveland clinic foundation: program impact and experience over 14 years. *Journal of Medical Practice Management, 22*, 237–242.

Thompson, G. (2009) *Indicators of hospital performance*. Care Quality Commission and Dr. Foster Research, House of Commons Standard Note: SN/SG/5237.

Wang, O. J., Wang, Y., Lichtman, J. H., Bradley, E. H., Normand, S. T., & Krumholz, H. M. (2007). "America's best hospitals" in the treatment of acute myocardial infarction. *Archives of Internal Medicine, 167*, 1345–1351.

Yasaitis, L., Fisher, E. S., Skinner, J. S., & Chandra, A. (2009). Hospital quality and intensity of spending: is there an association? *Health Affairs, 28*, W566–W572.