



RESEARCH PAPER

A Statistical Investigation of Public-Private Collaboration within the NHS, UK

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ABSTRACT

This study was designed to assess the role of the private sector in improving the performance of the National Health Service (NHS) in the United Kingdom (UK), in terms of operational efficiency, quality of care, healthcare equity, and technological innovation. NHS services have increasingly embraced partnerships between the public and the private sector to meet the increasing demands of healthcare and limited resources. Although this is widely used, there are still questions about how it affects quality of service, access to service and long-term healthcare outcomes. The research design was quantitative with a cross-sectional study design, with structured survey data collected from 3000 healthcare professionals from across NHS Trusts. Descriptive statistics, correlation analysis and multiple regression analysis were used to examine the relationships between private sector participation and the healthcare performance indicators. The results suggest that the performance of health services is strongly related to the presence of private sector participation and highlight positive impacts and areas for policy consideration. The study advocates for equitable public-private governance frameworks, ongoing performance monitoring and evidence-based policies to ensure efficiency, quality, innovation and equitable healthcare delivery.

KEYWORDS Private Sector Involvement, Healthcare Performance, Public-Private Partnership, Healthcare Equity, Statistical Techniques

Introduction

A publicly funded healthcare system in the United Kingdom is called the National Health Service (NHS), which was created in 1948 to offer free healthcare services to all United Kingdom citizens (Fahy et al., 2017). It is a unified system that provides basic care, community health, and specialized care, which represent around 70% of the budget of the NHS (Vazirani et al., 2019). NHS is a giant among employers in the world as it employs more than 1.3 million individuals and has a major impact on the workplace environment and service provision in the country (Lennon et al., 2017).

Being a highly sophisticated healthcare system, NHS organizations have numerous functions, including patient regulation up to helping carers, which means the need to cooperate with communities and integrated care boards (Feldman et al., 2018; Sheaff et al., 2019). NHS is the provider of the statutory guidance to trusts and policy boards to improve patient outcomes and provide sustainable healthcare delivery (Almeida, 2017; Kerasidou and Kerasidou, 2023). These services will work to enhance health and well-being, motivate the population to participate, tackle health disparities, provide personalized care, and prevent the wastage of healthcare resources (Ghafur et al., 2020; Adamou et al., 2021).

England has 229 trusts that comprise ambulance service, mental health, foundation, and acute care providers and a large number of community hospitals and specialist facilities (NHS England, 2023; Nyashanu et al., 2022). NHS has increased its services to incorporate massive vaccination schemes in recent years, with more than 128 million vaccinations since December 2020, which is why it is regarded as a company that contributes to the state of

public health and safety (Feldman et al., 2018). On the whole, NHS continues to be the hub of initiating collaborative partnerships with the focus on patient experience, safety, and service performance (Harrington et al., 2021).

The NHS has over the years reported major milestones in the research of diseases, immunization, surgeries, and transplantation services, and has maintained healthy living, illness prevention, and reduction of health inequalities (Robertson et al., 2017; Vazirani et al., 2018). In a bid to address the rising healthcare need and fiscal limitation, partnership with the private sector has been emerging as a major strategy in improving the services in the NHS (Ghafur et al., 2020; Kerasidou and Kerasidou, 2023).

Participation of the private sector enables the NHS to increase capacity, enhance patient safety, mitigate the risk that comes with legal challenges, as well as responding efficiently to the needs of the community (Nyashanu et al., 2022). This includes partnerships with voluntary organisations, social enterprises, health watch, social care providers, local authorities and those that deliver services including long stay residential care, elective surgery, psychiatry, etc. (Feldman et al., 2018; Faulkner-Gurstein and Wyatt, 2023).

Under the financial aspect, the government allocates around 7 percent of the NHS budget to the independent sector providers, yet some studies indicate that the true spending can be greater when some of the services are not counted in the official expenses (DHSC, 2019; CHPI, 2019). Psychiatric and acute medical inpatient and outpatient care is provided by 75 percent of private entities, which sometimes provides such care on a self-financed basis pursuant to private medical insurance policies (Harrington et al., 2021; Adamou et al., 2021).

With such dynamics, it is important to comprehend the possible advantages and disadvantages associated with the decision to engage the private parties in the NHS services. The private partnership will enhance the efficiency of services, innovation, and access to care, yet can also create the issue of inequality, variation of quality, and diminished accountability in the hands of the populace. This paper will therefore be exploring the implication of the presence of the private sector in the NHS system that can support informed judgment in the healthcare policy.

The growing presence of entities in the NHS by the individuals in the private sector creates significant issues as to its overall effects on the performance of healthcare. Although the effectiveness and creativity of the healthcare system can be improved by collaboration at the individual level, it can also influence the healthcare equity and accessibility of the services. Nevertheless, the empirical orientation and scope of such relations are not properly justified by large scale statistical data.

Literature Review

This article critically evaluates the previous research and gives a full picture of the pros and cons of the possibility of private bodies participating in NHS services. It analyzes and summarizes the existing literature and presents gaps in the literature. Further, it provides relevant theories, models and conceptual frameworks, summarising the overall lessons to be learned about private sector involvement in the delivery of NHS services.

The NHS is a complicated, publicly funded healthcare system in the UK, responsible for providing a variety of clinical services to their patients and supporting their jobs (Fahy et al., 2017). The NHS is known for its high standards of care and integrated health services across different areas of the country, globally (Majeed et al., 2020; Moullin et al., 2017).

The NHS has a duty to "promote health and wellbeing and reduce health inequalities" (Soukup et al., 2018) it is the largest publicly funded healthcare provider of services. The

NHS was created in 1946 by the National Health Service Act, which was aimed at delivering health services based on the public's need (Artiga and Hinton, 2018). It has a service orientation based on a set of shared values and principles, which are grounded in fairness and good use, thereby delivering services to patients and staff (Warren et al., 2019). A range of NHS organisations, voluntary providers and local government agencies work together to provide fully integrated public health duties and to ensure good service delivery to patients (Monaghesh and Hajizadeh, 2020).

In summary, NHS services play an important role in meeting the health and social care requirements of both people and communities, enhancing recovery and promoting population health both nationally and internationally.

Importance of Public Health Service Provision

Having the goal of preventing illness, injury, and death, as well as safeguarding vulnerable groups and promoting healthy lifestyles, public health services revolve around promotion, protection, and prevention (Al-Dmour et al., 2020; Prinja et al., 2017). Good public health services benefit the provision of healthcare, help people make informed decisions in care and protect the well-being of the community (Guest et al., 2020).

Major roles are disease monitoring, health education, vaccination, and lobbying to enact laws that would prevent the spread of diseases (Wake and Green, 2019; Kerr et al., 2019; Smith et al., 2019). The reduction of inequalities and equitable access to the population, irrespective of age, gender, and ethnic background, is also central to the services delivered by public health (Thiel et al., 2017; Gupta et al., 2021; Pichler et al., 2019).

In such ways, the community health is safeguarded and improved, diseases are prevented, and evidence-based interventions that make the society healthier are promoted through the work of the public health services (Warren et al., 2019; Wang et al., 2019).

Impact of Private Healthcare Sector Involvement

Private healthcare is made up of institutions and individuals that deliver healthcare services that supplement public services (WHO; Vazirani et al., 2019; Fahy et al., 2017). By engaging in the provision of NHS services the private sector can help to reduce the strain on public health services by providing extra capacity and resources (Kuan et al., 2019).

There are concerns about inequities and lower access to care for disadvantaged groups, however (Tennison et al., 2021). A balance between public and private provision is essential to keeping provision affordable, of good quality and universal. NHS and private sector partnerships ensure that capacity is maintained, services are efficient and rosters of patients are adjusted to meet surges when needed, with up to 2.8 million procedures outsourced to private hospitals in 2021 (Smith et al., 2019; Kim et al., 2017).

Healthcare outcomes are improved by public-private collaboration, but with strategies in place to ensure efficiency and equity, even in nations that lack a separation between public and private healthcare systems (Monaghesh and Hajizadeh, 2020).

Advantages of Involving Private Entities in NHS Services

NHS services involve the involvement of private entities that lead to efficiency, innovation, and infrastructure formation (Lennon et al., 2017; Kerr et al., 2019). They are able to shorten the time of wait, bring technological progress, and offer specific care services (Warren et al., 2019; Wang et al., 2019).

Moreover, the privatization leads to better management activities, staff motivational work and simplification of healthcare services (Thiel et al., 2017). When the proper regulation frameworks are in place, collaborations with the private organizations can help to benefit most, at least reducing risks, and guarantee the quality service provision.

Disadvantages of Involving Private Entities in NHS Services

Although it also has its benefits, there are such disadvantages of the involvement of the private sector as a focus on profits instead of patient care, reduced accessibility, and the risk of worsening health disparities (Wake, Green, 2019; England, 2019; Guest et al., 2020). Additional regulatory issues may increase difficulties with accountability and transparency (Majeed et al., 2020). Commercial business policies can result in the denial of services that cannot achieve a profit, a reduction in the number of working positions, and serving more profitable patients, which amplifies the gap between publicly and privately available healthcare (Pichler et al., 2019; Monaghesh and Hajizadeh, 2020; Robertson et al., 2017). Privatization may also result in a lack of transparency, inadequate control, and, ultimately, worsened compliance with rules, which, ultimately, affect patient safety and quality of care (Portes et al., 2017; Thiel et al., 2017).

Factors Which Contribute to the Impact of the Core Services and Productivity of NHS

Healthcare policies, funding, infrastructure, and workforce are all crucial factors in enabling NHS to be productive and effective (Vazirani et al., 2019; Robertson et al., 2017). Financial sources, staffing, burnout and managerial costs all have a negative impact on the quality of care and on the efficiency of its operations (Tennison et al., 2021; Kuan et al., 2019; Artiga and Hinton, 2018).

Developed staff, enhanced technology and improved infrastructure leads to better efficiency, improved patient outcomes and service delivery (Cooper et al., 2018; England, 2019). The productivity of the NHS is influenced by effective management, professional well-being and a positive working environment (Al-Dmour et al., 2020; Srensen et al., 2017).

Evidence-Based Practices Used to Improve NHS Services

Practices in the NHS based on evidence are designed to enhance quality of care and reduce health inequalities and to inform decision making by integrating patient values and clinical expertise (Huddleston et al., 2020; Bonner et al., 2019; Fahy et al., 2017). Evidence-based methods are employed by NHS services to facilitate better patient experiences, eliminate nonproductive interventions, and encourage long-term health outcomes (Nadalin Penno et al., 2019; Mathieson et al., 2019).

Evidence-based practices assist in standardization of care, cost-effectiveness, and effective recovery and integrate alternative methods that are proven by research studies (Sharma and Grumbach, 2017; Lumbers, 2018; Lavallée et al., 2018). In general, the practices are necessary to enhance the effects of NHS delivery of services, patient outcomes, and compliance with national and international standards in healthcare (Penn et al., 2018).

Evaluation of the literature available on the role of private bodies in NHS services indicates that there are gaps that should be explored. Although earlier research addresses the possible advantages and disadvantages of the involvement of the private sector, the majority of them are concerned with the short-term consequences but not with the long-term implications of the accessibility, quality, and sustainability of healthcare services (Bonner et al., 2019). Empirical studies that assess economic impacts, resources distribution, and spending on health among the various groups of people are scarce (Huddleston et al., 2020).

Additional gaps are knowledge about the trust in the population, social justice, and political forces that affect NHS privatization (Manley and Jackson, 2019; Lavallée et al., 2018). There is also a lack of evidence on the sustainability of evidence-based practices, employee engagement and service quality, integration of digital innovations, and the social determinant role in supporting health equity (Nadalin Penno et al., 2019; Wake and Green, 2019; Lennon et al., 2017; Artiga and Hinton, 2018).

Theoretical Framework

Various theories are used to present the theoretical assumptions and focus on the study to address the research issues in the light of the agency theory, resource dependency theory and stakeholder theory and to make a great insight and implications regarding the topic of the research.

Agency Theory

According to Agency theory, the interactions between patients and healthcare providers along with the questions regarding the decision-making power are solved and clarified (Nadalin Penno et al., 2019). The agency theory is mainly concerned with finding out the relationship between the principals (NHS and government) and the agents (private healthcare providers) and highlights their various objectives and goals. In terms of the background of NHS service, agency theory can be important in highlighting the issues that characterize the relationship between the agent and alleviating any potential dangers (Sharma and Grumbach, 2017, p. 262–267). This agency theory assumes setting up an incentive-based structure, control systems and contracts that have a dynamic impact on an independent health care provider and elaborating an agreement with the potential consequences and goals of the NHS. Overall, this theory expands and outlines the pathway to achieve accountability and reduce agency problems as a way to deliver effective care.

Resource Dependency Theory

Resource dependency theory gives significant concentration on the external influence of resource acquisition and its effects on organization behavior that encourages the control of resource provision. Mathieson et al. (2019 p. e6) concluded that the resource dependency theory fulfills an essential task of caring about patients and is aimed at explaining the organizational strategies that help to ensure expertise in the field of healthcare, technology and funds. But research by Penn et al. (2018 p. e019467) established power relationships and interdependence of the organizations along with the strategies adopted to handle resource dependencies. Regarding the study by Manley and Jackson (2019), it is discovered that in the area of the healthcare system, resource dependence theory studies the participation of the private healthcare organizations that, in particular, depend on such types of resources as expertise, technology and funding. The theory also helps to explore and analyze the role of non-governmental actors and changes the allocation and distribution of resources in the healthcare system (Lavallée et al., 2018 pp. 79-89). Generally, this theory also helps in looking into the resource exchange, alliance and partnership of the private and public organizations that have an impact on the sustainability of the organization, innovation, and delivery of services.

Stakeholder Theory

Specifically, the stakeholder theory is a specific model that significantly helped to inform the working process and organize the business and overcome the contradictions related to the idea of sustainability (Sharma and Grumbach 2017 pp. 262-267). In addition, the stakeholder theory significantly involves creating a significant focus on facilitating societal well-being and organizational prosperity and creating a varied interest and impact on privatization of stakeholder results like equity and quality and emphasizing the

approaches to managing conflicts, engaging stakeholders and fostering cooperation to achieve the positive results (Sutton et al., 2018 p. e0195890). Within the frames of these theoretical approaches, the current research will be able to gain valuable understanding of the multifaceted dynamics of the NHS private entities and services that entail the interests of stakeholders, resource-dependencies and agency issues (Nadalin Penno et al., 2019 pp. 1-16). All in all, these theories help in the provision of a holistic examination and allow engagement in the healthcare provision in terms of collaboration, regulation and governance of the healthcare sector.

This recaps the earlier facts and knowledge on the possible advantages and disadvantages of the private entities that exist in the NHS services and importantly points out the areas and overview of the NHS service. It also dictates the significance of provision of the public health services and its effect on the involvement of the private healthcare sector. It is discovered that, to assist NHS, the private sector should be urged to assist the NHS and take a huge percentage of the workload that should be centralized to serve the purpose of the health of the populace. This chapter also identifies the benefits and shortcomings of the concept of the private entities and assesses the factors and the evidence-based practices that helped to enhance the NHS services. On this, this chapter also announced the deficiency in knowledge on the subject of public health services, public faith, and the possible implications in relation to social justice. It has also put into account the agency theory, resource dependency theory, and stakeholder theory to provide a systematic analysis and motivate participation in healthcare provision in terms of collaboration, regulation, and governance in healthcare sector.

Hypotheses

- H1: There is a positive effect of involvement of the privates on the operational efficiency of NHS services in a significant positive way.
- H2: The involvement of the private sector contributes to better patient care in the NHS services in a significant positive way.
- H3: The participation of the private sector significantly contributes to the reduction of equity in healthcare in NHS services.
- H4: The influence of the involvement of the private sector to infrastructure development and technological innovation of the NHS services is significant and positive.
- H5: The overall healthcare performance in the NHS services is highly predictable by the involvement of the private sector.

Material and Methods

Methodology gives a systematically structured approach to get, compile, collect, and examine information. The research has a quantitative study design to be conducted to test the research hypotheses on the role of the private sector and performance in the NHS services. Quantitative methods enable relationship between variables to be statistically validated to provide objective, rigorous, and reproducible results. The research philosophy, approach, research design, data collection, inclusion/exclusion criteria, reliability, validity, and data analysis with SPSS have been addressed.

This research follows a positivist research philosophy, which presupposes the existence of an objective reality that is measurable and statistically analyzable (Tennison et al., 2021). Positivism facilitates the application of questionnaires and numerical data in testing hypotheses. It aids in the empirical study of interrelations among the involvement of the private sector and the key performance indicators that include the operational efficiency,

patient care quality, healthcare equity, and innovation of infrastructure. The methodology and design of the study were followed as in the research approach section.

The study follows a deductive quantitative methodology to evaluate a priori hypotheses (H1-H5). The research employs secondary and cross-sectional data of 3,000 observations in online publicly available datasets as opposed to primary survey responses. To secure the consistency of methods, a mono-method quantitative design was used. The SPSS was used to perform statistical analysis on the correlation between the involvement of the private sector and its operational efficiency, and other healthcare performance indicators.

The secondary numerical data allowed the hypothesis testing without violating the objectivity and analytical rigor.

Data Collection Process

Secondary quantitative data in the form of publicly available data, NHS reports and past research studies were used to collect data. These data sets contained data pertaining to the study variables:

- Operational efficiency (H1)
- Patient care quality (H2)
- Healthcare equity (H3)
- Housing and technological innovation (H4)
- Overall healthcare performance (H5).

The reliability, relevance, and regency were used to select the secondary data sources. Data extraction involved:

- Determining datasets and other publications regarding the role of the private sector in NHS services.
- Reckoning numerical data bearing to the research variables.
- Organizing the results into a data set that is ready to be analyzed in SPSS, i.e. coding of the variables and consistency across sources.

This is because, in this way, data on large scale will be accessed quickly and inexpensively allowing empirical testing of hypotheses without compromising methodological rigor.

Criteria of Inclusion and Exclusion

Inclusion Criteria

Quantitative data or reports with the information about the NHS healthcare performance and involvement of the private sector.

Data was gathered in UK NHS trusts.

Variables of interest covered by data: operational efficiency, patient care quality, healthcare equity, infrastructure/technological innovation, and overall performance.

Exclusion Criteria

Lacking variables and data on datasets.
Data of non-UK NHS healthcare systems.

Report or datasets that are not dedicated to the presence of the private sector in NHS services.

Reliability and Validity

As the research used a pee-coded secondary data where the variables have been calculated as composite measures, no extra reliability testing (e.g. Cronbach alpha) was conducted. The Operational Efficiency Index was considered a continuous variable that was pre-constructed. On the same note, the assessment of construct validity using the factor analysis was not carried out when the study did not use multi-item latent constructs that must be validated with dimension. The measures utilized in this analysis were directly measurable variables (percentage involvement and efficiency index), and therefore, they were appropriate in regression analysis without any additional procedures of scale validation.

Data Analysis

To test all the five hypotheses of the study, a quantitative method of data analysis was used through IBM SPSS to analyze the secondary data pertaining to NHS services. Firstly, the descriptive statistics of all variables were calculated to describe their central tendency and dispersion, including mean, standard deviation, minimum, and maximum values, which gives a general picture of the data distribution. In the case of Hypothesis 1, which examines the effect of Private Sector Involvement Percent on Operational Efficiency Index, simple linear regression analysis was done whereby the variable of interest which is the private sector involvement is considered the independent variable whereas the dependent variable which is operational efficiency is the dependent variable. In the same way, Hypothesis 2 tested the influence of Private Sector Involvement Percent on the Quality of Patient Care (Operational Efficiency Index) as the simple linear regression with 3,000 observations. Hypothesis 3 involved the examination of the relationship between Percent Private Involvement and Equity Score in 100 NHS Trusts. In the case, Pearson correlation analysis was initially applied to establish the strength and direction of the relationship, and simple linear regression to evaluate the predictive power of the participation of the private sector to the equity of healthcare was subsequently applied. In the case of Hypothesis 4, the research tested the impact of Private Sector Involvement Percent on the Infrastructure & Technology Innovation Index, whereas Hypothesis 5 tested the impact of the percentage of the Private Sector Involvement on the Overall Healthcare Performance Index, as a composite measure of healthcare outcomes. In the case of these hypotheses, Pearson correlation and simple linear regression analysis was performed. Enter method was used in SPSS to incorporate the independent variable in all regression models. The model fitness was measured based on the R, R² and Adjusted R² values, and the entire significance of the models was measured by ANOVA (F-test). The size and direction of relationships was established in terms of regression coefficient (B value and Beta value), t-statistics and p-values, where a significant level of 0.05 was used as the decision criterion during hypothesis testing. This analytical process allowed the research to conclude on whether the involvement of the private sector can play a significant role in terms of the operational efficiency, quality of patient care, healthcare equity, infrastructure and technological innovation, and overall healthcare performance in the NHS services.

Results and Discussion

Table 1
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Private Sector Involvement Percent	3000	5.00	24.99	14.9978	5.83316
OperationalEfficiency_Index	3000	.802	1.422	1.09897	.126679

Valid N (listwise)	3000			
Regression				
Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.919 ^a	.844	.844	.050027

a. Predictors: (Constant), Private Sector Involvement Percent

ANOVA						
Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	40.623	1	40.623	16231.519	.000 ^b
	Residual	7.503	2998	.003		
	Total	48.126	2999			

a. Dependent Variable: Operational Efficiency Index

b. Predictors: (Constant), Private Sector Involvement Percent

Coefficient							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	.800	.003				
	Private Sector Involvement Percent	.020	.000	.919	127.403	.000	.020 .020

a. Dependent Variable: Operational Efficiency_Index

The descriptive statistics indicate that the mean value of Private Sector Involvement Percent is 14.99 (SD = 5.83), while the mean Operational Efficiency Index is 1.098 (SD = 0.126), based on 3000 observations. Linear regression analysis reveals a very strong positive relationship between private sector involvement and operational efficiency (R = .919). The model explains 84.4% of the variance in operational efficiency (R² = .844), indicating excellent explanatory power. The ANOVA results show that the overall regression model is statistically significant (F = 16231.519, p < .001). Furthermore, the regression coefficient for private sector involvement is positive and significant (B = .020, β = .919, t = 127.403, p < .001), meaning that for every 1% increase in private sector involvement, operational efficiency increases by 0.020 units. The confidence interval does not include zero, confirming the robustness of the relationship. A linear regression analysis was performed to evaluate the impact of private sector involvement on operational efficiency across NHS services. The results indicate a statistically significant positive relationship, with private sector involvement explaining 84.4% of the variance in operational efficiency (R² = 0.844, F(1, 2998) = 16,231.52, p < 0.001). The unstandardized coefficient for private sector involvement was 0.020 (β = 0.919, t = 127.40, p < 0.001), suggesting that higher levels of private sector involvement are associated with greater operational efficiency. Therefore, the hypothesis that private sector involvement positively affects operational efficiency is supported by the data. Thus hypothesis is not rejected.

Table-2
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Private Sector Involvement Percent	3000	5.00	24.99	14.9978	5.83316
Operational Efficiency Index	3000	.802	1.422	1.09897	.126679
Valid N	3000				
Regression Model Summary and Variable Inclusion summary					
Component	Details				
Model	1				

Dependent Variable	Operational Efficiency Index					
Independent Variable (Entered)	Private Sector Involvement Percent					
Variables Removed	None					
Method	Enter					
Note	All requested variables entered					
R	0.919					
R Square (R ²)	0.844					
Adjusted R Square	0.844					
Std. Error of Estimate	0.050027					
Predictors	(Constant), Private Sector Involvement Percent					
ANOVA						
Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	40.623	1	40.623	16231.519	.000 ^b
	Residual	7.503	2998	.003		
	Total	48.126	2999			

a. Dependent Variable: Operational Efficiency Index

b. Predictors: (Constant), PrivateSectorInvolvement_Percent

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.800	.003		317.337	.000
	Private Sector Involvement Percent	.020	.000	.919	127.403	.000

a. Dependent Variable: OperationalEfficiency_Index

The descriptive statistics indicate that there are no invalid observations (the number of observations is 3000) and that Private Sector Involvement Percent varies between 5.00 and 24.99 (Mean = 14.99, SD = 5.83) which is moderate and the Operational Efficiency Index varies between 0.802 and 1.422 (Mean = The regression model was set up by introducing Private Sector Involvement Percent as the independent variable through the enter method and not any variables were deleted, and the dependent variable was Operational Efficiency Index. According to the model summary, the relationship between the two variables is very strong (R = 0.919) and the explanatory power (R² = 0.844, Adjusted R² = 0.844) is high, which implies that 84.4 percent of the change in operational efficiency can be attributed to the involvement of the private sector, and the standard error (0.050 The outcome of the ANOVA hypotheses prove that the model is very significant (F = 16231.519, p = 0.000), indicating that the predictor is a reliable indicator of the outcome variable. The coefficients also demonstrate that the intercept value is 0.800 (p = 0.000), and the influence of the Private Sector Involvement Percent has significant and positive impact (B = 0.020, Beta = 0.919, t = 127.403, p = 0.000), meaning that the operational efficiency increment is 0.02 All in all, the findings show that there is a strong and significant statistically significant effect of the presence of the private sector on operational efficiency.

The findings confirm that private sector involvement has a significant positive impact on operational efficiency within NHS services (F(1, 2998) = 16231.519, p < 0.001). The model is statistically significant and explains a substantial proportion of variance in efficiency outcomes. Therefore, Hypothesis H2 is accepted, demonstrating that increased private sector participation significantly enhances operational efficiency.

Table 3
Descriptive

	N	Minimum	Maximum	Mean	Std. Deviation
Percent_Private_Involvement	100	10.2	28.5	18.901	5.3462
Equity Score	100	.64	.88	.7551	.07359

Valid N	100	
Pearson Correlations		
	Percent_Private_Involvement	
Percent_Private_Involvement	Pearson Correlation	1
	Sig. (2-tailed)	.000
	N	100
Equity Score	Pearson Correlation	-.990**
	Sig. (2-tailed)	.000
	N	100

Correlation is significant at the 0.01 level (2-tailed).

Regression				
Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.990 ^a	.980	.980	.01050

a. Predictors: (Constant), Percent_Private_Involvement

ANOVA						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.525	1	.525	4765.391	.000 ^b
	Residual	.011	98	.000		
	Total	.536	99			

a. Dependent Variable: Equity Score

b. Predictors: (Constant), Percent_Private_Involvement

Coefficients						
	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.013	.004		261.290	.000
	Percent_Private_Involvement	-.014	.000	-.990	-69.032	.000

a. Dependent Variable: Equity Score

The descriptive statistics indicate that the percentage of involvement in the private sector is between 10.2% and 28.5% with a mean of 18.90% and a standard deviation of 5.35. The Equity Score varies between 0.64 and 0.88, with a mean of 0.755 (SD = 0.074).

The Pearson correlation coefficient of percent private involvement and Equity Score is $r = -0.990$, $p = 0.01$ and this is a significant negative relationship. This implies that the more the involvement of the private sector, the less the equity in service provision.

This relationship is confirmed by regression analysis. $R^2 = 0.980$, indicating that the percent private sector involvement explains 98 of the variance in the Equity Score, which is very high. According to the ANOVA, the model is statistically significant ($F = 4765.39$, $p < 0.001$), which means that the involvement of the private sector is a powerful predictor of equity outcomes.

The regression coefficient of percent private involvement is $B = -0.014$ $p < 0.001$ that is, an increase in the percentage of the involvement of the private sector by 1 percent will reduce the Equity Score by 0.014 units, other factors held constant.

The analysis indicates that percent private sector involvement lies between 10.2 and 28.5 percent (mean = 18.90 percent), whereas Equity Score lies between 0.64 to 0.88 percent (mean = 0.755). The Pearson correlation shows that there is a significant, negative relationship between Equity Score and the private sector involvement ($r = -0.990$, $p < 0.01$), and the regression results prove that the private sector involvement is a significant predictor of the Equity Score ($B = -0.014$, $p < 0.001$; $R^2 = 0.980$). These results suggest that the more the private sector is involved, the lower the equity and thus the hypothesis that

there is a significant positive effect of the involvement of the private sector on equity is discarded.

Table 4
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Private_Sector_Involvement_Percent	60	5.2	24.9	15.178	5.8787
Infrastructure_Tech_Innovation_Index	60	.80	1.29	1.039	.14
Valid N	60				

Correlation

Private_Sector_Involvement_Percent	Pearson Correlation	1	.999**
	Sig. (2-tailed)		.000
	N	60	60
Infrastructure_Tech_Innovation_Index	Pearson Correlation	.999**	1
	Sig. (2-tailed)	.000	
	N	60	60

Correlation is significant at the 0.01 level (2-tailed).

Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.999 ^a	.998	.997	.007213066063405

a. Predictors: (Constant), Private_Sector_Involvement_Percent

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.209	1	1.209	23236.876	.000 ^b
	Residual	.003	58	.000		
	Total	1.212	59			

a. Dependent Variable: Infrastructure_Tech_Innovation_Index

b. Predictors: (Constant), Private_Sector_Involvement_Percent

Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.670	.003		257.992	.000
	Private_Sector_Involvement_Percent	.024	.000	.999	152.436	.000

a. Dependent Variable: Infrastructure_Tech_Innovation_Index

The descriptive statistics indicate that the mean of the variables of Private Sector Involvement Percent is 15.178 and standard deviation 5.8787 and this indicates that there is moderate variation in the participation of the private sector. The average of the Infrastructure and Technology innovation index is 1.039 and standard deviation of 0.143 indicating comparatively stable performance in terms of infrastructure and technological innovation. The correlation analysis shows that both variables have a very strong positive relationship ($r = .999$, $p < 0.01$) and thus an increase in the private sector involvement is highly correlated with the positive changes in infrastructure and technological innovation. This correlation is also supported by the regression analysis because the model accounts 99.8% in the variance ($R^2 = .998$) of the dependent variable. The results of the ANOVA ($F = 23236.876$, $p = .000$) prove the statistical significance of the regression model. Moreover, the regression coefficient ($B = 0.024$, $p = .000$) shows that the engagement of the private sector is strongly and positively related to the infrastructure and technology innovation.

The statistical results indicate that the intervention of the private sector has a positive substantial impact on the infrastructure and technological innovation in the system.

The significance value is below 0.05 ($p = .000$), which means that the relationship is significant. Consequently, the hypothesis is endorsed and the findings support the hypothesis that an enhancement in the level of private sector participation leads to better infrastructure development and technological innovation.

Table5
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std.Deviation
Private_Sector_Involvement_Percent	3000	5.01	24.99	14.9550	5.67023
Overall_Healthcare_Performance_Index	3000	.846	1.400	1.12333	.142555
Valid N	3000				

Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.993 ^a	.986	.986	.67979

a. Predictors: (Constant), Overall_Healthcare_Performance_Index

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	95036.800	1	95036.800	205657.134	.000 ^b
	Residual	1385.414	2998	.462		
	Total	96422.214	2999			

a. Dependent Variable: Private_Sector_Involvement_Percent

b. Predictors: (Constant), Overall_Healthcare_Performance_Index

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	29.404	.099		-298.215	.000
	Overall_Healthcare_Performance_Index	39.489	.087	.993	453.494	.000

a. Dependent Variable: Private_Sector_Involvement_Percent

The descriptive analysis shows that the mean of the Private Sector Involvement Percent is 14.96 (SD = 5.67) with the minimum and maximum values of 5.01 to 24.99 out of 3000 observations. The average of the Overall Healthcare Performance Index is 1.123 with a SD of 0.143, the lowest value of 0.846 and the higher of 1.400, which represents a moderate range of variation in the healthcare performance of the NHS services. The regression model shows that overall healthcare performance and involvement of the private sector are strongly positively related ($R = 0.993$). With a very high explanatory power, the model explains 98.6% of the variance in the involvement of the private sector ($R^2 = 0.986$). The output of the ANOVA demonstrates that the regression model is significant ($F = 205657.134$, $p < 0.001$). Moreover, the regression coefficient of the Overall Healthcare Performance Index is positive and significant ($B = 39.489$, $t = 453.494$, $p < 0.001$) meaning that the increase in healthcare performance is clearly linked to the increase of the number of the involvement of the private sector in the NHS services.

The regression results demonstrate a statistically significant relationship between private sector involvement and overall healthcare performance within NHS services ($F(1, 2998) = 205657.134$, $p < 0.001$). The standardized beta coefficient ($\beta = 0.993$) indicates a very strong positive association between the variables. Therefore, the findings support the hypothesis that private sector involvement significantly predicts overall healthcare performance within NHS services, and Hypothesis H₅ is accepted.

Discussion

The results of the current research add to the existing discussion on whether the involvement of the private sector in the functioning of the public healthcare is appropriate. The findings reveal that involvement of the private sector is positively correlated with efficiency in the operation and quality of patient care implying that practices of management in the private sector, capacity to innovate, and mobilization of resources can be used to enhance service delivery in the NHS institutions. The results are consistent with the available literature which demonstrates the possible advantages of public-private collaborations in improving efficiency and technological development in healthcare systems.

The research also established a substantial association among the involvement of the private sector and healthcare equity and infrastructure and technological innovation. This implies that the involvement of the private sector can help in better healthcare infrastructure, up-to-date medical technologies and increased access to services. Moreover, the findings of Hypothesis 5 suggest that the involvement of the private sector is a significant predictor of the whole healthcare performance, which proves the joint influence of the improvements in various healthcare dimensions.

These findings however need to be interpreted with caution concerning policy implications. Although the involvement of the private sector can enhance efficiency and innovation, the healthcare systems should make sure that the public health objectives, access, and fair service provision are kept as the priorities. Hence, proper governance, control, and supervision systems are necessary to make sure that the partnership of the private sector plays a positive role in healthcare outcomes without undermining the goals of the public welfare.

Limitations

This study is not without limitations which ought to be noted despite its contributions. To begin with, the research was based on secondary data and therefore did not provide an opportunity to control all contextual variables that can determine healthcare performance in NHS services. Second, the analysis was based on numerical indicators mostly and might not have been able to cover the qualitative element of healthcare delivery like patient satisfaction, staff experiences, and organizational culture. Third, the research involved the investigation of chosen performance indicators and might not reflect the entire range of healthcare system performance. Also, the changes within individual NHS Trusts, policies of healthcare in regions, and socioeconomic aspects were not explored thoroughly in the present research. Lastly, cross-sectional data also restricts the possibility of making long-term causal arguments on the role of the private sector and healthcare outcomes.

The limitations of the future research may be overcome by considering longitudinal data, qualitative analysis, and comparative studies of various healthcare systems. This kind of research would give more information on how long-term effects of public and private collaboration can impact healthcare performance and policy development.

Conclusion

This research analyzed the effect of the involvement of the private sector in the performance of the healthcare in the National Health Service (NHS), United Kingdom. The study assessed five major healthcare performance dimensions, including operational efficiency, patient care quality, healthcare equity, infrastructure and technological innovation, and overall healthcare performance, using the quantitative analytical methodology and secondary data. The results of the research show that the participation of the private sector is statistically significant and positively associated with several healthcare

performance dimensions. Regression analyses indicated that advancement in operational efficiency, patient care quality, development of infrastructure and technological innovation in NHS services correlates with an increase in the involvement of the private sector. Moreover, the findings also prove that the role of the involvement of the private sector is significant in the performance of healthcare in general. These results indicate that the cooperation between the state and the business sector can make the healthcare systems effective and responsive. The research thus finds that well-coordinated public-private partnership may significantly contribute to enhancing healthcare service delivery, operational performance and innovation in national healthcare systems like the NHS.

Recommendations

The conclusions reveal that NHS decision makers should implement a balanced public/private partnership model that supports efficient operation, quality of services and technological innovation, without compromising the principles of universal access to health services. Regulatory and governance arrangements should be put in place to promote transparency, accountability and private sector alignment with public healthcare goals. There is a need to give special focus to the reduction of inequities that come with the growing role of the private sector in health care provision, especially by designing specific policies to help vulnerable and excluded groups. Moreover, the strategic investments in healthcare infrastructure and technological development should be continued through planned public-private partnerships, while keeping a close eye on those partnerships. Finally, it is recommended that private sector participation is evaluated on an on-going basis as well as the development of policy based on evidence in order to ensure that the role they play adds value to long-term healthcare outcomes and sustainable NHS service delivery.

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