Case Study

# Integrating Infrastructure and Clinical Management in PPPs for Health Care

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**Abstract:** The worldwide development of health care infrastructures and services has been increasingly founded on public-private partnerships (PPPs). Led by the benefits of this procurement model, governments felt tempted to engage themselves in long-term contracts for the provision and management of health care facilities, under distinct configuration schemes. Several arrangements have been tried: partnerships concerning just the infrastructure on a stand-alone basis, or bundling infrastructure and clinical services management, among other more unusual models. Experience has demonstrated benefits and pitfalls in each model. This paper tries to overcome the gap in the literature regarding the review of PPP arrangements in a cross-country perspective. Using case studies from 16 countries (10 European Union, Canada, Australia, Chile, Mexico, South Africa, and Lesotho), it provides a reflection on international experiences with health care PPPs and draws some recommendations for further development. To support the discussion on the trade-off between contract complexity and the ability to capture efficiency through vertical integration, the Portuguese case is presented in detail because it represents a unique model. The potential benefits of the integration should not be neglected. **DOI: 10.1061/(ASCE)ME.1943-5479.0000166.** © *2013 American Society of Civil Engineers.*

**CE Database subject headings:** Health care facilities; Partnerships; Private sector.

**Author keywords:** Health care infrastructure; Hospital management; Public-private partnerships; Private initiative.



## Introduction

Public-private partnership (PPP) arrangements have been used widely over the last decade to provide for health services and infrastructure. To date, there have been no published studies providing a survey of the varied models used around the world for private entities to provide services or infrastructure for national health systems (NHS). This paper describes these models and their use, with a particular emphasis on the integration of clinical and infrastructure management.

The factors affecting health care system management are constantly evolving. Changing disease patterns, aging populations, growing public expectations, and increasingly more stringent standards continually provide new and demanding challenges to managers and policy makers (Thompson and McKee 2004). At the same time, governments are struggling to decrease public expenditures and reduce excessive public debts, as is true for many European countries. With the shortage in international credit, it is difficult for health care agencies to meet their increasing capital needs and operational costs (Hsiao 2007), especially when hospitals account for 45–60% of many health care national budgets.

There is a global trend for governments to reduce their direct participation in health care infrastructure and public service delivery, resulting in increased private sector participation in system management and financing. Thus, the governance of global health care systems has become more complex (Gupta et al. 2002). Some governments, such as Cuba, resist using any private sector participation and retain full control of health care, while other countries, such as the United States, leave health care largely to the private sector for organizing and sustaining, with government using public insurance plans, such as the Obama health plan, to ensure full public access to the system.

The health care systems of most countries on Earth, both in the developed and the developing world, lie somewhere between Cuba and United States extremes. A mixture of public and private facilities has existed in most countries for decades, even if the entities sometimes provide overlapping services. Over the past two decades, however, the private sector has become involved in traditionally public hospitals and health centers. In these cases, the private and public sectors coexist in the same facility under governance schemes that are usually called PPPs. The models and features for PPP projects vary by country, although it is possible to identify some general types of models. PPP arrangements have been largely used in several infrastructure sectors such as water supply systems, roads, railways, dams, and other large-scale infrastructure projects (Marques and Berg 2010; Papajohn et al. 2011; Yuan et al. 2012). PPP options represent an intermediate model between public management and full privatization (Reibeiz 2012).

This paper will not provide irrefutable evidence about the benefits of private sector involvement in delivering health care. This paper will illustrate how the private sector has become involved in the provision of public health infrastructures worldwide. PPP arrangements for hospitals have traditionally centered on building construction and maintenance, with selected ancillary services included in some cases. New models developed in Spain and Portugal have also included clinical management. The benefits and problems

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Note. This manuscript was submitted on February 1, 2012; approved on January 4, 2013; published online on January 7, 2013. Discussion period open until March 1, 2014; separate discussions must be submitted for individual papers. This paper is part of the ***Journal of Management in Engineering***, Vol. 29, No. 4, October 1, 2013. © ASCE, ISSN 0742-597X/2013/4-471-481/$25.00.

of such approaches are not entirely known. This paper will address these issues and provide some recommendations for dealing with the integration of clinical and infrastructure management.

The focus in this paper will be primarily on infrastructure and health care delivery, although other health subsystems, such as drug development and distribution and epidemic control, may also be amenable to PPP development (see more in Widdus 2001 and Knickman and Stone 2007). After this introduction, the section "Private Sector Participation in the Provision of Health Care Services" will provide a literature review on PPP health care delivery, followed by a presentation of the most relevant international experiences. The Portuguese case is analyzed next, together with a critical review, and some conclusions are drawn at the end.

## Private Sector Participation in the Provision of Health Care Services

### Private Hospitals

In most countries around the world, there is some degree of private participation in the provision of health care services. In the European Union (EU), countries such as Germany (with the private sector providing 7% of hospital beds), Portugal (11%), France (17.5%) and Spain (18%) have a significant number of beds in private hospitals, while Belgium, the United Kingdom, the Nordic countries, and the Netherlands have negligible percentages of private participation in clinical services (Bentes et al. 2004).

Private hospitals take a profit-oriented approach to allow a fair return on private equity. The focus of this paper is not on these institutions, but rather on private participation with nonprofit oriented public hospitals providing universal access to health care through NHS.

### PPP Projects in Health Care Delivery

To accurately define a PPP arrangement, a distinction must be made: PPP options do imply innovative ways of financing, but is it essentially a procurement model, or an infrastructure provision model? England, France and Italy applied a PPP model that delivers the management of nonclinical activities to private companies. A PPP arrangement can be defined as a long-term contract between a public and a private partner for the provision of a public service or infrastructure, involving a significant risk assumption by the private partner (Ke et al. 2010; Pantelias and Zhang 2010).

In Portugal, the first wave of PPP projects started with infrastructure and clinical management provided under concessions. Spain went further, with a form of PPP arrangement usually called the *Alzira Model* after the name of the first hospital built under new legislation that allowed primary health care to be bundled with the management of the central hospital (Serrano et al. 2009).

The phenomenon of increasing participation of the private sector in public services delivery of products, such as health care, is commonly referred to as *privatization*. Privatization means an irreversible ownership transfer to the private sector, reserving the role of regulating the market to the public sector (Cruz and Marques 2011). When there is only a temporary or partial transfer of assets or coresponsibility for service delivery, the correct designation should be *PPP arrangement*. With few exceptions PPP arrangements are the case in most health care systems around the world.

One of those exceptions is the United States, where the health care system is fully privatized with a philosophy of full cost recovery for hospitals, and price affordability guaranteed by public health insurance (Galvin 2003). PPP projects had flourished essentially due the difficulty in providing the necessary capabilities (mainly capital outlays) and control cost overruns in investment (Skamris and Flyvbjerg 1997) and operation.

### Literature Review on PPP Health Care Delivery

Several studies have been performed regarding PPP development in health care, including application to subsystems. PPP arrangements have been applied to drug development (Croft 2005; Nwaka 2003; Nwaka 2005; Trouiller 2002), epidemic control (Buse and Harmer 2007; Dewan et al. 2006; Murthy et al. 2001), local communities (Bazzoli et al. 1997; Gillies 1998; Mitchell and Shortell 2000; Weiner and Alexander 1998), health equity problems (Asante and Zwi 2007) and hospital and health care delivery. The literature on PPP projects applied to hospitals and health care delivery is summarized in Table 1.

Although there are some exceptions, PPP projects generally arise in the health sector because of a need to increase efficiency and effectiveness or to decrease overall costs in construction and operation of health facilities. In Mediterranean countries, PPP arrangements have been shown to be useful for securing large investments that are not included in public deficit calculations (Cravinho et al. 2011).

## International Experience with Health PPPs

### Europe

PPP projects in the health sector across Europe can be placed into three overall groups based on to the partnership model *perimeter*, i.e., the group of activities included in the PPP arrangement. As presented in the section "Private Sector Participation in the Provision of Health Care Services", a hospital system can be categorized into infrastructure, clinical services and *soft facilities* that are usually on the interface between infrastructure and clinical services. By infrastructure, we mean the building itself and all of the systems necessary to ensure acceptable conditions, such as air conditioning, elevators, ventilation, water and energy systems. Clinical services comprise the personnel, materials and activities related to the provision of medical treatment, such as doctors, nurses, technical staff, and surgical materials. Soft facilities as laundry and security are those that are not directly related to medical activities. Medical equipment (e.g., computed axial tomography) might be included in infrastructure or in clinical services depending on the project.

The first and simplest PPP model regards only the design, construction, financing and operation (DFBO) of the infrastructure in a typical DBFO contract. Some PPP contracts apply to new infrastructure, while others apply to refurbishment work or capacity increase. Infrastructure PPP projects may also include the provision of soft facilities, such as cleaning, security, parking and catering, as well as the maintenance and management of some complex medical equipment. This is known as the *UK model*. The second PPP model includes not only infrastructure and soft facilities services, but also clinical and medical activities. Clinical and medical activities comprise the recruiting and management of medical staff, the operation, maintenance and upgrade of medical equipment and all medically related activities occurring in the hospital. The hospital is fully managed by the PPP-designated concessionaire, which is usually a consortium of companies that specialize in the various project components such as construction companies to build the infrastructure, health services management companies to operate the facility and banks to finance the investments. The vertical bundling of infrastructure and management activities is justified by increased efficiency when the same institution provides infrastructure management and clinical services. For example, having the group that



J. Manage. Eng. 2013.29:471-481.

**Table 1.** Literature Review on PPPs in Health Care Services and Infrastructure

| References | Type of analysis | Geographical scope | Observations |
|---|---|---|---|
| Rosenthal and Newbrander (1996) | Empirical | Global | The private initiative in health care delivery intends to improve efficiency, and generate increased revenues in the public sector. Author claims that each country should find the best options to private sector engagement. |
| Bazzoli et al. (1997) | Empirical/case study | United States | Analysis of PPPs role in joining two collaborative networks: (1) local coalitions of public and private stakeholders; (2) service delivery networks that seek to coordinate and provide collaboratively a continuum of services. |
| Pollock et al. (1997) | Empirical | United Kingdon | Authors call the attention to two pitfalls in PFI initiatives: (1) lack of openness surrounding the whole process (lack of transparency); (2) questionable assumptions that lie behind many hospital schemes in the pipeline. Author claims that these are not independent variables. |
| Boyle (1997) | Empirical | United Kingdom | Boyle presents a rather critic view on PFI stating that "there is almost universal agreement that the PFI has failed as an alternative source of capital funds for the NHS". The public sector expenditure has been reduced by 15%, but privately financed hospitals are experiencing large delays. |
| Harrington and Pollock (1998) | Empirical | United States and United Kingdom | Both the U.S. and UK Governments want to decrease public-sector expenditure. A decentralization movement of long-term care program, from Central Government to State and Local Governments, is taking place, simultaneously with a privatization wave. One of the main purposes of this policy is to move financing responsibilities from society to the individual. These changes in the financing schemes lack transparency and public debate. |
| Kickbusch and Quick (1998) | Empirical | Global | The author analyzed several partnerships for health and proposed a six-category ranking. It also concluded that partnership building was a key strategic component of health development. |
| Pollock et al. (1999) | Empirical/case study | United Kingdom | Main findings can be summarized in: hospitals funded through PFI are being planned on the basis of financial, not clinical, needs; data used in support of PFI planning do not conform to the Department of Health's standards and definitions; full business cases under the PFI are incomplete with respect to total and specialty bed numbers, the caseload to be treated, and the service needs of the population; PFI hospitals entail major reduction in the clinical workforce, and service capacity—in direct contradiction of government policy; in many areas PFI hospitals will need to generate income from private patients, as a result some hospitals have increased the proportion of private beds; and the PFI will result in a shrunken NHS, inadequate to meet the needs of the population. |
| Gaffney et al. (1999a) | Empirical | United Kingdom | The authors concluded that investment under the PFI costs more than public sector procurement. The annual charge for the use of privately financed facilities is between 9.1 and 18% of the original construction cost, whereas government can borrow at interest rates of 3.0–3.5%; the extra cost of private finance is disguised by the Treasury's insistence that NHS trusts discount cost at 6% per annum when comparing the costs of the private finance option with public sector investment; the amount of risk transferred to the private sector under privately financed deals has been exaggerated, leading to spurious attributions of additional value to private sector options. |
| Gaffney et al. (1999b) | Empirical/case study | United Kingdom | Looking at the new NHS system, based on a PFI initiative program, authors present the following remarks: the PFI does not provide new money for public services; the high costs of capital under the PFI translates into service and workforce cuts; the reduction in public provision of long-term care, NHS dentistry, optical services, and elective surgical care shows the trajectory for the NHS under the PFI; shrinkage in service provision combined with budget constraints could force primary care trusts to redefine entitlement to NHS care and seek privately funded solutions for those who can afford to pay, leaving a rump service; the PFI is a regressive instrument and is likely to increase inequalities in health and in wealth. |
| Price et al. (1999) | Empirical | Global | Authors argue on the opening of public services to the private initiative, through government procurement agreements, dispute-settlement procedures, and the investment rules of global financial institutions. The UK experience in developing private-sector accounting rules to public services and the funding investment through PFIs is analyzed in detail. Some implications of private participation in European public health care systems are presented and threats are identified like universal coverage, solidarity through risk pooling, equity, comprehensive care, and democratic accountability. |
| Reich (2000) | Empirical | Global | Reich claims that PPP are the best model to address global health issues. Nevertheless, there are organizational and ethical challenges in the development of partnerships that can jeopardize the desired objective. |
| Buse and Walt (2000a) | Empirical | Global | This article is the part I of two on this subject. It reviews the interests, policies, practices and concerns on the UN, on the private sector, and governments (low income countries), regarding global PPP development. |
| Buse and Walt (2000b) | Empirical | Global | The paper identifies three categories for PPP development in health: product, product development and systems. For the public sector PPP have allowed to increase resources and provided access to private sector skills and management talents. On the other hand, private sector experienced an increase in corporate influence in global policy-making and at the national level, due to PPP development, and also brought direct financial returns, as well as indirect financial benefits. The main pitfalls identified regarding PPP development are problems with accountability and uncertainty. |

**Table 1.** (*Continued.*)

| References | Type of analysis | Geographical scope | Observations |
|---|---|---|---|
| Jones (2000) | Empirical/case study | United Kingdom | Main findings: the use of the private initiative for procuring new buildings for the NHS has come under mounting criticism from independent bodies. |
| Pollock et al. (2001) | Empirical/case study | United Kingdom | Main findings: healthcare companies and property developers are rapidly expanding into the ownership and provision of primary care premises; under the PFI, there are no restrictions on the amounts that can be borrowed or invested; *bundling* of diverse NHS and non-NHS facilities into one project allows the commercial sector to target new sources of revenue; no data are collected centrally on the different types of PPP in primary care or on the various methods of financing and their implications for future NHS expenditure; questions about the extent to which planning, population needs, and accountability are incorporated into the procurement process remain unanswered. |
| Shortell et al. (2002) | Quantitative | United States | This study examines two additional possibilities: (1) the need for a well-articulated shared vision; (2) the governance and management capabilities of the partnership itself. They conducted a midstream process evaluation of twenty-five community partnerships associated with the Community Care Network Demonstration Program. They examined how the roles of a common shared vision, strong governance, and effective management influence a partnership's ability to achieve its objectives. The findings, based on both qualitative and quantitative analyses, underscore the importance of membership organizations' perceived benefits and costs of participation and management capabilities to the partnership's progress toward a vision. Based on qualitative data, six key governance and management characteristics are identified that separate the top performing partnerships from the lowest performing ones. They explore the implications of this research for future evaluations of public-private community health partnerships. |
| Drevdahl (2002) | Empirical | — | Paper addresses the issue of how to balance growth of for-profit health care corporations with concerns for communities and populations. It is proposed that public health nursing has to recognize and to dialogue about these complexities so that nursing's voice can be heard as solutions to these dilemmas are created. |
| Pollock et al. (2002) | Empirical/case study | United Kingdom | Main findings of this work: PFI brings no new capital investment into public service and is a debt which has to be served by future generations; government's case for using PFI rests on a value for money assessment skewed in favor of PFI; higher costs of PFI are due to financing costs which would not be incurred under public financing; many hospitals PFI schemes show value for money only after risk transfer, but large risks said to be transferred are not justified; and PFI more than doubles the cost of capital as a percentage of trusts annual operating income. |
| Broadbent et al. (2003) | Analytical | United Kingdom | Development of a system for postproject evaluation. |
| Dunnigan and Pollock (2003) | Empirical/case study | Scotland | The paper looks at service delivery after PFI had been adopted. Results show that service delivery has been reduced across Lothians Hospitals (Scotland) associated with PFI development, and also evidence of an independent *PFI effect* on hospital downsizing and bed reductions, which resulted in severe capacity constraints across all acute specialties. |
| Nishar (2004) | Empirical | Global | The author places the *origins* of PPP, on the inadequacies of the public sector to provide public services, in an efficient and effective manner. Regardless the advantages of leveraging the project's management on private sector experience, there are complex ethical and process-related challenges. For example, due to the global scale of some of these projects, global principles and norms should be considered. |
| Buse and Harmer (2004) | Empirical | Global | This paper addresses issues of governance in health PPP, namely questions like: who has power; how is power exercised; and on what basis? Results suggest an *elite* power inhibiting critical analysis of partnerships. |
| Thompson and McKee (2004) | Empirical | Euopean Union—15 | Thompson and McKee describe financing mechanism for health care delivery and hospital financing across Europe, presenting PPP as the novel financing model. |
| Richter (2004) | Empirical | Global | Richter argues that PPPs are not necessarily positively innovative per se. PPPs carry large risks, and the author claims that there are less risky alternatives to health care delivery. |
| | Empirical/survey | United Kingdom | Main findings: the use of PFI is increasing in terms of number, capital value and size of projects; several risk management techniques were employed, but the prominent strategies were insurance cover and subcontracting. |
| Akintoye and Chinyio (2005) Vining et al. (2005) | Empirical/case study | Canada and United States | Main findings: in some cases, projects have ended up largely or completely financed with the public sector bearing risk; evidence of opportunism by the private sector was found. |
| Tountas et al. (2005) | Empirical | Greece | Main findings: public health services can become more competitive if there is a substantial increase in public health expenditure |
| Teicher et al. (2006) | Empirical/case study | Australia | Main findings: PPPs can arguably facilitate the awareness of government, private and not-for-profit sectors as a way to reduce the costs of providing public goods while at the same time improving the focus on recipients. |

**Table 1.** (*Continued.*)

| References | Type of analysis | Geographical scope | Observations |
|---|---|---|---|
| Asenova et al. (2007) | Empirical/case study based | United Kingdom | This article explores some key points of comparison on risk issues and builds a framework for the assessment of risk-related issues. A twin case study approach is adopted: a care home for older people and a PFI hospital. The analysis suggests that in the case of both private financing and of private delivery of health and social care services, the increased involvement of the private sector necessitates rigorous risk assessment and management. |
| Hsiao (2007) | Empirical | Several | Description of health financing schemes in several countries. |
| Barros and Martinez-Giralt (2009) | Quantitative | Portugal | Exploring alternative configurations of contracts and assess whether the equilibrium allocations attain the first-best solution. |
| Shaw (2003) | Empirical | United Kingdom | Analysis of *New Labour* versus *Old Labour* on PFI approach to Health delivery: although retaining the same "traditional commitment to the free delivery of healthcare", it developed a more commercial based approach to public sector management. |

predicts and designs future clinical services in the same consortium as the infrastructure planners allows for more appropriate and flexible architectural and engineering infrastructure designs. The third PPP model goes beyond hospitals to include other components of the global health system, such as primary care centers. The rationale for this model is that the flow of patients from the primary care center to the hospital can be controlled. Only predetermined cases are directed to the hospital. In this way, there is less misuse of specialized facilities and patient problems are solved at the level below hospitals, in accordance with the principle of subsidiarity. PPP arrangements are mostly used in countries where there is an NHS. Table 2 shows a large use of PPPs in Europe. Most countries use PPPs just for infrastructure purposes, leaving clinical services management to their NHS. Even in countries where bundled contracts (infrastructure plus clinical services) have been launched, recent events have shown a shift toward single, infrastructural PPPs. This trend toward single infrastructural PPPs has not been confined to Europe, as it will be presented next.

### Canada

Canada has been shifting from traditional procurement methods to PPP arrangements, known as P3 projects by Canadian authorities. This shift started in 2001 in Ontario and British Columbia, which are two of the most populous provinces. The shift has now spread to Quebec as well. A recent $1.6 billion project in British Columbia, Abbotsford Regional Hospital and Cancer Centre, began operation in late 2008. In Ontario, 19 hospitals have already been developed by the private sector under financing-construction schemes and there are seven more in the pipeline.

Canadian hospitals have traditionally been built using governmental subsidies or bond issues. In the new PPP projects, the consortium finances the project on a long-term basis, while the government makes regular payments for those financing costs akin to a mortgage payment. The government also pays for other services provided by the consortium. Some projects have been performed on a lease back arrangement, where the consortia owns the building and leases it to the public sector, while in other projects, the hospital board maintains the ownership rights (Philpott 2007).

### Australia

The Port Macquarie Base Hospital located in Northern New South Wales was the first Australian experience with a health PPP project. A concession contract was signed in 1992 between the government and the consortium for building the hospital and providing clinical services. The partnership provided good value in the construction process because the project was delivered in a record time within the budget. The same did not happen with clinical services as the model evolved to the classical UK model by focusing only on infrastructure-related activities (Teicher et al. 2006). The first partnership developed under the Partnerships Victoria, the Berwick Community Hospital built in Victoria in 2002, used the UK model. Since 2002, the Health Reform Committee has recommended $1,700 million in capital investments to meet Australian needs for health care services. There are plans to deliver other hospital infrastructure under PPP arrangements, but there is no evidence of changing from the basic UK model.

### Latin and South America

In Latin and South America, Chile and Mexico are among the leading countries in PPP usage and planning. Mexico developed the first PPP projects in 2004 for two new 120-bed hospitals in Toluca

**Table 2.** Overview of Health PPP Arrangements in Europe

| Country | Type of PPP | Observations |
|---|---|---|
| Denmark | — | PPP has been used rarely in the Danish health sector, more at a regional level, than in large scale projects. Projects are still at an early stage, and there is not consensus on the "pros" of using this procurement model (Vrangbaek 2008) |
| France | Infrastructure | In 2002, a major investment program in health, called *Hôpital 2007*, intended to boost the development of health facilities, in a total of 6.000 million Euros, of which, 1.400 were devoted to 35 PPP projects. The model adopted includes only infrastructure provision, and clinical services were left aside. |
| Greece | Infrastructure | The Greek choice was to separate medical and clinical services from infrastructure management. The first group of activities is performed under the publicly managed National Health System, while the second is the core of the PPP projects. The Government is currently undertaking 4 projects, delivering 1.214 beds, worth 1.040 million Euros, with different profiles: general, pediatric, oncological, and a rehabilitation & recovery center. Additional projects are under consideration. |
| Germany | Infrastructure | The hospital network in Germany in constituted mainly by three types of hospitals, according to their ownership structure: owned by municipalities or federal states (university hospitals), owned by private companies and owned by charitable institutions. Each cluster has approximately one third of total hospitals. The adoption of PPPs for infrastructure development had to do with a large financial deficit and an inability of the public sector, traditionally responsible for finance infrastructure assets, to cope with the need for additional expenditure. The current projects awarded or in preparation, concern the design, construction, financing and operation of buildings, though some projects also include the provision of soft facilities (cleaning, catering and laboratory). Two proton therapy centers have been awarded in a total of 560 million Euros. |
| Italy | Infrastructure | In Italy between 2000 and 2004, 2.583 million Euros of projects where put up to bid, and 3.273 million Euros where under consideration for launching. Italy developed between 2000 and 2005, 19 new hospitals, 15 refurbishment projects and nine structures for nursing homes and other services were developed under a PPP scheme, in a total investment of 4.000 million Euros budget representing 14.250 beds. The Italian model also only includes in the PPP the infrastructure management, and, in some, cases some soft facilities. |
| Ireland | Infrastructure | Ireland started the use of PPP in health by community nursing units, following the UK model. The private sector was responsible for the design-build-finance and operate the infrastructure, leaving clinical services outside the concession perimeter. |
| Portugal | Presented in detail in the section "Discussion of Existing Models" | |
| Spain | Infrastructure and clinical service<br>Infrastructure | In Spain there are two different models, respectively the Valencia (Alzira) and Madrid ones. *Valencia (Alzira) Model* The Alzira model became worldwide known because it was pioneer in bundling primary care and hospital care. In 1999, a contract to build and manage the Hospital de la Ribera under a concession regime, was signed to a private company called UTE-Ribera (Union Temporal de Empresas, Temporary Union of Companies – Ribera), accounting for a catchment area of 245,000 habitants. It was soon realized that it was needed a coordination of medical care at the hospital level and at the primary care level. A second model was put in place in 2003, establishing an integrated private management model for primary and hospital care. The payment scheme follows a per capita approach. *Madrid Model* In Madrid's Model, infrastructure management and clinical services are separated, in a "UK based approach". There is one contract, and one special purpose vehicle for the infrastructure, though sub contracting is allowed. Payment is made according to the infrastructure availability. |
| United Kingdom | Infrastructure | United Kingdom was pioneer in PPP projects, or PFI as commonly mentioned. Contracts include infrastructure building, management, and also soft facilities, while the clinical management stays in the National Health Service (Shaw 2003). |

and Tlalnepantla under a build-finance-operating (BFO) scheme. Chile is currently developing efforts to implement health sector PPP arrangements where the concessionaire will propose a DBOT model for infrastructure and soft facilities. Clinical services will continue to be provided by health care professionals who are directly funded by the government. The investment plan covers 13 hospitals costing a total of $500 million (Garcia 2005).

### *South Africa and Lesotho*

Several PPP models have been used in South Africa. For example, the Western Cape Rehabilitation Center uses an infrastructure management model, while the Port Alfred and Inkosi Albert Luthuli public facilities use a full management, or DFBO model. The South African government has thus been testing different delivery models. Some atypical PPP structures have also been tried, such as the rental of public facilities for private delivery of health services at the Universitas Hospital (Toit 2003). One of the most important contracts was signed in 2009 regarding the rebuilding of the Queen Elizabeth II Hospital in Lesotho. The contract set between the Government of Lesotho and the Tsepong consortium included refurbishment work that was set to be complete in 2011, the financing of medical equipment and the management of clinical services for 18 years. The model was thought to maximize efficiency by getting as much synergy between infrastructure and medical services management as possible.

## Discussion of Existing Models

The models for private sector engagement in health care infrastructure can be simply categorized into three, as mentioned earlier: the first: just infrastructure and ancillary services (designated as the UK model); the second: infrastructure, ancillary services and clinical management (the model adopted in Portugal and described in more detail in the next section); and third (the Alzira model):

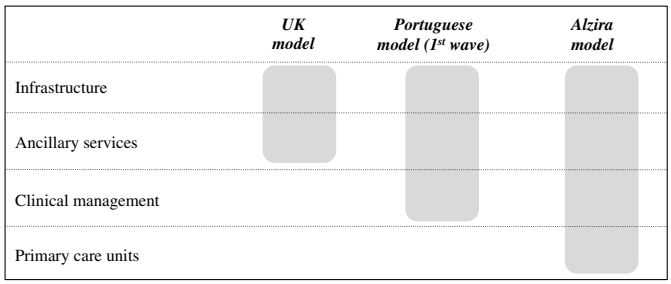


**Fig. 1.** PPP models for health care

infrastructure, ancillary services, clinical management and the management of primary health care (Fig. 1).

Each model corresponds to different levels of risk sharing and potential to capture synergies. The main risks in hospitals are related to demand, technological changes (equipment and diagnosis methods) and changing patterns in medical care.

The UK model adopts a conservative risk-sharing approach, since it does not include any of the main risks. The private partner only assumes the risks inherent to infrastructure management and maintenance activities and also the risks associated with ancillary activities. These can be seen as *second level* risks. The government decided to keep control of the clinical management due to the intrinsic uncertainty of these activities and their sensitive nature.

On the opposite side, the Alzira model moves the main risks to the private partner. To foster a more efficient operation of the hospital, it also gives to the private partner the control of the primary health care units, in order to control the *flow*, as mentioned earlier. In this case, all the main risks are transferred.

The international experiences show that governments have preferred the UK model approach over a more aggressive risk-sharing model. In the case presented next (the Portuguese experience), the model began with significant transfer of risks and evolved towards a less aggressive approach. We will present and discuss the case in detail, using it to support some reflections on the benefits and pitfalls of both approaches. The methodology followed was a case study analysis, looking at the main key historical moments of the process and discussing the systems' evolution from a risk assessment perspective and value for money achieved.

## The Portuguese Experience

### Historical Evolution

The Portuguese health system is centered on the NHS, which was created in 1979 to provide universal access to health care services. The NHS is managed by the Ministry of Health, which is responsible for the political strategy for the health sector. The Ministry also indirectly manages the hospitals in the system by appointing boards for each facility.

Health care expenditures have been increasing in Portugal, rising from 8.6% of the GDP in 1995 to 10.2%, or approximately €15 billion, in 2005. Public expenditures provide over 70% of the financing of the health system, which makes Portugal one of the highest *health spenders* within the EU and the OECD (Thomson et al. 2009).

There have been significant changes in the health system since 1990 both in system financing and in the organization and market structure. The trend has been toward more effective purchase-provider splits by encouraging, among others, more entrepreneurial approaches, the introduction and promotion of generics, liberalization of prices, reform of primary care, and redefinition of the national health plan (Barros and Simões 2007). Among the preceding changes, one of the most important has been the involvement of private partners in the direct provision of infrastructure and services in the NHS. Most of the major hospitals in Portugal were built in the first half of the 20th century, which meant that some required replacement or heavy refurbishment works.

The Portuguese Government adopted PPP models for the same reasons as other countries, such as dealing with financial constraints while having to increase health service spending, cost overruns in infrastructure investments and a political directive to increase private sector involvement in the delivery of public services.

The use of PPP models in Portugal started years ago with the construction of the national highway system. Other PPP arrangements followed in areas such as railways, light-rail systems, water, energy, roads and waste management. The framework for the implementation of PPP projects in health that could include building, maintenance, and operation of health facilities was created in 2002. At that time, the changes in hospital organization included a new model for the management of hospitals, enabling the shift to public enterprises as 34 hospitals, representing approximately 40% of the hospitals in Portugal, became public. The *public enterprise* status provided autonomy to the hospital management while keeping the ownership and ultimate responsibility for service provision in government hands. Although the new PPP model allows more flexibility for managers, the advantages of the model are still emerging. More experience and information are required to prove the merit of the model (Simões and Marques 2011).

### First Wave

The first PPP project for a new hospital was launched in 2003 for the Hospital of Loures. This was followed by three more projects for Cascais, Braga and Vila Franca de Xira. These first four hospitals are known as the *first wave* for PPP arrangements in health care. The tenders were launched and managed by Parcerias. Saúde (Health Partnerships), a taskforce within the Ministry of Health. This group was responsible for setting the bidding process and managing the project until the contract was signed.

The first wave Portuguese model is unique. Each PPP project includes two different partnerships and two contracts, one them includes clinical management and all soft facilities and the other concerns the infrastructure itself, including building and heavy medical equipment operation. The first wave infrastructure contract is granted for a 30-year period, while the first wave management contract is granted for 10 years, after which a new tender is launched for management services. The entity responsible for managing the infrastructure is paid based on infrastructure availability criteria. This model has the advantage of rebidding the clinical services contract every 10 years, meaning that the incumbent cannot adopt a *quiet life* during the concession period, otherwise it can be replaced. This brings the benefits of competition to one of the contracts, but also avoids potential renegotiations to adapt the original contract to changes in the contractual output specifications (during a 30-year period, there is a high probability that the government would want to change the contract specifications regarding clinical treatments). Regarding infrastructure, this is not possible since the full amortization of the building requires a longer duration.

The first wave also included the NHS Call Centre and an orthopedic and physical rehabilitation hospital. The NHS Call Centre, which provides triage assistance, guidance to patients and health-related information, is another PPP arrangement. Extensive operational savings are expected to arise from more efficient resource allocation and management. The comparison of these PPP projects

with their respective public sector comparator (PSC) shows a 17.5% and 6.2% expected decrease in costs, thereby proving the merit of PPPs versus traditional procurement methods. The PSC is a theoretical costing model that estimates the lifecycle cost for public management projects (see more in Cruz and Marques 2012).

The first wave Portuguese model is somewhere between the UK model, developed just for infrastructure and ancillary activities, and the Spanish Alzira model, which included infrastructure, clinical management and primary care units. The rationale behind the Portuguese model is to capture the efficiencies of a joint infrastructure and clinical management arrangement without creating an excessively-complex model by including primary care units. Besides, it avoids the interface risks.

### *Second Wave*

The second wave of PPPs was launched in 2006 with six new hospitals, including Lisboa Oriental, Faro, Seixal, Évora, Espinho/Vila Nova de Gaia and Póvoa do Varzim/Vila do Conde. The second wave model is different from the first wave model. The PPP arrangement is established only for the infrastructure and hospital building and ancillary services, while clinical management remains under the responsibility of the public sector. This is similar to the UK model. Table 3 presents an overview of the Portuguese health sector PPP projects initiated in 2006.

## Lessons from the Portuguese Case

The process of design and implementation of PPP arrangements in Portugal took a long time, and the standard program had to be adjusted several times. One question about PPP projects is whether they provide value to the public sector. Data for the Cascais and Braga hospitals indicate that PPP options provided good value to the public sector (Barros and Martinex-Giralt 2009). The PSC for Cascais Hospital was estimated to be €409 million. The initial offers from the four bidders were between €429 and €526 million. The two selected bidders were invited to negotiate and presented as best and final offers (BAFO) of €359 and €373 million Euros, both below the PSC. The same effect was identified for the Braga Hospital, with six offers ranging between €851 and €1,136 million for a PSC of €1,186 million, and BAFOs for the two selected bidders of €843 and €794 million. Although the quality of service has yet to be analyzed, the PPP arrangement appeared to provide value compared to the traditional procurement method.

A second question about PPP arrangements is the effectiveness of including clinical management. The evidence to date is mixed. Overall, when there are difficulties with measuring the quality of the provided medical services, clinical management should not be performed by the private sector (Barros and Simões 2007) because of the possibility of poor service adversely affecting patients. If quality can be readily monitored using key performance indicators, there may be an advantage in allowing private clinical management.

Nevertheless, this organization model led to an underestimation of PPP expenditures because the initial €5.500 million budgeted for the 2007–2038 period did not account for the cost of management contracts to be signed after the initial 10-year period. From an accountability perspective, there some forecasts should be made for public expenditure with the clinical management after the 10-year period, though with a high degree of uncertainty.

The unbundling of infrastructure and clinical management can pose challenges to interface services such as energy, security and cleaning. These services fall between the clinical and infrastructure management areas. The provision of the interface services may affect the clinical operations, but they are typically the responsibility of the infrastructure manager. It is thus difficult to improve efficiency when interface service decisions and clinical care decisions are not made under the same optimization principles.

Despite the problems with the separate management arrangement, the reason for the shift in the Portuguese PPP model from an integrated arrangement of infrastructure plus clinical services to an unbundled arrangement of privately operated infrastructure while clinical management remained in the public sector had nothing to do with economics but rather with politics and the delay and complexity of managing the tender procedure. One of the main problems with the Portuguese PPP experience was the absence of a well-trained and stable body of public servants who could understand the various issues and safeguard the State position in negotiations. Problems with public servant negotiations arise in other sectors such as water, solid waste, transportation and energy, but they are more critical in health services where a higher degree

**Table 3.** Overview of Portuguese PPP Projects in Health Sector in 2006

| PPP designation | Type of contract | Concessionaire | Date of beginning | Investment (M€) | Observations |
|---|---|---|---|---|---|
| Operation | | | | | |
| NHS Call Centre | Management contract | LCS, SA | 2005 | 55.9 | — |
| Orthopedic and Physical Rehabilitation Centre (Algarve) | Management contract | HPP, SA | 2006 | 3.0 | The building already was constructed; the private partner invested in equipment |
| Construction | | | | | |
| Braga Hospital | Build-maintain-transfer | Escala Braga, SA | 2008 | 131.0 | Teaching hospital—Old infrastructure managed through PPP until new one opens |
| Cascais Hospital | CS management contract | HPP, SA | 2008 | 402.6 | Old infrastructure managed through PPP until new one opens |
| Cascais Hospital | Build-maintain-transfer | TDHOSP, SA | 2008 | 286.2 | — |
| Tender procedures | | | | | |
| Loures Hospital | Build-maintain-transfer | — | — | 80.8 | — |
| Vila Franca Xira Hospital | Build-maintain-transfer | — | — | 74.2 | — |
| Lisbon Oriental H. | Build-maintain-transfer | — | — | 377.0 | — |
| Algarve Hospital | Build-maintain-transfer | — | — | 267.0 | — |

of complexity demands profound and insightful knowledge (Pitman and Holve 2009). In addition, the work required for simultaneous launching of multiple tenders was underestimated, which caused serious delays—over 5 years. This has created the impression that the transaction costs were too high and the government was not ready to deal with such complex tasks.

Apart from the contract management administration problems, there is the question of how well PPP systems work overall. There may be advantages in having private partners develop and manage hospital infrastructures, although there is some evidence that the value of a PPP arrangement for just infrastructure may not be worthwhile (Pollock et al. 2002). The value of a PPP project depends on the system complexity and the inefficiency of the public sector compared to the private sector (Vining and Boardman 2008). A case-by-case analysis is required to determine the merits of a PPP arrangement.

When considering the possible efficiency gains by involving the private sector in health care delivery, infrastructure development and management is only one, and maybe the least relevant, gain because of the shortage of private equity in most economies. Financing is getting more expensive, and financial institutions in Mediterranean countries, are now getting governmental guarantees in order to access international credit. This means that the public sector is both providing guarantees to financial institutions to access credit and *buying* credit to finance health investments. This means that the government is paying a higher premium for private sector involvement compared to that required three or four years ago. The larger drivers for efficiency gains are in clinical and interface services management, particularly when private specialized companies in health services delivery are growing in the market, ensuring a high level of competition for these services. A restructuring in clinical management requires a disruptive change that may be made possible by bringing in a private management company. The advantage of private management was a key reason that PPP arrangements were considered in the first place. Health demands, patient volume and disease patterns are tremendously uncertain. The ability to optimize the infrastructure layout for the services being provided is only possible under a bundled model. Designing and planning hospitals for 30 years into the future cannot be performed under a predefined long-term master plan. The design and planning requires continual adaptations, and directly depends on clinical services management. Expected developments in the future will broaden the scope of PPP models to include primary and continuing care services.

## Conclusions

The use of PPP arrangements in health care delivery has become widespread across the world, although their benefits and disadvantages should be correctly assessed.

The main advantages of a PPP project for health care is the ability to take a life-cycle approach to planning and account for costs and benefits and the efficiency gains of introducing the private sector's commercial and profit-oriented approach to the delivery of an expensive public service that can be a major burden on national budgets.

However, care should be taken when extrapolating the benefits of these arrangements based on PPP arrangements applied to other sectors such as energy, transportation, water and solid waste. The results of services such as water, solid waste and energy are relatively easy to monitor, measure, and verify quality standards. Easy monitoring is not the case for health care. Although it is possible to define quality indicators and monitoring plans to ensure the success of the project, there is a greater complexity and wider scope of *measuring* health services. This is one of the critical factors where more work is required to keep the partnerships *under contro*l. That work requires the precise definition of quality standards for health care services, including waiting times and recidivism rates after discharge, among others.

Another important issue is risk-sharing (Asenova et al. 2007). To leverage the full potential of the partnership, an effective sharing of risk between the public and the private sector is required. A PPP arrangement gives good value to society only when there is an efficient assumption of risk by the private sector. To effectively share risk, the levels of uncertainty surrounding the project need to be well understood. Such understanding is difficult with health care because forecasting demand, such as disease patterns and population profiles, or supply, such as available medical treatments, equipment, and drugs, is much more difficult than with traditional utilities areas.

The complexity is greater when the private partner also performs clinical services. The difficulty in dealing with technological uncertainty and effectively measuring quality of service causes problems for the government regulators, beyond the commitments for contract monitoring. These problems are given as the main reasons for the shifting in both Portugal and Spain, from an integrated model toward the UK approach of keeping clinical management under the NHS. Uncertainties surrounding clinical management and health care demand may increase the premium risk required by the private sector, making the project more expensive than it would be under a traditional procurement model. Flexibility in infrastructure planning and design is a key requisite to breakthrough this problem. More research is required in this field, although some work in hospital expansion projects has been developed (Neufville, R., Lee, Y. S., and Scholts, S., "Flexibility in hospital infrastructure design", working paper, Massachusetts Institute of Technology, Boston, MA; Maseda 2008), but only from the perspective of investment timing. The focus should be on the quality of service itself, giving the private partner the managerial flexibility to provide the specified levels of quality at the lowest cost possible.

Under this *vertical unbundling approach*, potential synergies between infrastructure and clinical management are abandoned, and these were, and still are, pointed out as the main drivers for increasing efficiency in health PPP arrangements. More research in required, and while there are some broad experiences, it is the authors' opinion that vertical integration should be maintained as a PPP alternative.

## References


Akintoye, A., and Chinyio, E. (2005). "Private finance initiative in the health care sector: Trends and risk assessment." *Eng. Construct. Architect. Manage.*, 12(6), 601–616.

Asante, A. D., and Zwi, A. B. (2007). "Public-private partnerships and global health equity: Prospects and challenges." *Indian J. Med. Ethics*, 4(4), 176–180.

Asenova, D., Stein, W., McCann, C., and Marshall, A. (2007). "Private sector participation in health and social care services in Scotland: Assessing risk." *Int. Rev. Adm. Sci.*, 73(2), 275–292.

Barros, P. P., and Martinex-Giralt, X. (2009). "Contractual design and PPPs for hospitals: Lessons for the Portuguese model." *Eur. J. Health Econ.*, 10(4), 437–453.

Barros, P. P., and Simões, J. A. (2007). "Portugal: Health system review." *Health Sys. Transit*, 9(5), 1–140.

Bazzolli, G. J., Stein, R., Alexander, J. A., Conrad, D. A., Sofaer, S., and Shortell, S. M. (1997). "Public-private collaboration in health and human service delivery: Evidence from community partnerships." *Milbank Q*, 75(4), 533–561.

Bentes, M., Dias, C. M., Sakellarides, C., and Bankauskaite, V. (2004). "Health care systems in transition: Portugal." WHO Regional Office for Europe on behalf of the European Observatory on Health Systems and Policies, Copenhagen.

Boyle, S. (1997). "The private finance initiative undermines rational planning of health services." *Br. Med. J.*, 314(1214), 1266–1271.

Broadbent, J., Gill, J., and Laughlin, R. (2003). "Evaluating the private finance initiative in the national health service in the UK." *Account. Audit Account. J.*, 16(3), 422–445.

Buse, K., and Harmer, A. M. (2004). "Power to the partners? The politics of public-private health partnerships." *Development*, 47(2), 49–56.

Buse, K., and Harmer, A. M. (2007). "Seven habits of highly effective global public-private health partnerships: Practice and potential." *Soc. Sci. Med.*, 64(2), 259–271.

Buse, K., and Walt, G. (2000a). "Global public-private partnerships: Part I—A new development in health?" *Bull. World Health Org.*, 78(4), 549–561.

Buse, K., and Walt, G. (2000b). "Global public-private partnerships: Part II—What are the health issues for global governance?" *Bull. World Health Org.*, 78(5), 699–709.

Cravinho, A. C., Marques, R. C., and Cruz, C. O. (2011). "Public-private partnerships for wind power generation: The Portuguese case." *Energ. Policy*, 39(1), 94–104.

Croft, S. L. (2005). "Public-private partnership: From there to here." *T. Roy. Soc. Trop. Med. H.*, 99(1), 9–14.

Cruz, C. O., and Marques, R. C. (2011). "Contribution to the study of PPP arrangements in airports." *Transport Pol.*, 18(2), 392–400.

Cruz, C. O., and Marques, R. C. (2012). "Using probabilistic methods to estimate the public sector comparator." *Comput. Aided Civ. Infrastruct. Eng.*, 27(10), 782–800.

Dewan, P. K., et al. (2006). "Improving tuberculosis control through public-private collaboration in India: Literature review." *Br. Med. J.*, 332(7541), 574–578.

Drevdahl, D. (2002). "Social justice or market justice? The paradoxes of public health partnerships with managed care." *Publ. Health Nurs.*, 19(3), 161–169.

Dunnigan, M. G., and Pollock, A. M. (2003). "Downsizing of acute inpatient beds associated with private finance initiative: Scotland's case study." *Br. Med. J.*, 325(7395), 1–6.

Gaffney, D., Pollock, A. M., Price, D., and Shaoul, J. (1999a). "PFI in the NHS—Is there an economic case." *Br. Med. J.*, 319(7202), 116–119.

Gaffney, D., Pollock, A. M., Price, D., and Shaoul, J. (1999b). "The politics of the private finance initiative and the new NHS." *Br. Med. J.*, 319 (7204), 249–253.

Galvin, R. (2003). "Purchasing health care: An opportunity for a public-private partnership." *Health Affair.*, 22(2), 191–195.

Garcia, P. (2005). "Public-private partnerships (PPP) in health projects." Ministry of Health, Government of Chile 2005.

Gillies, P. (1998). "Effectiveness of alliances and partnerships for health promotion." *Health Promot. Int.*, 13(2), 99–120.

Gupta, R., et al. (2002). "Increasing transparency in partnerships for health – Introducing the Green Light Committee." *Trop. Med. Int. Health*, 7(11), 970–976.

Harrington, C., and Pollock, A. M. (1998). "Decentralisation and privatisation of long-term care in UK and USA." *J. Lancet*, 351(9118), 1805–1808.

Hsiao, W. (2007). "Why is a systemic view of health financing necessary?" *Health Affair.*, 26(4), 950–961.

Jones, J. (2000). "The private finance initiative: Spinning out the defence." *Br. Med. J.*, 320(7247), 1460–1461.

Ke, Y., Wang, S., and Chan, A. P. C. (2010). "Risk allocation in public-private partnership infrastructure projects: comparative study." *J. Infrastruct. Syst.*, 16(4), 343–351.

Kickbusch, I., and Quick, J. (1998). "Partnerships for health in the 21st century." *World Health Stat. Q*, 51(1), 68–74.

Knickman, J. R., and Stone, R. I. (2007). "The public/private partnership behind the cash and counseling demonstration and evaluation: its origins, challenges, and unresolved issues." *Health Services Res.*, 42(1Pt2), 362–377.

Marques, R. C., and Berg, S. (2010). "Revisiting the strengths and limitations of regulatory contracts in infrastructure industries." *J. Infrastruct. Syst.*, 16(4), 334–342.

Maseda, L. J. (2008). "Real options analysis of flexibility in a hospital emergency department expansion project, a systems approach." M.Sc. thesis, Eng. and Management thesis, System Design and Management Program, Massachusetts Institute of Technology, Boston, MA.

Mitchell, S. M., and Shortell, S. M. (2000). "The governance and management of effective community health partnerships: A typology for research, policy, and practice." *Milkbank Q.*, 78(2), 241–289.

Murthy, K. J. R., Frieden, T. R., Yazdani, A., and Hreshikesh, P. (2001). "Public-private partnership in tuberculosis control: Experience in Hyderabad, India." *Int. J. Tuberc. Lung Dis.*, 5(4), 354–359.

Nishar, S. (2004). "Public–private 'partnerships' in health—A global call to action." *Health Res. Policy Syst.*, 2(5), 1–7.

Nwaka, S. (2005). "Drug discovery and beyond: The role of public-private partnerships in improving access to new malaria medicines." *Trans. R. Soc. Trop. Med. Hyg.*, 99(1), 20–29.

Nwaka, S., and Ridley, R. (2003). "Virtual drug discovery and development for neglected diseases through public-private partnerships." *Nat. Rev. Drug Discov.*, 2, 919–928.

Pantelias, A., and Zhang, A. (2010). "Methodological framework for evaluation of financial viability of public-private partnerships: Investment risk approach." *J. Infrastruct. Syst.*, 16(4), 241–250.

Papajohn, D., Cui, Q., and Bayraktar, M. E. (2011). "Public-private partnerships in U.S. transportation: Research overview and a path forward." *J. Manage. Eng.*, 27(3), 126–135.

Philpott, T. G. (2007). "Public-private partnerships: A Canadian hospital's perspective." *Health Manage Forum*, 20(4), 33–67.

Pitman, P., and Holve, E. (2009). "The health services researcher of 2020: A summit to assess the field's workforce needs." *Health Service Res.*, 44(6), 2198–2213.

Pollock, A. M., Dunningan, M. G., Gaffney, D., Macfarlane, A., and Majeed, F. A. (1997). "What happens when the private sector plans hospital services for the NHS: Three case studies under the private finance initiative." *Br. Med. J.*, 314(7089), 1266–1271.

Pollock, A. M., Dunningan, M. G., Gaffney, D., Price, D., and Shaoul, J. (1999). "Planning the 'new' NHS: Downsizing for the 21st century." *Br. Med. J.*, 319(7203), 179–184.

Pollock, A. M., Player, S., and Godden, S. (2001). "How private finance is moving primary care into corporate ownership." *Br. Med. J.*, 322(7292), 960–963.

Pollock, A. M., Shaoul, J., and Vickers, N. (2002). "Private finance and "value for money" in NHS hospitals a policy in search or a rationale?" *Br. Med. J.*, 324(7347), 1205–1209.

Price, D., Pollock, A. M., and Shaoul, J. (1999). "How the World Trade Organisation is shaping domestic policies in health care." *J. Lancet*, 354(9193), 1889–1892.

Reibeiz, K. S. (2012). "Public-private partnership risk factors in emerging countries: A BOOT illustrative case study." *J. Manage. Eng.*, 28(4), 421–428.

Reich, M. R. (2000). "Public-private partnerships for public health." *Nature Med.*, 6(6), 617–620.

Richter, J. (2004). "Public–private Partnerships for Health: A trend with no alternatives?" *Development*, 47(2), 43–48.

Rosenthal, G., and Newbrander, W. (1996). "Public Policy and private sector provision of health services." *Int. J. Health. Plan. M.*, 11(3), 203–216.

Serrano, C. T., Ferrer, M. M., and Torner, A. R. (2009). "The Alzira model: Hospital de la Ribera, Valencia, Spain." *Capital investment for health: Case studies from Europe*, B. Rechel, J. Erskine, B. Dowdeswell, S. Wright, and M. McKee, eds., World Health Organization Publications, Copenhagen, Denmark, 11–25.

Shaw, E. (2003). "Privatization by stealth? The Blair government and public-private partnerships in the National Health Service." *Contemporary Pol.*, 9(3), 277–292.

Shortell, S. M., et al. (2002). "Evaluating partnerships for community health improvement: Tracking the footprints." *J. Health Politics Pol. Law.*, 27(1), 49–92.

Simões, P., and Marques, R. C. (2011). "Performance and congestion analysis of the Portuguese hospital services." *Cent. Eur. J. Oper. Res.*, 19(1), 39–63.

Skamris, M., and Flyvbjerg, B. (1997). "Inaccuracy of traffic forecasts and cost estimates on large transport projects." *Transp. Pol.*, 4(3), 141–146.

Teicher, J., Alam, Q., and Gramberg, B. V. (2006). "Managing trust and relationships in PPPs: Some Australian experiences." *Int. Rev. Adm. Sci.*, 72(1), 85–100.

Thompson, C. R., and McKee, W. (2004). "Financing and planning of public and private not-for-profit hospitals in the European Union." *Health Pol.*, 67(3), 281–291.

Thomson, S., Foubister, T., and Mossialos, E. (2009). "Financing health care in the European Union: Challenges and policy responses." *European Observatory on Health Systems and Policies, Observatory Studies Series No. 17.*, World Health Organization, Copenhagen, Denmark.

Toit, J. D. (2003). "PPP insights in South Africa." *World Hosp. Health Serv.*, 39(1), 2–10.

Tountas, Y., Karnaki, P., Pavi, E., and Souliotis, K. (2005). "The 'unexpected' growth of the private health sector in Greece." *Health Pol.*, 74(2), 167–180.

Trouiller, P., Olliaro, P., Torreele, E., Orbinski, J., Laing, R., and Ford, N. (2002). "Drug development for neglected diseases: A deficient market and a public-health policy failure." *J. Lancet*, 359(9324), 2188–2194.

Vining, A. R., and Boardman, A. E. (2008). "The potential role of public-private partnerships in the upgrade of port infrastructure: Normative and positive considerations." *Marit. Policy Manag.*, 35(6), 551–569.

Vining, A. R., Boardman, A. E., and Poschmann, F. (2005). "Public-private partnerships in the US and Canada: There are no free lunches." *J. Com. Pol. Anal.: Res. Practice*, 7(3), 199–220.

Vrangbaek, K. (2008). "Public-private partnerships in the health sector: The Danish experience." *Health Econ. Pol. Law*, 3(2), 141–163.

Weiner, B. J., and Alexander, J. A. (1998) "The challenges of governing public-private community health partnerships." *Health Care Manage. R.*, 23(2), 39–55.

Widdus, R. (2001). "Public-private partnerships for health: Their main targets, their diversity, and their future directions." *Bull. World Health Org.*, 79(8), 713–720.

Yuan, J., Wang, C., Skibniewski, M. J., and Li, Q. (2012). "Developing key performance indicators for public private partnership projects: Questionnaire survey and analysis." *J. Manage. Eng.*, 28(3), 252–264.