



## Review

# The efficiency of health care production in OECD countries: A systematic review and meta-analysis of cross-country comparisons



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## ABSTRACT

There has been an ongoing interest in the analysis and comparison of the efficiency of health care systems using nonparametric and parametric applications. The objective of this study was to review the current state of the literature and to synthesize the findings on health system efficiency in OECD countries. We systematically searched five electronic databases through August 2014 and identified 22 studies that analyzed the efficiency of health care production at the country level. We summarized these studies with view on their sample, methods, and utilized variables. We developed and applied a checklist of 14 items to assess the quality of the reviewed studies along four dimensions: reporting, external validity, bias, and power. Moreover, to examine the internal validity of findings we meta-analyzed the efficiency estimates reported in 35 models from ten studies. The qualitative synthesis of the literature indicated large differences in study designs and methods. The meta-analysis revealed low correlations between country rankings suggesting a lack of internal validity of the efficiency estimates. In conclusion, methodological problems of existing cross-country comparisons of the efficiency of health care systems draw into question the ability of these comparisons to provide meaningful guidance to policy-makers.

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## 1. Introduction

The need for a sustainable, efficient, and effective health care system is a major ongoing topic, which concerns nations worldwide. In the past decades, health care spending in OECD countries has been rising dramatically. While the mixture of private and public providers differs across countries, on average, more than 70% of total health care expenditure in OECD countries came from public sources in 2013 [1]. It is therefore not surprising that policymakers

show particular interest in understanding how different health systems work, and whether the resources invested in the health care sector produce good outcomes or whether there is scope for improving value for money.

Starting with the seminal work of Farrell [2] there has been an explosion of studies developing methods and calculating efficiency relative to a best-practice production frontier. Frontier methods are broadly classified into nonparametric methods, such as Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH), and parametric methods, such as Stochastic Frontier Analysis (SFA). Nonparametric and parametric methods each have relative strengths and weaknesses against one another and researchers view them as competing or sometimes complementary approaches. The methodology of nonparametric and parametric efficiency analysis in health care are

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described in detail in Coelli [3], Jacobs et al. [4] and elsewhere.

The extensive review of Hollingsworth [5] of 317 papers and book chapters published up to mid-2006 revealed that most efficiency studies in health care settings focused on the micro-level perspective, mostly analyzing the efficiency of hospitals or nursing homes within one country. International comparisons of health care system efficiency can potentially provide a rich source of evidence and can influence policy decisions by outlining reforms for improvements. Initiatives such as Organisation for Economic Co-operation and Development (OECD) Health data [1] and World Health Organization (WHO) Health statistics [6] have made cross-country data increasingly available and have given rise to the macro-level analyses of health care system efficiency.

To our best knowledge, no systematic review of studies analyzing the efficiency of health care systems in OECD countries has been conducted so far. Hence, the goal of this study is to systematically review the current state of literature and to synthesize the findings on health system efficiency across OECD countries. In particular, we summarize the included studies with view on their sample, methods, and variables used to describe health care production and to explain differences in efficiency estimates. Next, we develop and apply a checklist of 14 items to assess the quality of the reviewed studies along four dimensions: reporting, external validity, bias, and power. Moreover, we perform a meta-analysis of the efficiency estimates reported in some of the reviewed studies to analyze the stability of the efficiency rankings of OECD countries. The study concludes with a discussion of methodological and policy implications.

## 2. Methods

### 2.1. Search strategy

To identify studies performing cross-country comparisons of the efficiency of health production with a focus on OECD countries we searched for studies published through August 2014 in English in five electronic databases: Business Source Complete, CINAHL, EconLit, MEDLINE, and Web of Science. These databases provide a solid selection of economic, policy, and managerial studies. To draw out a broad range of relevant studies, the search algorithm included terms on efficiency or productivity, efficiency methods, and cross-country comparisons. The following search algorithm was used: (“*efficienc\**” OR “*productiv\**” OR “*inefficienc\**”) AND (“*data envelopment*” OR “*DEA*” OR “*stochastic frontier*” OR “*SFA*” OR “*parametric*” OR “*econometric*” OR “*non-parametric*” OR “*nonparametric*”) AND (“*health care*” OR “*healthcare*” OR “*health system\**”) AND (“*count\**” OR “*OECD*” OR “*cross-count\**” OR “*international*”). We subsequently extended our search by looking through the reference sections of the studies identified in the databases.

In order to be included in the review, a study had to satisfy the following inclusion criteria: (1) a study had to empirically estimate efficiency, (2) a study had to have health care systems as the unit of analysis, (3) a study had

to include OECD member countries in the analysis, and (4) a study had to be published in a peer-reviewed journal. We excluded, thereby, review studies, studies relying on descriptive methods, working papers, studies focusing only on developing countries, studies focusing on different measures (e.g., productivity change), studies looking at the efficiency of only a part of the health care system (e.g., hospital sector), and studies severely lacking consistent reporting. Two authors performed the selection of the studies independently of each other to reduce the selection bias.

### 2.2. Quality assessment checklist

To develop the checklist of items for quality assessment, we used the literature on the assessment of the quality of health care interventions [53,54], observational studies [55], and efficiency analyses [5]. We evaluated the reviewed studies according to the following four dimensions (adapted from the five dimensions of Downs and Black [53]): reporting (5 items), external validity (2 items), bias (5 items), and power (2 items).

The reporting dimension ensured that the study provides sufficient information to enable an unbiased evaluation of the findings. The five items in the reporting dimension controlled whether the reviewed studies outlined their objectives, described the underlying economic theory, clearly defined their input and output variables, comprehensively presented the main findings, and discussed the study limitations. The two items from the external validity dimension addressed the inclusiveness of the analyzed sample and the comparability of the analyzed countries against a common frontier. The bias dimension contained the following five items: data accuracy, the appropriateness of used techniques, the presence of outliers, the curse of dimensionality, and potential bias in the second-stage analysis. The power dimension assessed whether the authors provided evidence that the study findings were not an artifact of chance. The two items in the power dimension concerned performing sensitivity analyses and providing confidence intervals for the estimated efficiency scores.

All items in the quality assessment checklist were scored 0 (no/unclear) or 1 (yes). One item addressed the sources of potential bias in the second-stage analysis and was thereby only applicable to studies conducting a second-stage analysis. The total maximum score was 13 for studies that did not conduct a second-stage analysis and 14 for studies that conducted a second-stage analysis. The maximum score (100%) for each study was based only on the items that were applicable for that study design. The checklist of 14 items is provided in Appendix A.

### 2.3. Meta-analysis

To assess the consistency of the efficiency estimates for OECD countries from different studies and models, we conducted a meta-analysis of the reported findings. We did not include in the meta-analysis the efficiency estimates if they were based on a combined analysis of developed and developing countries because the efficiency estimates for OECD

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