

**Efficiency in hospitals owned by the  
Iranian Social Security Organisation:**

Measurement, determinants, and  
remedial actions

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# PAPERS PUBLISHED, SUBMITTED AND PRESENTED DURING CANDIDATURE

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## PEER REVIEWED

**Hajialiafzali H**, Moss JR, Mahmood MA. Efficiency measurement for hospitals owned by Iranian Social Security Organisation. *Journal of Medical Systems* 2007; 31: 166-172.

**Hajialiafzali H**, Moss JR, Mahmood MA. A conceptual health-oriented framework to select the most appropriate variables for measuring hospital efficiency in Iran. *Eastern Mediterranean Health Journal* (under review).

## CONFERENCE PRESENTATIONS (ORAL)

- **Hajialiafzali H.**, Moss J.R., and Mahmood M.A. *Efficiency measurement for hospitals owned by the Iranian Social Security Organisation. 48th International OR (Operational Research) Conference.* City of Bath: UK; September 11-13, 2006, p. 45.
- **Hajialiafzali H.**, Moss J.R., and Mahmood M.A. *Efficiency measurement for hospitals owned by the Iranian Social Security Organisation. 3rd Annual Meeting Health Technology Assessment International (HTAi).* Adelaide: Australia; July 2-5 2006, p.133.
- **Hajialiafzali H.**, Moss J.R., and Mahmood M.A. *Construction of a model for hospital efficiency measurement: the application of a broader set of variables. 4th Health Services and Policy Research Conference.* Canberra: Australia; November 14-16, 2005, p. 62.
- **Hajialiafzali H.**, Moss J.R., and Mahmood M.A. *Construction of a health-oriented framework to select the most appropriate variables in hospital efficiency measurement using DEA. 17th Triennial Conference of the International Federation of Operational Research Societies (IFORS).* Hawaii: USA; July 11-15, 2005, p. 106.
- **Hajialiafzali H.**, Moss J.R., and Mahmood M.A. *Hospital efficiency measurement: challenges in selecting the most appropriate variables. Public Health Association of Australia and Australasian Faculty of Public Health Medicine joint conference 'Public Health Futures – Research and Practice',* Adelaide, Australia, October 9, 2004. p.10.

# ABSTRACT

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Given the need to ensure the best use of scarce resources, increasing emphasis is being placed on hospital efficiency measurement. In the literature about hospital efficiency measurement, there is an absence of a well-defined framework to select the most appropriate set of input and output variables. Variables used in hospital efficiency studies predominantly reflect a narrow view of hospital functions with a little attention to quality variables. This implies that the hospital goal and its full range of functions in efficiency measurement are poorly understood.

While numerous studies have been undertaken in developed countries, there have been only a few attempts at measuring hospital efficiency in developing countries. However, there has so far been no systematic attempt, using frontier-based techniques, to measure the efficiency of Iranian hospitals, and to identify factors affecting efficiency and remedial actions to improve efficiency.

By focusing on the above two issues, this thesis makes three arguments. First, by undertaking an in-depth investigation regarding the multi-product nature of hospitals, considering a fuller range of hospital functions, and the values of various stakeholders including patient, staff, and community, this study has proposed a health-oriented framework with a focus on the Iranian hospitals to select the most appropriate variables for measuring hospital efficiency. I argue that both variables (existing in the literature, and discussed for addition) should be taken into account in order to enhance the validity of hospital efficiency studies.

Second, two types of techniques (simple ratio analysis and data envelopment analysis) were used for measuring the technical efficiency of hospitals owned by the Iranian Social Security Organization (SSO). The benefits and shortcomings of each method were discussed. For example, considering major surgery rates, which implicitly provide information about the case-mix, has revealed that all high-turnover, high-occupancy outlying hospitals as well as the majority of hospitals falling in the relatively well-performing quadrant in the Lasso diagram had a low major surgery rate. This suggests that simple ratio analysis can only measure the performance of hospitals over a single dimension ignoring their multi-input and multi-output nature of hospitals.

Using Data Envelopment Analysis (DEA), I measured technical efficiency, scale efficiency, and types of returns to scale for the SSO hospitals. In addition to studying their overall and relative efficiency, I analysed the magnitude of the inefficiency for each individual hospital. The results revealed that 22 of the 53 hospitals were deemed to be efficient. Inefficient hospitals had an average score of 78%, implying a potential reduction in all inputs on average by about 22% with no impact on output levels. The comparison of DEA results and simple ratio analysis has revealed that hospitals with an exceptional performance on individual variable even though less valuable compared with other variables can gain a full efficiency score. This critical analysis of the study strongly suggests that the findings obtained from unconstrained DEA should be interpreted with caution.

Finally, in addition to simply measuring efficiency, it was felt that a better understanding of the factors affecting hospital efficiency and remedial actions to improve efficiency is needed. Using qualitative methods, a complex mix of organisational factors such as hospital financing, political influences such as political pressures in determining hospital location, and the training and experience of the managers were argued to be influential factors in hospital efficiency. The interviews also provided a great insight into remedial actions such as reforms in the regulatory framework and corporatization.

# DECLARATION

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This thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis being made available in the University Library.

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**Hajialiafzali H**, Moss JR, Mahmood MA. Efficiency measurement for hospitals owned by the Iranian Social Security Organisation. *Journal of Medical Systems* 2007; 31: 166-172.

**Hossein Hajialiafzali**

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# ABBREVIATIONS

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<b>AHRQ</b>	Agency for Health Care Research and Quality
<b>ALOS</b>	Average Length of Stay
<b>BOR</b>	Bed Occupancy Rate
<b>BTR</b>	Bed Turnover Rate
<b>CRS</b>	Constant Returns to Scale
<b>DALY</b>	Disability Adjusted Life Years
<b>DEA</b>	Data Envelopment Analysis
<b>DMU</b>	Decision Making Unit
<b>DRG</b>	Diagnosis Related Groups
<b>DRS</b>	Decreasing Returns to Scale
<b>FTE</b>	Full Time Equivalent
<b>GDP</b>	Gross Domestic Product
<b>HDI</b>	Human Development Index
<b>HPH</b>	Health Promoting Hospital
<b>IRS</b>	Increasing Returns to Scale
<b>QALY</b>	Quality Adjusted Life Years
<b>SFA</b>	Stochastic Frontier Analysis
<b>SSO</b>	Social Security Organisation
<b>VRS</b>	Variable Returns to Scale
<b>WHO</b>	World Health Organisation
<b>WIES</b>	Weighted Inlier-Equivalent Separations

# GLOSSARY

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<b>Benchmarking analysis</b>	The comparison of service providers against a benchmark or ideal level of performance chosen on the basis of performance over time or across a sample of comparable service providers, or an externally set standard.
<b>Constant returns to scale</b>	Where a given percentage increase in inputs will lead to the same percentage increase in outputs.
<b>Data Envelopment Analysis (DEA)</b>	A mathematical programming method for estimating the efficient production frontier and measuring the relative level of efficiency based on a measure of distance to the frontier.
<b>Decision Making Units (DMU)</b>	DMU is the name used by Charnes et al (1978) to describe the units being analysed in DEA. It refers to the entity (such as hospital, school, etc) which is regarded as being responsible for converting inputs into outputs.
<b>Decreasing returns to scale</b>	A property of a production function of the DMU such that changing all inputs by the same proportion changes output less than in proportion.
<b>Increasing returns to scale</b>	A property of a production function of the DMU such that changing all inputs by the same proportion changes output more than in proportion.
<b>Iranian Social Security Organisation (SSO)</b>	The SSO provides different range of social benefits including health care services for 40% of the Iranian population (28 million). The SSO, after the Ministry of Health, is the main institutional source in hospital care in Iran. In the financial year 2002-03, the SSO operated 59 hospitals with around 8,200 beds.
<b>Peer group</b>	A peer group of an inefficient unit is the set of efficient units to which the inefficient unit has been most directly compared when calculating its efficiency rating.
<b>Stochastic Frontier Analysis (SFA)</b>	An econometric method of estimating the efficient cost or production frontier for measuring the level of efficiency for service providers. A deviation from the frontier is assumed to be the results of inefficiency or random error.
<b>Targets</b>	The values of the inputs and outputs which would result in an inefficient unit becoming efficient.
<b>Variable returns to scale</b>	Where a given percentage of increase in inputs will lead to a larger or smaller percentage increase in output.