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The Impact of Hospital Competition on Strategies and Outcomes of Hospitals: A Systematic Review of the U.S. Hospitals 1996-2016

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ABSTRACT

Purpose: This study aims to review the literature about the impact of hospital competition on strategies and outcomes of hospitals 1996-2016.

Design/methodology/approach: Four well-established databases including PubMed, Scopus, Google Scholar and Embase were chosen to perform a comprehensive search by using keywords related to completion, hospital, and various measures of competition. The search generated 9,806 articles. After removing the duplicates and eliminating the non-relevant publications by utilizing pre-determined criteria, 65 articles remained for abstraction.

Findings: The results indicated that majority of studies (about 88%) used Herfindahl-Hirschman Index (HHI) to measure hospital competition, whereas the remaining 12% used the number of competitors in the market. Forty studies (61%) defined hospital market based on Metropolitan Services Area, County, Health Services Area, Health Referral Region (HRR), Hospital Services Area, and Health Facility Planning Area, whereas the reminder used some other definitions such as Euclidian distance, radius, or patient-flow. Finally, concerning statistical relationships, out of 143 explored relationships, almost half of them found significant relationship between hospital competition and various outcome measures (35 positive and 38 negative), whereas the remaining 70 (or 49%) did not find any significant association.

Originality/value: This is the most current and comprehensive systematic review summarizing the result of different studies of hospital competition and its effect on specific hospital outcomes or strategies.

Keywords

Hospital Competition, Herfindahl-Hirschman Index, HHI, systematic review, market share

INTRODUCTION

Basic theories in economics support competition as a mechanism to improve quality of care and contain costs for health care institutions (Chang et al., 2011; Jiang, Friedman, & Jiang, 2013). Competition prevents monopolistic buyers or monopolistic sellers from manipulating prices in the market in their own favor, and thereby producing economical results that are neither equitable nor efficient. In a competitive market, the individual provider or payer does not have significant enough influence on the market to disrupt pricing. In functional competitive markets, the possibility of collusion among providers or buyers to fix the prices would be limited, fewer barriers to market entry would exist, and information about the price and quality would be more accessible. Because different geographic markets for health care services have structural and functional differences, there are competing models and measures of competitiveness used to characterize and study the effect of competition on the market.

Competition , especially among hospitals, is crucial phenomena due to market-oriented structure of U.S. health system (Antos, 2015). Although pricing of a product or service is the primary basis for purchasing decisions by consumers in traditional competitive markets, price competition in U.S. health care markets is disrupted by lack of price transparency and the prevalence of health care insurance. For the most part, the patients (i.e., consumers) have been protected from the cost consequences of their choices and have little concept or concern for the price of medical care at the point of purchase. Rather, the decision to use care is based on non-cost influences such as the amenities, services, and perceived quality of the provider. Providers in these competitive health care markets, in turn, can increase their market share by having or improving the various aspects of non-price competition, such as higher quality of care, more convenience, nicer amenities, and newer technologies (Fuchs, 1988). Ironically, in many cases, competition in health care works against the conventional market mechanisms and, instead, leads to better quality, services, and amenities, but at higher prices (Morrisey, 2001).

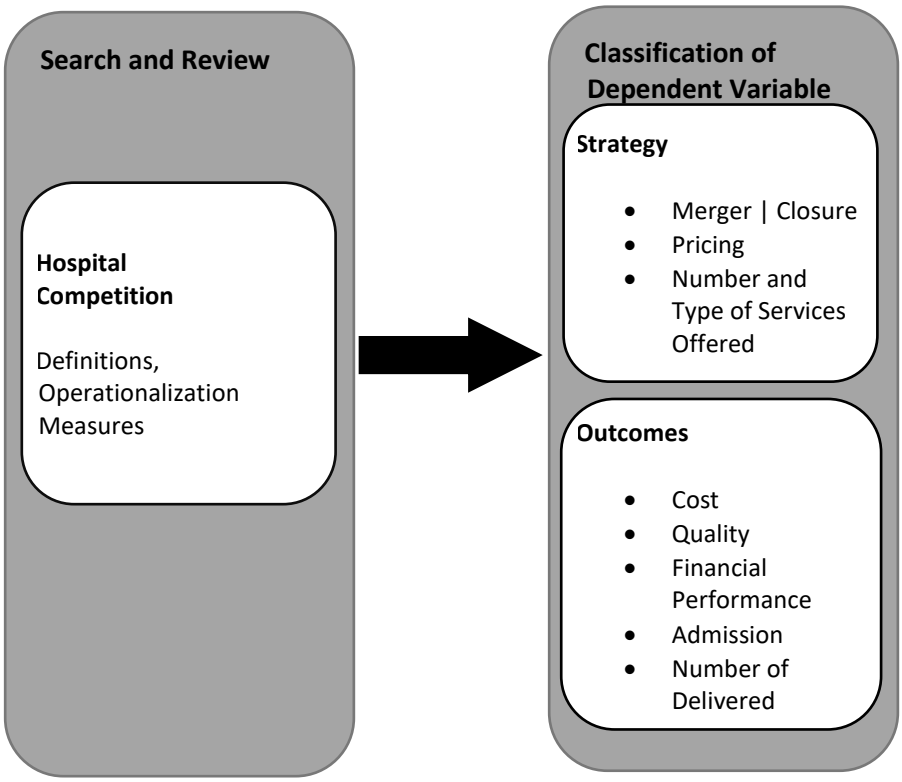
There is extensive empirical literature that examines the impact of competition on quality of care, patient satisfaction, pricing, types of provided care, cost of services, and financial performance of hospitals (Alexander & Lee, 2006; Bundorf et al., 2004; Burgess, Carey, & Young, 2005; Capps & Dranove, 2004; Kathleen, Carey, Burgess, & Young, 2011; Jan P Clement, White, & Valdmanis, 2002; Kessler & Geppert, 2005). While numerous studies have considered the impact of competition among providers in U.S. health care industry, few provide summary and analysis of the results of existing works. In fact, thus far there has been no comprehensive systematic review assessing the impact of hospital competition on strategies and outcomes of hospitals. Systematic reviews on competitive practices and outcomes are important and meaningful contributions to the body of knowledge in this area as they provide information and context for health service managers, researchers, and policymakers. This study contributes to the literature by deploying a comprehensive literature search; reviewing the impact of competition on various hospital outcomes and strategies; synthetizing existing measures of competition; and summarizing twenty years of academic literature (1996-2016) on hospital competition that would inform future studies.

CONCEPTUAL FRAMEWORK

The conceptual framework was build (Figure 1) on a preliminary literature review and categorized existing studies in relationship to hospital competition (various measures and operationalization), strategies, and outcomes of hospitals. Hospital strategy category has three variables including pricing, merger, and type of services. The hospital outcome category has six variables consisting of cost, financial performance, quality, admission, closure, and the number of delivered services (Figure 1).

In our conceptual framework, the left side on hospital competition focuses on various measures, definitions, and operationalization of hospital competition. Hospital competition is a measure whose importance and necessity for valuable research models are endorsed by many scholars. However, there is a considerable controversy on how to define hospital market and hospital competition (Wong, Zhan, & Mutter, 2005). Researchers have used patient flow, fixed and variable radius, and various geopolitical boundaries to define market, while measuring hospital competition using different methods such as Herfindahl–Hirschman Index (HHI), number of competitors, and overlap density (Wong, Zhan, & Mutter, 2005). Therefore, it is important to systematically summarize various market definitions and measures of competition that have been used by the researchers within last twenty years.

Figure 1. Conceptual Framework



Strategy variables are those identified as resulting from decision-making processes of the organization. While we recognize that many of the decisions made a subject of these studies are complex and may not be attributed exclusively to competition, we respect the hypothesis and findings as to the influence of competition on the outcome. The pricing of services is one such strategy variable this study identified. Hospitals may decrease or increase the price or pricing structure of services they offer for some reasons, including attempting to improve market share or in response to waning financial condition. Another two strategies that we put in one group due the few number of studies (only three articles) were merger and closure. Hospitals apply these strategies to mitigate the negative effects in highly competitive markets (Cutler & Scott Morton, 2013). We further consider that increasing or decreasing the number and type of healthcare services that a hospital offers in the market is a strategic decision and include this among the strategy variables in our classification.

In contrast, we categorized separately those articles reporting on studies investigating the impact of the competitive environment on outcomes that represent the progress toward presumed objectives of the organization. We inferred that subject organizations shared the conventional position that it is in the interest of the organization that costs be constrained and measures of productivity and quality increased. We organized studies with these parameters into six categories including cost, quality, financial performance, admission, and number of delivered services. Cost is presented as an outcome variable in several articles, measured as either the cost of delivering identified services or the cost of care for a specified patient population. Those studied were sorted into the category of financial performance used gross revenues or other widely accepted measures of profitability (e.g., total margin, return on asset, and operating margin). Quality of care was represented by a range of outcome measures and variables included those such as mortality rate, perceived quality of care, length of stay, multi-factor quality assessment models, surgery outcomes, and patient's choice of hospital. We included articles on patient flow measures with those examining the number of admissionsAlthough we appreciate that one may propose that exiting the market is a decision, and as such should be sorted as a strategy variable, we reject this premise and assume that closure occurs as an unavoidable demise of the organization. The number of services delivered by hospitals during study period is differentiated from the strategy variable (i.e., deciding number and type of services offered) in that measures of the later consider completed market transactions; progress toward increased revenue.

The following questions are based on the conceptual framework to guide us in this article:

1. In the various studies reviewed, what measure of hospital competition in the defined market was used?
2. What outcome variables have been used to evaluate the effect of competition?
3. What strategy variables have been used to evaluate the effect of competition?
4. What are the major results of existing studies assessing the relationship between hospital competition and selected outcome and strategy variables?

METHODS

This review was conducted by using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) as a guidance (Liberati et al., 2009) and included three major steps: (a) defining and identifying the keywords, (b) arranging keywords with Boolean operators (Figure 2) and using them in multiple searhers in multiple databases, (c) aggregating studies and applying a priori exclusion/inclusion criteria to determine the final set of studies for abstraction. Keywords to be used in the search method were compiled from previously published peer-reviewed articles proposing measures of competition in the healthcare market; defining the structure of the health care market; and establishing a theoretical basis by which the competitive environment influences organizational process and outcomes (e.g., Bernstein & Gauthier, 1998; Gaynor, Ho, & Town, 2015; Hirth, 1997). These keywords, depicted in Figure 2, were employed in an inclusive search strategy designed to obtain all potentially relevant articles. Comprehensive searches were performed in four well-known databases including Google Scholar, Embase, Scopus and PubMed.

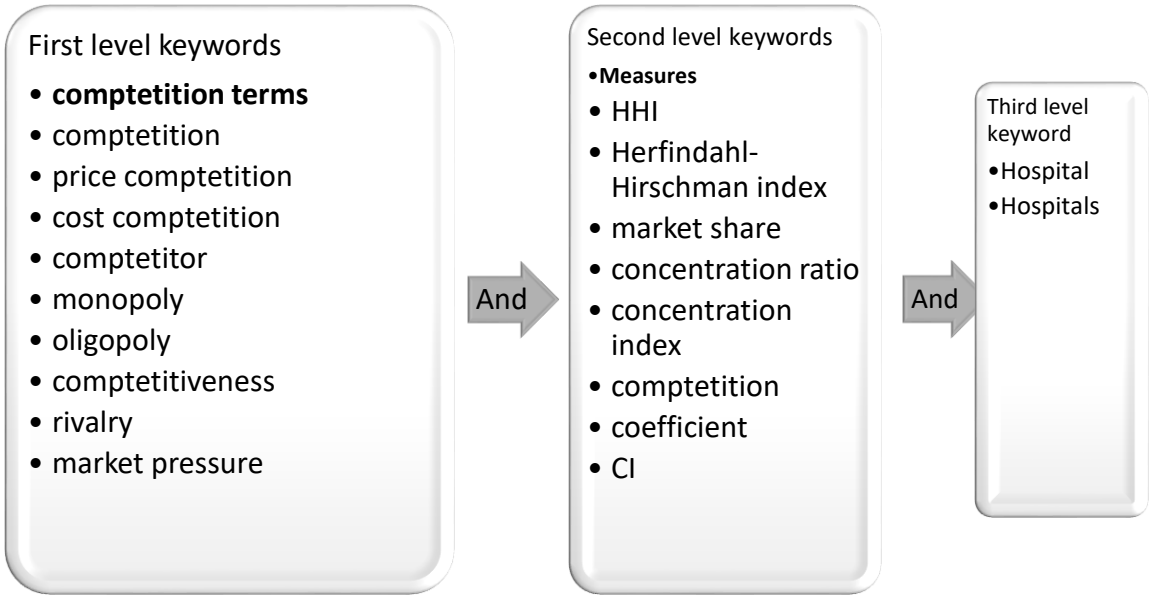


Figure 2: Keywords used in search

Results were filtered to include those articles with specified keywords in their titles or abstracts, published in English language between February 1996 and March 2016. Once abstracts were collected and reviewed, we applied the predetermined inclusion criteria. Specifically, the article was considered for inclusion and advanced to full text review if the article was (a) a quantitative empirical analysis; (b) of data collected after 1995; (c) on competition among U.S. hospitals; (d) subsequently published between February 1996 and March 2016; (e) in a peer-reviewed journal of good repute; (f) with the full text available in English.

Multiple searches generated 9,806 articles from four databases: 5,208 from Embase; 2,675 from PubMed; 706 from Scopus, and 242 from Google Scholar. All the articles were downloaded and saved into Thomson Reuters' EndNote Reference Management Tool. Duplicated results on 895 articles were removed and 8,911 remained for further review. Based on the study's established inclusion criteria, a large number of studies were excluded (n=8150), because they were not related to hospital competition. Further excluded were 62 articles using data that were collected before 1995, 126 articles reporting on data collected outside the U.S., 155 articles not of an empirical nature. The results included 104 articles that had one or more of the search terms in the title, but had no abstract and had to be excluded. After the abstract and title review, 572 articles remained and were forwarded for systematic review.

After full text review of the remaining articles, we excluded an additional 507 for the following reasons: 202 articles were not related to measurements of hospital competition; four articles used competition as a dependent variable; 28 were related to quality of care and patient satisfaction; 41 were studies related to hospital merger and acquisition; 32 were focused on statistical methods (e.g. descriptives, t-test, Anova) other than regression; 43 were review papers; 29 were studies related to markets in other countries; 26 were focused on competition among payers; 102 were focused on competition among healthcare providers other than hospitals, such as nursing homes, ACSs, medical production companies, or pharmaceutical industry. The 65 articles remaining after the full text review were abstracted in the current study. The multiple stage process for article review is summarized in Figure 3.

Information on each of the articles was tabulated in Microsoft Excel 2016 and included first author name and affiliation, published year, beginning and end years of the data analyzed, journal type, study objective, sample, study design, sample level, sample location, type of health facility, hospital type, hospital ownership, measure of competition used, how the market was defined (e.g., MSA, county, health service area, health referral region, or perimeter distance), measure of the market share (inpatient days, admissions, discharges, etc.), outcome variables, types of analyses, key findings related to competition, independent variables, and additional comments and notes. We also coded competition measurement, market definition, market shares, and significant relationships. Microsoft Excel 2016 and IBM SPSS version 23 were used for analyses. The results are summarized and reported as figures and tables in result section of current paper.

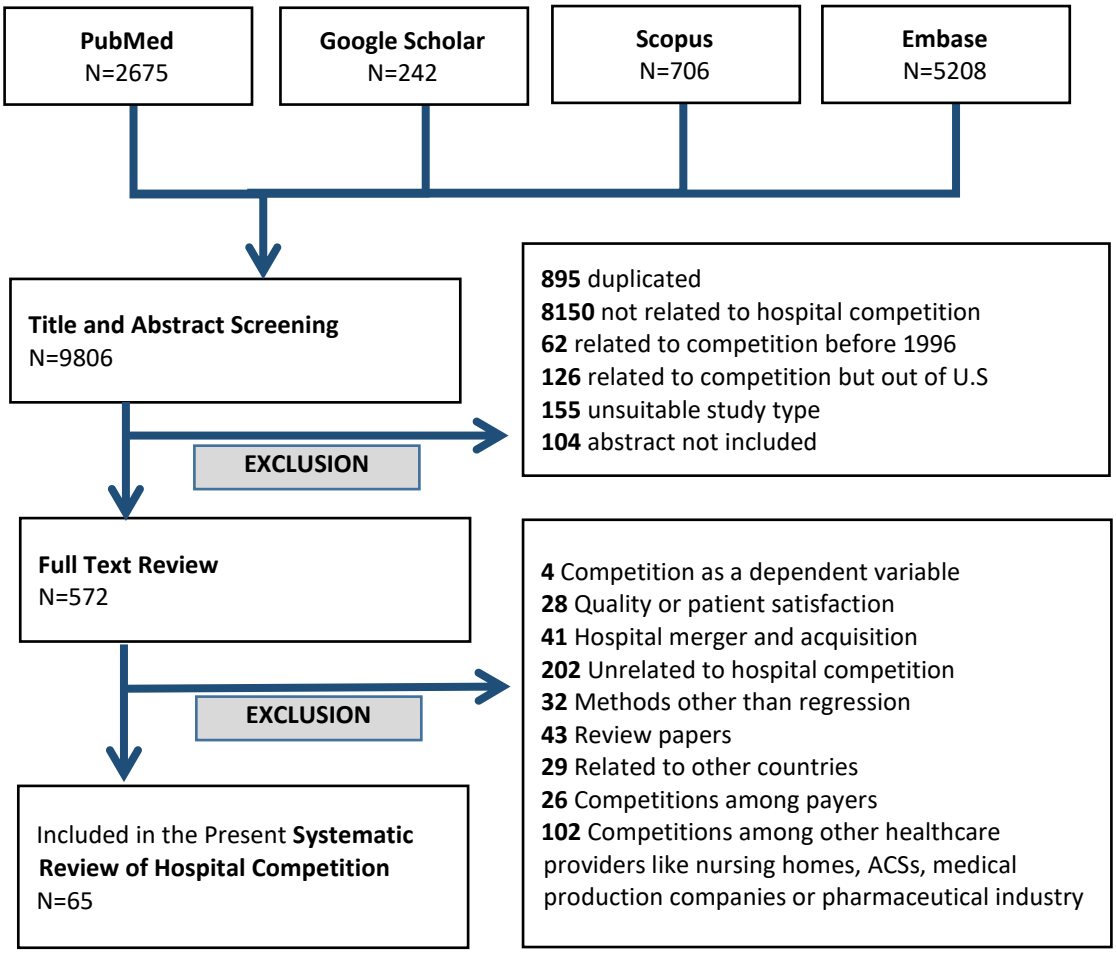


Figure 1. Process Map for Review and Inclusion (Adopted from PRISMA, Liberati et al., 2009).

RESULTS

From the 9,806 unique contributions produced by the extensive search and screened for inclusion, we conducted a full text review of 572 journal articles that potentially met the criteria established for the systematic review. The final analysis includes 65 studies conducted between 1996 and 2016. Qualitative summaries of these studies are exhibited in Appendix A and provide a comprehensive synopsis of the state of research on measures of competition among hospitals and their association with organizational process and outcomes within the last twenty years. Table 1 sets out descriptive statistics of abstracted studies on hospital competition and reported impact on strategies and outcomes of hospitals. About 61.5 percent of first authors are affiliated with Schools of Medicine or Health and Health-related academic programs. The vast majority (87.7%) of articles on this subject have been published in health related journals. Just under two-thirds of studies (63.1%) employed a longitudinal study design. Approximately half of articles (49.2%) were conducted at national level, and 52 percent of them were assessing the effect of competition in an urban hospital market. Moreover, majority of studies (86.2%) did not limit their study to hospital ownership and included all types of ownership

Table 1. Descriptive Statistics reviewed articles

Descriptive (N=65)		Count	Percentage
First Author Affiliation	Business School	4	6.2%
	Health/Medicine School	40	61.5%
	Non-academic Institution	9	13.8%
	Other Schools	12	18.5%
Journal Type	Business (Non-health)	8	12.3%
	Health-related	57	87.7%
Study Design	Cross-sectional	24	36.9%
	Longitudinal	41	63.1%
Sample Level	Multiple States	9	13.8%
	National	32	49.2%
	Single State	24	36.9%
Sample Location	Not limited to a subgroup	28	43.1%
	Rural	3	4.6%
	Urban	34	52.3%
	Hospital	63	96.9%
Hospital Type	Acute Care	51	78.5%
	Both	11	16.9%
	Specialty	3	4.6%
Hospital Ownership	For-profit	5	7.7%
	Non-Public (non-gov)	1	1.5%
	Not limited to a subgroup	56	86.2%
	Not-for-profit	3	4.6%
Total		65	100%

Figures 4 and 5, respectively, exhibits the frequency distribution of publications of the studies and periods of data collection for the individual studies that were analyzed in abstracted manuscripts. The highest number of publications during the period was in 1997, and there are fewer published articles on the topic over time; with only a single study report in 2015.

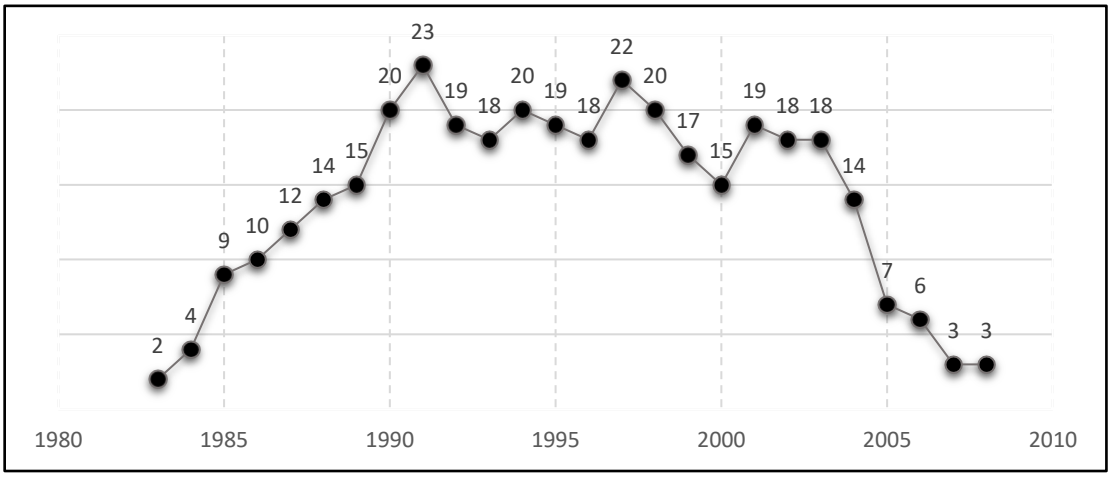


Figure 4. Distribution of study periods (N=65)

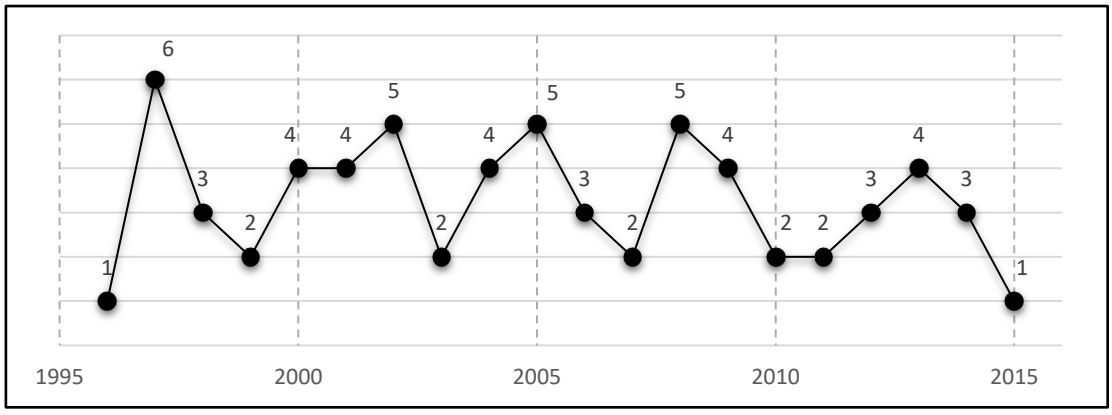


Figure 5. Distribution of publication (N=65) by publication year

Table 2 reports the frequencies of the dependent variables used in the included studies. It demonstrates that while there is consensus on the use of the Herfindahl-Hirschman-index (HHI) as a measure of market concentration, there is significant diversity of opinions concerning how to best define the market and calculate the organization's market share. Of all articles, 57 (88%) measure hospital competition using Herfindahl-Hirschman-index (HHI). Only eight (12%) articles used a different measurement; usually, the number of competitors in market. In defining and measuring the market, there is less commonality. The Metropolitan Service Area (MSA) defined the market more often than any other single measure, but represented less than 30 percent of all measures used. Measuring market share, however defined, was marginally better with about half of the published articles using number of admissions to calculate and organization's relative share. Six articles were sorted into an "other" category because the methodology section did not expressly define those measures or use more than one definition of market or share.

We classify each dependent variable into one of nine categories. Three are strategy variables (merger and closure, pricing and number and type of offered services), five are outcomes (cost, quality, financial performance, admission, and the outcomes-related articles, quality of care was the topic most often examined (N=22), and the fewest articles were devoted to the relationship between competition and number or type of services delivered. Pricing was the strategy variable in the greatest number of publications and services offered the least in publications during the period of the strategy type.

Table 2. Frequencies of Dependent Variables, by measure of competition, market definition, and share

		Strategies			Outcome variables						
	Variables	Merger / closure	Pricing	Number of Offered Services	Cost	Quality	Financial Performance	Admission	Number of Delivered Services	Others	Total
Competition measurement	HHI	1	9	1	11	19	9	3	2	2	57
	Non-HHI	2	0	0	1	3	1	0	0	1	8
Definition of Market	Health Service Area (HSA)	1	2	0	1	1	0	1	0	0	6
	County	1	1	0	3	3	3	1	0	0	12
	Metropolitan Service Area (MSA)	0	2	0	3	5	4	0	1	3	18
	Health Referral Region (HRR)	0	0	0	1	1	0	0	0	0	2
	15-mile radius from zip code	0	2	0	0	1	0	0	0	0	3
	Concentration	0	0	0	1	1	0	0	0	0	2
	Patient Flow	0	1	0	2	6	1	0	0	0	10
	Health Facility Planning Areas (HFPA)	0	0	1	0	0	1	0	0	0	2
	Hospital Service Area	1	0	0	0	2	0	0	0	0	3
	Euclidian Distance	0	0	0	0	0	0	1	0	0	1
	Others	0	1	0	1	2	1	0	1	0	6
Market Share Indicator	Inpatient Days	0	0	0	1	0	2	1	0	0	4
	Bed Number	0	2	1	0	4	1	0	0	0	8
	Admission	1	4	0	3	12	2	1	1	2	26
	Discharge	0	2	0	4	3	1	0	0	1	11
	Certain Services	1	1	0	3	2	2	1	0	0	10
	Others	1	0	0	1	1	2	0	1	0	6
Total		3	9	1	12	22	10	3	2	3	65

According to table 3, out of 167 relationship of review articles, 32 relationship were between cost variable and competition and 31 relationships were related to the competition and mortality. Out of 143 relationships, almost half of them (70) were not significant and the remaining half were distributed almost equally between positive (n=35) and negative (n=38).

Table 3. Frequencies of Hospital Competition Relationships by Dependent Variable Categories

Dependent Variable Categories	Negative Significant [a]	Positive Significant [a]	Insignificant relationship [b]	Total
Admissions	3	1	1	5
Asset	1	-	-	1
Closures	-	-	1	1
Cost	10	5	17	32
Discharges	-	-	1	1
Efficiency	1	-	2	3
LOS	-	-	2	2
Market overlap	-	1	5	6
Mortality	6	6	19	31
Occupancy rate	-	-	1	1
Other	2	1	1	4
Other clinical outcome	6	8	5	19
Price	2	4	7	13
Profit	2	2	1	5
Revenue	3	3	4	10
Staff	1	-	-	1
Strategies	1	4	3	8
Grand Total	38	35	70	143

DISCUSSION

Our purpose was to investigate the impact of hospital competition on strategy variables – those related to strategic decision-making – as well as outcome variables – those related to the organization's success in achieving its goals. Our findings underscore several important points and provide some guidance for future research. First, we observed that HHI is the dominant and widely accepted measure of hospital competition in the literature. Using simpler measures (i.e., number of competitors) that fail to not account for differences in size and market share of hospitals are not generally accepted as optimal measure of competition. HHI, in contrast, is widely regarded as the authoritative standard and is used by researchers, practitioners, and governmental agencies. The measure's computational ease, long standing and widespread use, and calculation that consider factors lost in the more intuitive notions of competition support its continued use, despite its weaknesses. The HHI does not consider other potentially mitigating factors such as geographical

location of the service providers and the quality of care. Despite these limitations, researchers as well as the Department of Justice and the Federal Trade Commission predominantly use HHI, because of its and absence of alternative measures (Baker, 2001).

Secondly, none of the two aforementioned competition measures captures the effect of state and federal level regulations, health insurance companies, or stakeholders on hospital competition. Another problem is the impact of the quality of care on patients' choice of different hospitals. In some areas, patients may be attracted to specific hospitals because of their monopolistic nature regarding having advanced and expensive technology, access to capital, or professional medical staff (Wong et al., 2005). It seems that more research needs to be done in this area to develop more comprehensive measurement of competition. We also suggest that there should be some consistency in regards to the methods and calculation of HHI.

Our third point pertains to the hospital market definition. More than half of the abstracted articles (40 or about 62%) defined hospital market based on metropolitan service area, county, health services area, hospital services area, and health facility planning areas. These approaches are usually called geographical boundaries. According to the literature, computational ease is the most important advantage of these methods (Baker, 2001; Wong et al., 2005). Capturing potential competitors and using available data to calculate competition are the other advantages. On the other hand, one of the problem with these approaches is the calculation of identical intensity of competition for all hospitals in a specific geographical boundary (i.e., market). In another words, there is no variation of HHI for hospitals located in a specific geographical market. Another problem is that these measures do not identify and account for the patients who were referred to hospitals from out of these boundaries and influence the market of hospitals either for availability of services or the quality of care (Baker, 2001; Wong et al., 2005). Moreover, the inconsistent use of various geographical market boundaries in different studies makes the comparison of these studies extremely difficult. Therefore, there is a need for more methodological studies similar to Wong et al. (2005) that compares various competition measures. This may lead to the adoption of more consistent measures of competition among researchers and make the comparison between studies more reliable. Such an endeavor may even lead to the merge of one of the geographical approaches with aforementioned patient focused approaches that consider differences in quality of care to obtain reliable and close to reality definition of market.

Our fourth point pertains to the assortment of variables that were used in the market share calculations such as inpatient days, acute care patient days, number of beds, admissions, and discharges. As shown in Table 2, many articles (26 or 40%) have used admissions to calculate market share. Discharges and service type were the second most used variables with frequencies of 11 and 10, respectively. Again, the inconsistent use of multitude of variables in calculating market share impedes the comparability of the findings of these studies. Therefore, we suggest more focus from the research community in developing some standards in calculating market share.

Our fifth point refers to some interesting findings that were exhibited as frequencies within certain categories in Table 2. The number of articles that utilized quality of care as outcome variables had the highest frequency (about 34%) and financial performance and pricing were the next most frequent dependent variables. On the other hand, there were only two articles using provided or

offered services as dependent variables. Studying the number and the type of services supplied by each hospital in different competitive environments can be very important, especially due to financial concerns. According to some studies, having overlap in provided services might lead to financial distress or closure of hospitals (Al-Amin & Housman, 2012). Literature shows that hospitals in a different competitive environment often offer or supply specific services as a differentiation strategy in their market. As a result, it seems that there is a gap in the literature about the impact of hospital competition on the type and number of services in hospitals. Such an information would be valuable since managers can use the result of these types of studies to add or remove services from their service line to become more efficient in their market.

Our sixth point pertains to the non-existence of prominent organizational behavior factors such as motivation, conflict, leadership, and culture. Studies in organizational behavior have identified factors such as motivation, conflict, type of leadership, organizational culture and organizational equity as an important predictor of hospital performance (Chen et al., 2015; Holt, 2012; Keroack et al., 2007). Moreover, organizational behavioral factors could strengthen or weaken the effects of external forces like competition. It appears that there is a gap in literature and this area is one of the areas that can be examined to see the impact of hospital competition on employees' motivation, organizational culture, conflict, organization climate, and power in organization, organizational equity, and so on.

Our seventh point refers to the underlined importance of quality of care within competition research. In our literature review, 22 of articles were related to the association between hospital competition and quality of care. Out of these 22 articles, about 86% (19) have used HHI as the measurement of hospital competition and only three of them used the non-HHI (number of competitors) measure. Even though, based on the association between quality of care and hospital competition does not seem to be consistent; these results may be due to the different measures of the quality of care and competition. For example, in some studies, the indicator for quality of care is mortality rate, readmission, or harmful effects of specific medicine or procedure. In these types of studies, the impact of hospital competition and the quality of care is negative in the sense that hospital competition reduce the rate of mortality, readmission, or harmful effects of medicine or procedures. Thus, the overall impact of hospital competition on quality of care is considered positive. This finding is important for hospital administrators and policy makers, given that hospitals tend to provide better quality of care in more competitive areas.

Our last point pertains to the findings of this literature review about the relationship between hospital competition and different outcome variable. According to our findings (see table 3), almost in 50 percent of articles that relationship is not statistically significant. The number of positive and negative significant relationship are equal. These results show an inconsistency in the impact of competition on different dependent variables. Thus, it is necessary to do empirical study to find out inconsistency in the relationships.

Our literature review had some limitations that should be acknowledged. First, due to our search limitation on the title and abstracts of articles, there is a possibility that we may have left out some studies. However, we attempted to overcome this limitation by carefully examining references of 65 abstracted studies and two seminal methodological articles on competition (Baker et al. 2001; Wong et al. 2005). Third, we concentrated on U.S hospitals, however, studying other countries

could be helpful to develop different perspectives from different countries and produce more comprehensive literature review.

CONCLUSION

This study is the most recent and comprehensive systematic review in hospital competition covering publications from 1996 to 2016. In this systematic review, we summarized the information about different aspects of 65 articles and identified potential research gaps for future studies.

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Appendix A: Studies that Utilized Hospital Competition as an Independent/Control Variable

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Al-Amin, et al (2012)	The relationship between general hospitals and Ambultary care settings has been examined	1997-2006/ 51 exits among 406 ASCs and nine exists among 222 hospitals/ cox proportional hazard model/ U.S. Florida	Overlap density and non-overlap density/ Health Service Area (HSA)/ Certain Service/Product	Bankrupt/ defunct or voluntarily terminated their license	High level of ASCs competition is related to high exit rate and also hospitals tend to be exit with high ASC density.
Alexander, J. A. et al (2006)	This article seeks the impact of board configuration on a range of performance in non for profit hospitals.	1985-1994/ 3090 non for profit hospitals/ U.S national	Market competition was measured by 1 minus the Herfindahl/ County/ Admissions index (the sum of the squared market share of all community hospitals in the county)	Number of admission	Result shows that corporate governance in compare to philanthropic governance is more likely to be efficient and have a large of market share.
Bamezai, A, et al (1999)	This paper explored the impact of HMO and PPO on cost growth and also the impact of interactive relationship between managed care market share and hospital competition on cost growth	1989-1994/ 4382 and 3904 hospitals for 1989 and 1994, respectively/ U.S national	We construct a hospital-level HHI from the 1989–1990 Medicare discharge data (MEDPAR) using actual zip code level patient flow data to define hospital markets/ patient flow/ Discharges	Change in annual operating costs	The result of this study shows that PPOs and HMOs constrained cost growth of hospitals in competitive environment.
Bazzoli, G, et al. (2006)	To study of influence of financial pressure resulting from the Balanced Budget Act and market forces on indigent health care	1996-2000/ 1693 urban general acute hospitals, U.S nation	HHI/ Health Service Area (HSA)/ Certain Service/Product	Admission	Higher HHI had association with more uncompensated care. In fact, in more competitive market uncompensated care is less.
Bian, J, et al (2006)	The authors estimated the market impact of hospital competition and HMOs penetration on emergence of ASCs	1992-2001/ 317 MSAs/ U.S national	HHI Herfindahl-Hirschman Index (HHI) from AHA admissions data	ASCs per 10,000 populations	A decrease from 5 to 4 equal-market-shared hospitals in a market is related with an increase of 2.5 ASCs per 1 million populations.

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Brooks, G, et al. (1997)	The purpose of this study is to demonstrate the hospitals characteristics impact merger behavior of hospital and also the characteristics of specific pairs of hospitals influence the probability of the pair engaging in a merger	1983-1992/ 110 hospitals/U. S California	Herfindahl index across all zip codes of residence of all patients admitted to the focal hospital/ Hospital Services Area/ Admissions	Merger incidence	The results illustrated that a specific pair of hospitals associated to degree of market overlap positively, but regarding individual hospitals and condition of rivalry, there is no relation between market share and hospital merger.
Brooks, J, et al (1997)	Determining the factors affecting price negotiating between hospitals and insurers	1988-1992/ 293,595 inpatient and 707 hospitals / U.S national	Because a large Herfindahl index may result from either high concentration or few hospitals, the number of hospitals was included to separate the two effects. The highly significant coefficient on the Herfindahl index across all specifications shows that increased hospital concentration leads to greater hospital bargaining power/ County/ Discharges	1-Actual payment for appendectomy episode Market area modeled list price for appendectomy episodes. 2-Medicare average payment for appendectomy episode of similar severity	The result showed that higher hospitals concentration improves hospitals' bargaining power
Bundorf, M, et al (2004)	To study the impact of market-level managed care program on the cost, treatment and outcomes of services for Medicare FFS acute myocardial infraction patients.	1994-1996/ 93,386 admission / U.S national	Hirschman-Herfindahl Index (HHI) based on the number of hospital beds/ Metropolitan Service Area (MSA)/ Number of Beds	Treatments, costs, and outcomes of care for Medicare AMI patients	Patient admitted to more competitive hospital market more likely to receive primary intervention, revascularization and cardiac catheterization, but higher competition does not effect on less invasive interventions.
Burgess, J, et al (2005)	This paper is looking to determine the relationship between hospital network and hospital pricing behavior during dynamic increase in hospital network.	1994-1998/ 1493 hospitals/ U.S California	Herfindahl–Hirschman Indexes (HHI) market definitions based on patient origin and accounting for network relationships/ Metropolitan Service Area (MSA)/ Discharges	Price index	We find a positive network effect on hospital pricing but not statistically significant.

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Capps, C, et al (2004)	Studying the impact of hospital consolidation on actual prices have been paid by PPOs	1997-2001/ not applicable/ U.S Several states	Hospital HHI. This measure accounts for competition localized down to the ZIP codes and major diagnostic categories from which each hospital draws its patient and System HHI. we computed Change in HHI: The System HHI minus the Hospital HHI / patient flow/ Admissions	the log of the con-tract price (either per discharge or diem)	The authors found that consolidation give this ability for hospitals to increase prices in three of four studied markets.
Carey, K, et al (2008)	To compare he cost of physician owned hospitals with general hospitals.	1998-2004/ 389 hospitals/ U.S Texas, Arizona and California	Herfindahl–Hirschman Index (HHI), based on patient flows to obtain coronary artery bypass graft surgery/ Health Service Area (HSA)/ Certain Service/Product	Costs	Findings do not support that specialty hospitals are more efficient than general hospitals. Orthopedic and surgical hospital were more cost efficient than general hospitals.
Carey, K, et al (2011)	This paper examines the impact of ASCs competition on cost, revenue and profit margins of hospitals which providing ASCs' services.	1997-2004/ 742 unique hospitals/ U.S Arizona, California, and Texas	The competitive market areas were the Hospital Referral Regions (HRRs), regional health-care markets defined/ Health Referral Region (HRR)/ Inpatient Days	Cost, revenue and profit margin	The result of regression analyses shows significant impact of ASCs on hospitals market. Downward force has been observed on cost, revenue and profits of hospitals with ASCs presence
Chang, D, et al (2011)	This study determines the association of hospital competition and gross charges	2000-2003/ 1,492 hospitals/ U.S National	Herfindahl-Hirschman Index (HHI) calculated by The Agency for Healthcare Research and Quality for each hospital based on its patient-flow market. /Four definitions of hospital market areas were used: geopolitical boundaries, fixed radius, variable radius, and patient flow. / Certain Service/Product	Total Hospital Charge and Hospital Cost Estimate	Greater level of competition is related to greater hospital gross charge. However, there was no relationship between competition intensity and hospital costs.
Chou, S, et al (2014)	The impact of using report cards on the quality of care in competitive market of hospitals	1995-2004/ 76,862 patients/ U.S Pennsylvania	We therefore calculate HHIs using predicted market shares for residential zip codes rather than the actual market shares of admitting hospitals/ patient flow/ Admissions	Log of the total cost for each patient, hospital mortality and readmission rates	The results showed that after online report card, hospitals in higher competitive environment used more resources and achieved lower mortality rate

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Clement, J, et al (1997)	The impact of hospital alliance on financial performance of hospitals.	1994-1995/ 2,462 hospitals for the cash-flow equations and 2,492 hospitals for the net revenue/ U.S National	HHI/ Health Service Area (HSA)/ Inpatient Days	Cash flow per bed, Natural log of net patient revenue per adjusted discharge, Natural log of operating expenses per adjusted discharge	The results show that a negative relationship between hospital Herfindahl-Hirschman Index (HHI) with revenue and expenses. This suggests that hospitals in less competitive markets generate lower revenues and expenses per adjusted discharge.
Clement, J, et al (1997)	Whether market factors have affected dynamic cost shifting among acute care hospitals during 1980s-1990s	1982-1992/ 268 hospitals/ U.S California	HHI shared bed in the county/ County/ Number of Beds	Net revenue per adjusted patient day from private payers	Results show that hospitals had experienced cost shifting. Hospital competition and HMO penetration doesn't have significant effect in this shifting.
Clement, Jan P, et al (2001)	This study aims to examine the impact of non- for profit hospitals on the charity care provision behavior of for profit hospitals and also the impact of managed care and competition pressure in supplying uncompensated care.	1990-1996/350 acute care hospitals/ U.S California	HHI, hospital acute care hospital beds/total acute care beds in HFPA / HFPA/ Number of Beds	Charity care	The results show that FP hospitals don't compete with neighboring NFP hospitals for a good public image by providing more charity care, as the NFPs provide more charity care. Instead, they offer less.
Co, J. P. T, et al (2002)	The objective of this study was to define the perceived quality of care of pediatric inpatient care and look at the relationship between hospital characteristics and perceived quality of care	1997-1999/6030 parents of children from 38 hospitals /cross-sectional/ U.S national	UHC Market Stage Classification/ Hospital Services Area/ Number of Beds system.	Perceived quality of pediatric cares	Parents in more competitive environment stated 3% more issues about quality of care in compare to less competitive market.

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Courtemanche, C, et al (2010)	This paper demonstrates the effect of ASCs on hospital surgical volume	1997-2004/ not applicable/ U.S national	HHI, The HHI for each hospital is the sum of the squared market shares of admissions for all of the hospitals in a hospital's market. / An area within a 15-mile radius from the given hospital's zip code location/ Certain Service/Product	Log of hospital surgeries/ An area within a 15-mile radius from the given hospital's zip code location	The result showed that ASCs entry influences hospitals surgery in close distances. The effect is higher for large ASCs and first enter once.
Delia, D, et al (2009)	This article evaluates the impact of Certificate of need reform on decreasing long standing disparities to angiography	1995-2004/ not applicable/ U.S New Jersey	HHI is the Hirschman- Herfindahl Index, which is a measure of market concentration, for cardiac angiography (CA) procedures among hospitals in the choice set for each zip code/ Health Service Area (HSA) / Certain Service/Product	Difference of cardiac angiography (CA) rates	Result determines that greater concentration of cardiac angiography (CA) procedures has been associated with increase in disparity.
Dor, A, et al (2012)	This paper aims to look at the impact of hospital competition, HMO penetration and patient severity on the up taken of laparoscopic colectomy and its price related to open surgery for colon cancer.	2002-2007/ 7424 hospital admissions/ U.S national	Herfindahl-Hirschman Index (HHI) is the measure of hospital concentration It is defined by the share of hospital admissions squared, summed over all hospitals in the market area/ Metropolitan Service Area (MSA)/ Admissions	Uptake of laparoscopic colectomy and its price relative to open surgery for colon cancer	Market forces influence the laparoscopy implementation. In fact, the more HHI leads the less laparoscopic colectomy and the more HHI is related to higher prices.
Douglas, T. J, et al (2003)	This paper examines the different competitive advantages in hospital industry and examine direct and joint impact of market structure, organizational level competencies and inter-organizational relations on hospital performance	1996-1998/ 32 largest hospital markets, 824 hospitals/ U.S National	Herfindahl index. A measure of rivalry was calculated as one minus the calculated Herfindahl index/ Metropolitan Service Area (MSA)/ Certain Service/Product	Cash flow margin	The findings show that managers can deploy different competency strategies to come up with the effects of market.

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Dranove, D, et al (2008)	Examining the relationship between price and concentration among hospitals.	1990-2003/ 342 in 1990 to 299 in 2003 in California and from 180 to 154 in Florida/ U.S California and Florida	Herfindahl Hirschman Indices (HHIs). we use zip code level patient flow data for individual hospitals and system membership information to directly compute system level HHIs/ An area within a 15-mile radius from the given hospital's zip code location/ Admissions	Price	There was positive relationship between price/concentration in this study.
Eastaugh, S. R, et al (2014)	Determinants of hospital-line specialization trend	2001-2010/234 hospitals/ U.S national	Herfindahl index bed concentration/ Metropolitan Service Area (MSA)/ Number of Beds	Inpatient case-mix specialization	In competitive market like West Coast, specialization is higher. General hospitals in competitive situation with specialty hospitals constrained their cost and also reduce the array of services.
Everhart, D, et al (2013)	To examine the impact of nurse staffing on profitability of hospitals in competitive and non-competitive market	2008/ 8,853 nurse surveys and 121 hospitals were included/ U.S Florida	Hospital competition was measured by the Herfindahl-Hirschman Index (HHI), an indicator of market concentration that is calculated by taking the sum of hospitals' market shares squared in a county/ County / Inpatient Days	Total profit margin	There was significant and positive relationship between nurse staffing and profitability of hospitals in most competitive market.

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Garmon, C, et al (2009)	Examining the impact of competition and hospital charity care	1999-2002/ 120 such hospitals in Florida and 114 such hospitals in Florida and Texas	Competition is measured using the system-specific Herfindahl-Hirschman Index (SSHHI). The SSHHI is calculated by first dividing patients into groups and calculating the HHI for each group. For each hospital system, the SSHHI is then the weighted average of all of the micro-HHIs, where the weights are based on the importance of each patient group to that hospital system/ patient flow/ Admissions	Net inpatient revenue per admission for self-paying patients, total inpatient charity care and bad debt charges multiplied by the hospital's cost-to-charge ratio and outpatient uncompensated care cost which is outpatient charity care and bad debt multiplied by the hospital's cost to charge ratio	According to the results, there is no significant relationship between competition and charity care
Gift, T, et al (2002)	Examines the effect of competition on price bargaining power	1994-1995/ 93 hospitals/ U.S Washington state	The measure of competition was the number of hospitals within 10 miles or same urban/ Metropolitan Service Area (MSA)/ Discharges	Insurer payment system	In competitive environment, hospitals more likely to accept prospective payment methods and also it is more likely to offer discount by increasing the competitors in market. Also, but increasing the competition, price will decrease and market power shifts from provides side to buyers side.
Gowrisankaran, G, et al (2003)	Examine the effect of competition on quality decision for patients of Medicare and HMO	1989-1193/ not applicable/ U.S California	HHI measures the degree of competition for individual. For hospital j by the relative likelihood that the patient will be admitted to hospital/ patient flow/ Admissions	Log of AMI Mortality and Log of Pneumonia Mortality	Finding illustrated that increases competition will decrease mortality rate for HMO patients but increase for Medicare patients

Author(Year)	Study objective paraphrased version	Study Period/ Sample/ Design/ Location	How Competition Measured/Definition of The Market	Outcome variables	Key Findings Related to Competition Paraphrased Version
Hadley, J, et al (1996)	The impact of competition and financial pressure on performance of hospitals	1987-1989/ 1,435 acute care hospitals/ U.S national	We use the Phibbs and Robinson HHI for their 75% and 90% variable-radius market areas and an HHI based on the hospital (ie, "low competition") Are the omitted reference group in the regressions. In the case of the HHI based on MSAs, the omitted group also includes all rural hospitals. This is appropriate, given that rural hospitals tend to have few competitors/ Metropolitan Service Area (MSA)/ Admissions	Expenses, revenues, profitability, input use, and efficiency	Hospitals in high competitive environment control their costs and they experience slower revenue increase
Henke, R, et al (2013)	To analyze the impact of hospital competition on small -area inpatient resource use of payers.	2008/ not applicable/ U.S National	We measured hospital competition using the Herfindahl-Hirschman Index (HHI). The Herfindahl-Hirschman Index is the sum of the squares of market shares for all of the hospitals in the CBSA/ Metropolitan Service Area (MSA)/ Discharges	Length of stay (LOS) per discharge. Second, we measured cost per discharge	Hospital competition had significant relationship with lower discharge for both Medicare and private enrollees. Competition doesn't have significant impact of length of stay.
Horwitz, J, et al (2009)	This paper examines the spillover effects of three hospital ownership types-government, for profit and non profit	1988-2005/ Not applicable/ U.S national	Herfindahl–Hirschman. the sum of squares of each hospital's share of total admissions within each MSA/ Metropolitan Service Area (MSA)/ Admissions	Service provided	Non for profit hospitals' service provision is different by market mix. For profit hospitals have greater margins in market with more for profit hospitals.

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Jiang, H. J, et al (2013)	Examine the effect of managed care and hospital competition on cost and quality of post-managed era	2001-2005/ 1521 urban hospitals/ U.S. National	We measured hospital competition using the Herfindahl– Hirschman Index (HHI). The HHI is a concentration index, computed as the sum of squared market shares of all competing hospitals in a county. We used hospital admissions (which were derived from the HCUP data) rather than hospital beds to calculate market share that reflects the actual amount of services/output/ County/ Admissions	AHRQ Inpatient Quality Indicators (IQI) and average cost per stay	Increase hospital competition over time is associated with decrease in mortality rate when HMO penetration is high. In market with low HMO penetration, the hospital competition has association with higher cost but no effect on mortality rate.
Keeler, E, et al (1998)	This paper aims to look at the association between hospital prices and competition.	1986–1994/ 300,000 case/year for 4 years and 120,000 are non-Medicare patients/ California	HHI (population/square mile), share of total discharges and the summation runs over all hospitals/ County/ Admissions hospital's market	Net revenue per discharge	Competition has significant impact on hospital pricing.
Keon-Hyung, et al (2015)	The effect of hospital competition on efficiency	2001-2004/ 106 hospitals in average/ U.S Florida	We used the Herfindahl-Hirschman Index (HHI) as a measure of hospital competition. The HHI we used was based on the patient-origins data by patient ZIP code to determine the extent of each hospital's market. / patient flow/ Admissions	Technical efficiency	Technical efficiency and hospital competition had reverse association with each other
Kessler, D, et al (2005)	Impact of hospital competition on health expenditures and quality of care for elderly Medicare patients	1985-1996/ not applicable/ U.S national	We identify the effect of competition with an HHI that is a function of distances from each patient to his hospital choices and other exogenous characteristics of patients and hospitals/ patient flow/ Admissions	High-risk at Onset of Illness	Low-valuation patients receive less intensive services in more competitive market but with same result with less competitive markets. However, high-valuation patients in more competitive markets with better outcomes in compare with uncompetitive markets.

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Langabeer Ii, J, et al (1998)	To examine the relationships among competitive strategy of hospitals, their market characteristics and financial performance.	1993/ 100 acute teaching hospitals/ U.S national	Number of competitors exist in MSA of each teaching hospital/ Metropolitan Service Area (MSA)/ n/a	Return on invested capital	Hospital choose effective strategies based on their turbulent environment
Maeda, J, et al (2014)	To examine the effect of market competition on inpatient price per discharge between private and public payers.	2006/ 3,333,065 dis-charges across all discharges from 6 states/ U.S Multiple states	The Herfindahl-Hirschman Index (HHI) represents sum of square of market shares for all hospitals within a county. / County/ Discharges	We estimated payer -specific inpatient prices (net revenue) by applying the HCUP PCR to total hospital charges.	Variation among private payers was higher regarding inpatient price per discharge. Also, the was positive relationship between hospital competition and higher price per discharge for knee arthroplasty for both types of payers.
Maeda, J, et al (2012)	Study of the relationship between evidence-based measures, hospital competition and short-term mortality of patients with chronic heart failure	2003-2006/ 3011 nonfederal, short-stay, Joint Commission-accredited acute care Hospitals/ U.S national	we employed the Herfindahl-Hirschman Index. The HHI was determined by taking the sum of the square of market shares for heart failure patients at all hospitals within an HRR. (HHI) as the market competition measure. / Health Referral Region (HRR)/ Admissions	Mortality	There was no relationship between competition and mortality rate.
Meltzer, D, et al (2002)	The impact of competition on the cost for low and high cost admission in DRGs before and after prospective payment system in Medicare	1983-1993/ not applicable / U.S California	HHI based on total annual discharge within a county level. / County/ Discharges	Ratio of cost to charges	Result shows that hospital cost increase before PPS in competitive market, however, the effect of competition been decreased later.
Mobley, L, et al (2009)	The Effect of market structure on hospital pricing	1998/ 336 general hospitals/ U.S. California	That is, we measure market concentration using the Herfindahl index (HHI), defined over market shares in net patient revenue at the hospital's HFPA level/ HFPA/ Discharges	Inpatient revenue received from private payers per private inpatient day, adjusted to reflect outpatient care	In markets where concentration is relatively high before a proposed merger, we demonstrate that Ordinary Least Squares (OLS) can lead to the wrong policy conclusion while the more conservative lag estimates do not

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Moriya, A, et al (2010)	Impact of hospital and insurer concentration on hospital services price.	2001-2003/ 940,816 inpatient admissions and 800 HSA/ U.S national	Herfindahl-Hirschman indices (HHIs). the flow of Medicare hospital patients between HSAs/ Health Service Area (HSA)/ Admissions	Hospital prices	Insurance market concentration has reverse relationship with hospital price, but hospital concentration does not have significant relationship with hospital prices
Mutter, R, et al (2008)	Relationship between hospital competition and quality of inpatient care	1997/ 2595 hospitals/ U.S national level	County, MSA, HSA, Fixed radius, Variable radius, Patient flow, County, HHI MSA, HHI HSA, HHI Fixed radius, HHI Variable radius, HHI Patient flow, HHI	AHRQ QIS in hospital quality models	Hospital competition has some effects on some quality measures. However, the effect is unstable and some indicators show positive impact and others negative impacts on quality of care.
Omal, A, et al (1998)	Relationship between hospital and market characteristics and mortality rate	1990-1991/ 398 hospitals/ U.S California	Herfindahl-Hirschman Index, based on patient discharges/ County/ Discharges	Mortality	The was significant relationship with higher competition and less mortality rate
Proenca, E, et al (2005)	The effect of membership in health system and hospital cost performance with looking at the impact of market factors as moderator	1998/ 1368 private urban hospitals/ U.S national	The level of competitive pressure in the hospital's market (COMP) was measured with a Herfindahl Index. This index was reverse coded (i.e., subtracted from one)/ Metropolitan Service Area (MSA)/ Admissions/ n.a	The dependent variable, total hospital cost, was defined as the logarithm of total expenses divided by the price of labor.	Services provided in system level had negative relationship with hospital cost and there was no significant moderator effect of hospital competition on this relationship.
Rivers, P, et al (1999)	Effect of competition on hospital costs	1991/ 29 MSAs/ U.S national	Hirschman-Herfindahl index (HHI). It is calculated as one minus sum of squared market shares of firms in the industry/ Metropolitan Service Area (MSA)/ MSA/ Admissions	Operational expense per adjusted admission	The effect of competition on hospital cost was significant.
Rivers, P, et al (2004)	Impact on HMO penetration and hospital competition on mortality rate	1991/ 1957 acute hospitals/ U.S national	Hirschman-Herfindahl index (HHI). It is calculated as one minus sum of squared market shares of firms in the industry/Metropolitan Service Area (MSA)/ Admissions	Adjusted mortality rate	There was negative relationship between hospital competition and mortality rate

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Rogowski, J, et al (2007)	Impact on HMO penetration and hospital competition on mortality rate	1994-1999/ 363 hospitals/ U.S. California	a competition index calculated as one minus the Herfindahl index based on bed shares.) a competition index calculated as one minus the share of beds held by the largest three hospitals/ not applicable/ Number of Beds	Mortality after hospitalization	More competition leads to less 30-day mortality rate
Roh, C, et al (2008)	The impact of competition, services scope and network participation on rural women's choice for obstetric care	2000-2003/ 10,384 Colorado rural female patients/ U.S. Colorado	The independent variable (hospital competition) was measured using a hospital-level Hirschman–Herfindahl Index (HHI). The HHI was constructed based on the work of Zwanziger and Melnick [41], who collected patient- origin data by zip code to determine the extent of each hospital's market. The HHI is calculated by summing the squared market share of all the hospitals in the relevant market / HHI/ Admissions	Discrete variable representing whether a rural Colorado female patient chooses a specific hospital	The effect of competition on patient's choice was positive and significant
Saleh, S, et al (2001)	The impact of competition and different levels of managed care activities on likelihood of pursuing managed care as a strategy	1997/ 139 rural hospitals / U.S. lm and Nebraska	market density was defined as the number of competitors in the focal hospital's market area. Market areas were constructed for each hospital using the shared patient-origin hospitals approach. Hospital service areas defined based on patient flow data are preferred to others because they measure actual rather than potential competition/ patient flow/ Admissions	Whether their hospitals in the process of developing alone or with other parties a managed care organization	More competition increases the likelihood of hospitals implementing managed care strategies.

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Santerre, R, et al (2002)	Examines the impact of hospital competition on bed capacity in California	1999/ 309 community hospitals/ U.S. California	Inter-hospital competition is measured by the Herfindahl-Hirschman index (HHI) based on the share of inpatient days of each community hospital in the same geographical market. / Metropolitan Service Area (MSA)/ n/a	Reserve margin	Higher competition leads to hospital reduce their beds
Sari, N, et al (2002)	To examine the effect of hospital competition and managed care on quality of care	1992-1997/ 3868 hospitals / U.S. multiple states	Herfindahl–Hirschman index by county. / County/ Admissions	HCUP quality indicators	Higher competition associated with lower quality of care
Schlesinger, M, et al (1997)	The study of the effect of hospital competition on access to inpatient services and preexisting variation between for profit and non profit hspitals	1987-1988/ 915 respondent hospitals/ U.S national	The first method was to ask administrators to rank their hospital in 1-5 scale. In the second way, HHI was used. However, they used the first method in this study/ Not applicable/ n/a	Number of innovative services. Added services in the last year. Eliminated services in the last year. Uncompensated care as a percent of revenues.	In limited competition, for profit hospitals provide less access than nonprofit counterparts. However, more competition reduces the ownership differences.
Schneider, J, et al (2007)	The effect of specialty hospitals presence on financial performance of general hospitals	1997-2004/ 93 specialty hospitals/ U.S national	HHI/ County/ n/a	Hospital patient care revenue, cost and operating margin	The presence of specialty hospitals has positive effect on general hospitals operating margin but negative effect on general hospitals cost
Sethi, R, et al (2013)	Hospital competition helps hospitals to be EVAR adopt ore and improve AAA repair outcomes	2001-2007/ 21,600 patients and 652 hospitals/ U.S. National	HHI is calculated as the sum of squared market shares for all hospitals existing in markets defined by geopolitical boundaries, fixed radius, variable radius, and patient flow according to methods described by Wong et al/ patient flow/ Discharges	AAA repair outcomes	Patients at more competitive hospitals (lower HHI) were at increased odds of undergoing EVAR vs open repair. There was no significant association between competition and mortality, vascular neurological complications.

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Succi, M, et al (1997)	Impact of competition on rural hospitals closure	1984-1991/ 2,780 rural hospitals/ U.S. national	Market level competition measures and market position. Market density was defined by the number of hospitals within the focal hospital's designated market area, excluding the focal hospital. To assess market concentration, we used the Herfindahl index, calculated by summing the squared market share for all hospitals in the market (Phibbs and Robinson 1993) active to other hospital providers (differentiation). Differentiation of the focal hospital was captured along three dimensions. / County / n/a	Hospital closure	More density increases the risk of closure. The effect of density on closure been disappeared with considering market position
Tay, A, et al (2003)	Using random-coefficient model to show that importance of quality as well as distance in patient flow to hospitals.	1994/158720 patients and 2400 hospitals/cross-sectional/ U.S national level	Distance/ based upon Euclidian distance/Inpatient Days	Patient flow	People less likely to go future hospitals. Also quality of care is important determinant of hospital choice. However, the probability of hospital choosing decrease by distance and increase by quality. Thus, quality competition impacts patients' choices.
Town, R, et al (2001)	Estimating of determinants of price negotiation between hospitals and HMOs	1990-1993/ 12,700 HMO enrollees/ U.S. Loss Angeles	Herfindahl–Hirschman Index (HHI). We calculated the HHI using hospital beds as the measure of size. / An area within a 15-mileradius from the given hospital's zip code location/	Hospital pricing logarithm	There was no significant relationship between hospital competition and logarithm of hospital price
Volpp, K, et al (2005)	Examine the impact of law which changed regulated price to price competition that decreased charity care and also the effect of market on mortality rate	1990-1996/ 469,629 discharges/ US New Jersey and New York	We created a Hirschman–Herfindahl index (HHI) for each HSA by summing for all HSA residents the squares of each hospital's market share (based on hospital admissions)/ Hospital Services Area/ Admissions	Mortality rate	Competition increase mortality rate

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Wu, V. Y, et al (2008)	Examine the anti-competitive impact of hospital closure	1993-1998/ 974 hospitals of all types closed between 1990 and 2000/ US national	HHI/ Health Service Area (HSA)/ Certain Service/Product	Hospital prices	Change in HHI because of closure did not have any significant effect
Young, G, et al (2000)	The relationship between market concentration and the pattern of pricing	1990-1995/ The number of observations ranged between 153 and 169 for each year of the study/ US California	The HHI, which is a widely used measure of market concentration, is generally computed as the sum of the square of each firm's market share/ Metropolitan Service Area (MSA)/ Admissions	Annual percentage change in hospital price	In more concentrated market, all three types of non-for profit hospitals exercising higher price and this is more aggressive for members of nonlocal systems.
Younis, M, et al (2004)	The impact of Hospital competition and HMO penetration on hospital cost per adjust admission	1991/ 1967 hospitals/ U.S national	Herfindahl-Hirschman Index (1-the sum of squared adjusted admission)/ Metropolitan Service Area (MSA)	Cost per adjust admission/ Admissions	There is no relationship between competition and cost per adjust admission
Zwanziger, J, et al (2000)	The impact of selective contracting on revenue and costs of California hospital	1983-1997/ 421 California general hospitals/ US California	We chose the Hirschman-Herfindahl index (HHI) as our basic measure of competition. / Not applicable/ Certain Service/Product	Operating expenses Total operating revenue	More competition leads to low rate of increase in revenue and cost
Zwanziger, J, et al (2000)	The impact of selective contracting on cost and revenue of hospitals	1983-1997/ 421 acute hospitals / U.S California	We chose the Hirschman-Herfindahl index (HHI) as our basic measure of competition / Not applicable / Certain Service/Product	Total hospital expenses and revenues	Hospitals in more competitive markets had significantly lower rate of revenues and costs

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Zwanziger, J, et al (2005)	Relationship between implied prices and hospital market factor and plan	1995-1999/ 373 hospitals/ US New York	The measure of competition we used was the Hirschman-Herfindahl Index (HHI), where the sum is over all the competitors in the market. We found the market shares of the competing hospitals in each ZCA, and then summed the squares of these market shares to calculate the ZCA's HHI/ Not applicable/ Discharges	Hospital prices	After 1997 hospitals located in more competitive market paid less.
Zwanziger, J, et al (2000)	This paper aims to determine that whether, and under what circumstances, hospitals will shift costs to private payers especially in competitive circumstances.	1983-1991/52 revenue centers/ Cross-sectional/U. S California	HHI Hospital Discharge Data/ concentration/ Discharges	Cost shifting	Competition has some impacts on hospital cost shifting behavior in responses to Medicaid reimbursement, but the relationship is not significant statistically.