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Review

Association between physician density and health care consumption: A systematic review of the evidence

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ABSTRACT

Background: Supplier-induced demand (SID) for health care could be a crucial factor of rising health expenditures. However, there is thus far no consensus on the topic.
Objective: To assess how physician density (physician-to-population ratio) and health care consumption correlate.
Methods: A systematic review of studies retrieved through electronic databases: Medline, Econlit, PsychINFO and Embase. Search, inclusion and quality appraisal were based on standard procedures and applied independently by two researchers.
Results: Twenty-five studies, generally of moderate quality, were included. Despite a substantial heterogeneity in study design and data modelling, a significant association between physician density and health care consumption was consistently observed. However, estimates varied according to a number of method parameters such as the definition of the dependent variable (physician volume or care intensity), the geographical entity or the medical specialty under consideration, and the adjustment for confounding factors.
Conclusions: The exact importance of SID and the underlying motivations remain poorly understood. We discuss technical issues for better SID assessment. In the absence of more accurate information, limiting physician supply as a measure of cost containment should also be considered cautiously.

Contents

1. Introduction

It is generally assumed that the utilization of health services is partly induced by the providers themselves [1]. In the early 1960s, Roemer already noted the existing correlation between the density of hospital beds and the rate of hospital stays and concluded that "a bed built was a bed filled" [2,3]. Extended to medical services, the "Roemer's Law" became the well-known 'supplier-induced demand' (SID). Thus the SID refers to the phenomenon of physicians deviating from their agency responsibilities

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to provide unnecessary care with the main objective of increasing their own pecuniary resources. Health expenditures are on the rise worldwide [4,5], and SID is considered a substantial contributor to it, together with economic growth, technical innovations and population ageing. This has been a strong argument to limit physician numbers in many countries, most often by restricting the number of medical trainees [6,7]. For instance, such *numerus clausus* was recently implemented in Belgium, a country where the very high physician density (35 medical doctors per 10 000 inhabitants [8]) was considered by the late 1990s to not longer be financially sustainable [9].

However, there is thus far no consensus on the existence and the exact importance of SID. Different factors could explain such uncertainty. First, outcomes studied have varied considerably from patient health [10–12] and quality of care [13] to economic impact [14]. Second, a variety of appraisal strategies, from ecological studies to regression modelling of individual data, have been applied. Lastly, it remains difficult to distinguish inducement by suppliers and by patients themselves [15,13,16]. The diverse, and sometimes contradictory, resulting evidence has made a global appraisal difficult. Some authors have even underscored that SID, when present, is often of small magnitude [17] and could be context-dependent, particularly in relation to the medical fees scheme [11,18,19].

Considering the importance of the topic for policy-makers concerned in the fair allocation of public resources, as well as for health providers and patients, we systematically reviewed the scientific evidence on how physician density (physician-to-population ratio) and health care consumption correlate. Our review did not address specifically the link between physician density and income because income is fully correlated to activity volume when fees are pre-determined, while in other physician remuneration systems disentangling the relative contribution of those factors (i.e. modifications in fees and/or activity volume) is difficult [20]. However, it can be fairly assumed that an increased activity volume will result in higher income, regardless of the physician remuneration system.

2. Materials and methods

We searched the following electronic databases: Medline (access: OVID), Econlit (access: OVID), PsychINFO (access: OVID) and Embase (access: Embase.com). We combined, with the Boolean operators OR and AND, the following keywords in the four databases: induced demand OR supplier inducement OR supplier$ induced demand OR physician$ induced demand OR physician$ created demand OR physician$ initiated demand OR demand for physician$ service$ OR (demand creation AND health care) OR inducement hypothesis OR physician density OR competition in physician$ service$ market$ OR practitioner$ behavior$ OR physician$ behavior$ OR physician$ pricing OR physician$ utilization OR information$ (asymmetr$ AND health care) OR inefficien$ in physician$ practice$ OR (financial$ incentive$ AND health care).

We performed the search and the review during the first half of 2007 but used the OVID alert system to identify relevant papers subsequently published. Bibliographies of retrieved papers were scrutinized for relevant references. Grey literature was also searched using the same keywords in Google and Google Scholar.

Table 1
List of the criteria used for the critical appraisal.

1	Research question	Well explained
2	Study design	Appropriate to address the research question Cross-sectional or longitudinal Representativeness of the sample
3	Data quality	Source of data mentioned Quality check reported
4	Analysis	Methods clearly explained (management of outliers; modelling process) Appropriate statistics: cluster or multi-level accounted for; confidence intervals reported Validity of models: normality, heteroscedasticity and collinearity tested in case of regression modelling
5	Discussion	Internal validity External validity Conclusions supported by findings

The inclusion criteria were:

1. Studies addressing medical care utilization (number of medical services per physician and/or per patient) in relation to physician density (exposure variable). Studies focused on dentists, psychiatrists and physiotherapists were not considered.
2. Original studies (i.e. no opinion or methodological papers) based on individual empirical data, with analysis adjusted for the effect of at least one of the most common confounders: patient age, sex, socio-economic and health status and/or physician age and sex. Results adjustment for confounding factors is important to appraise actual size of associations in observational studies [10,16,21–25]. Studies based on data aggregated geographically (region, nation) were not included because such results adjustment on patient characteristics is difficult and because such studies are prone to ecological fallacy. An extensive illustration of problems induced by analyses of aggregated data was provided by Sorensen and Grytten [26].
3. Published in English, French or Dutch between 1980 and today.

The exclusion criteria were:

1. Studies focused on patient satisfaction.
2. Studies focused on the effect of physician density on medical fees.
3. Studies focused on the impact of medical fee scheme (co-payments) on healthcare consumption.

Two reviewers (CL and DR) independently screened all titles and abstracts, assessed fulfilment of inclusion criteria, and appraised study quality of included studies (Table 1). On the basis of those quality criteria, a global un-weighted score was issued for each paper (high (H), medium (M) or low (L) quality). At each step, disagreements between the two raters were solved by a consensus discussion involving the third author (SS).