



# The impact of healthcare spending on health outcomes: A meta-regression analysis



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## ARTICLE INFO

### Article history:

Received 9 May 2016

Received in revised form

1 February 2017

Accepted 14 February 2017

Available online 20 February 2017

### Keywords:

Healthcare spending

Mortality

Life expectancy

Publication bias

Meta-regression

## ABSTRACT

While numerous studies assess the impact of healthcare spending on health outcomes, typically reporting multiple estimates of the elasticity of health outcomes (most often measured by a mortality rate or life expectancy) with respect to healthcare spending, the extent to which study attributes influence these elasticity estimates is unclear. Accordingly, we utilize a meta-data set (consisting of 65 studies completed over the 1969–2014 period) to examine these elasticity estimates using meta-regression analysis (MRA). Correcting for a number of issues, including publication selection bias, healthcare spending is found to have the greatest impact on the mortality rate compared to life expectancy. Indeed, conditional on several features of the literature, the spending elasticity for mortality is near  $-0.13$ , whereas it is near to  $+0.04$  for life expectancy. MRA results reveal that the spending elasticity for the mortality rate is particularly sensitive to data aggregation, the specification of the health production function, and the nature of healthcare spending. The spending elasticity for life expectancy is particularly sensitive to the age at which life expectancy is measured, as well as the decision to control for the endogeneity of spending in the health production function. With such results in hand, we have a better understanding of how modeling choices influence results reported in this literature.

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## 1. Introduction

Increases in healthcare spending have garnered much attention among academics, policymakers, and the public at large. Across OECD countries, for example, healthcare spending is currently averaging nearly 10% of GDP, and at over 17% in the United States is quite disconcerting to many (OECD, 2015). At the same time, there have been noticeable advances in health outcomes. For instance, the average infant mortality rate among OECD countries has fallen more than 80 percent since 1970, while average life expectancy has increased roughly 15 percent over the same period (OECD, 2015).

In light of these observations, it is not surprising that studies have examined the link between healthcare spending and health outcomes. Typically utilizing a production function approach,

whereby healthcare spending is an input into the production of health, these studies regress health outcomes (most commonly a mortality rate or life expectancy) on healthcare spending and other determinants. Such studies report multiple estimates of the elasticity of health outcome with respect to healthcare spending (defined as the ratio of the percentage change in health outcome to the percentage change in healthcare spending), which we label as the 'spending elasticity'. While most spending elasticities fall within the inelastic range, there is significant variation in elasticities. For instance, with respect to mortality, some studies (e.g., Hitiris and Posnett, 1992) report spending elasticities in the neighborhood of zero, implying that spending has little influence on mortality, whilst other studies (e.g., Crémieux et al., 1999) report spending elasticities significantly greater than zero in absolute value. Similarly, in regards to the impact of healthcare spending on life expectancy, some studies report larger spending elasticities (e.g., Akinkugbe and Mohanoe, 2009) compared to other studies (e.g., Guindon and Contoyannis, 2012).

Since the efficacy of healthcare policy is often tied to the relationship between healthcare spending and health outcomes, it is important to understand why spending elasticities differ in the

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literature. For instance, if the spending elasticity is typically found to differ across types of spending, then such findings could be used to promote particular forms of spending over others. Accordingly, in this new quantitative review of this literature, we examine differences in spending elasticities by conducting a meta-regression analysis (MRA). Focusing on studies which utilize a mortality rate or life expectancy as health outcomes, there are three objectives of our study. First, given that publication selection bias has been detected in other systematic reviews of health economics literature (e.g., see [Costa-Font et al., 2011](#); [Doucouliagos et al., 2012](#)), we assess its influence on reported spending elasticities. Second, we assess the influence of study attributes on spending elasticities by estimating several meta-regressions. To examine the robustness of the results, meta-regressions differ in several respects, including amongst others, model specification and methods used to weight observations. Third, based on our results, we construct predicted spending elasticities for the mortality rate and life expectancy.

The remainder of the paper is organized as follows. In [Section 2](#) we discuss the methods used to identify the studies included in the analysis. This is followed in [Section 3](#) with a summary of the included studies. In [Section 4](#) we discuss several issues associated with the meta-data, which is followed in [Section 5](#) with a description of the MRA model. Estimation procedures and results are presented in [Section 6](#), while concluding comments are provided in [Section 7](#).

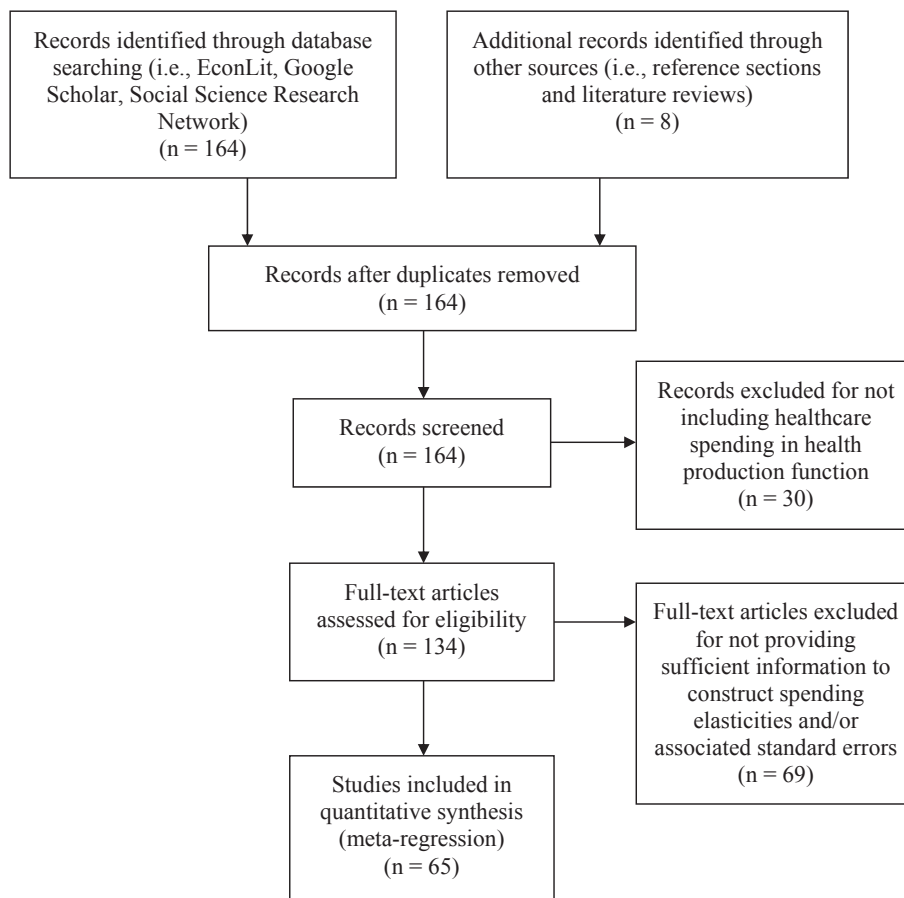
## 2. Methods

There is much literature on the relationship between healthcare

spending and health outcomes. Following MAER-net guidelines ([Stanley et al., 2013](#)), which require that an MRA examine a comparable effect size (in our case, the spending elasticity) within a literature, since the bulk of the literature on healthcare spending and health outcomes uses either a mortality rate (i.e., number of deaths relative to a population) or life expectancy (i.e., average years expected to live) as indicators of health outcomes, we focus on these two health outcomes.

In line with recommended guidelines for conducting a meta-analysis (see [Liberati et al., 2009](#); [Stanley et al., 2013](#)), to identify the initial set of studies we performed multiple English language searches (over the 2014–15 period) on EconLit, Google Scholar, and Social Science Research Network (using combinations of the following keywords: “healthcare spending”, “healthcare expenditure”, “pharmaceutical spending”, “pharmaceutical expenditure”, “health outcomes”, “health status”, “life expectancy”, “mortality”, and “health production function”) for papers published (or completed, in the case of working papers) in 2015 or prior years. These electronic searches identified 164 studies (see [Fig. 1](#)). We further perused literature reviews (e.g., [Nolte and McKee, 2004](#); [Nixon and Ulmann, 2006](#)), as well as reference sections of all studies identified, to find 8 additional studies. Of these 172 studies, 8 were excluded for being duplicate studies, while 30 others were excluded for not including healthcare spending in the health production function.

As we discuss in [Section 4](#), in order to address publication selection bias, not only do included studies need to report spending elasticities, but they must also report associated standard errors or provide information allowing us to calculate standard errors. Of the



**Fig. 1.** PRISMA flow diagram of selection process.

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