



## Enhancing financial management in healthcare: The impact of Activity-Based Costing and Time-Driven Activity-Based Costing methodologies in Kordan's private sector in Jordan

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### Abstract

This study examines the effectiveness of implementing Activity-Based Costing (ABC) and Time-Driven Activity-Based Costing (TDABC) in Jordan's private healthcare sector focusing on managing costs while maintaining quality care. A descriptive and analytical approach was adopted involving 213 individuals working in the financial affairs departments of private hospitals in Amman representing various types of institutions. The key variables of interest were the accuracy of cost measurement, expense reduction, cost allocation and various cost management approaches. The main findings indicate that implementing ABC and TDABC significantly improved cost management and cost reduction within these institutions. These systems have been effective in enhancing the accuracy of cost measurement, improving profitability, reducing unnecessary expenses, and achieving better cost allocation, thereby leading to better financial stewardship. This study underscores the critical importance of integrating these systems into healthcare financial frameworks. Moreover, it highlights the need for further training for financial managers and accountants to fully leverage these approaches and contribute to ongoing improvements in healthcare financial management. Additionally, this research presents empirical evidence from an underrepresented region where no prior studies have been conducted, thereby contributing to the existing body of knowledge and offering valuable insights for future initiatives in Jordan. The study also provides useful guidance for implementing these cost-management approaches more broadly in other regions and countries.

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## 1. Introduction

In healthcare settings, the combination of increasing costs and control over quality care has emerged as a vital concern. Therefore, this study investigates the topic of Activity-Based Costing (ABC) and Time-Driven Activity-Based Costing (TDABC) methodologies that have progressively captured attention given their sophisticated approach in appraising and administering healthcare expenditures. Recent studies have illuminated the effectiveness and challenges associated with implementing ABC and TDABC within healthcare settings (Balakrishnan, Koehler, & Shah, 2018; Etges, Polanczyk, & Urman, 2020). These studies among others have underscored the potential of ABC and TDABC to streamline cost management processes and

enhance quality care across different health systems in similar settings found in Jordan's private healthcare sector.

The investigation is positioned at the convergence of this global discourse with a specific emphasis on Jordan's private healthcare sector. Hence, we aim to critically assess the contribution of ABC and TDABC in enhancing health services in Jordan's private hospitals. The focus of this study is on key aspects such as cost measurement and reduction, allocation and control. Thus, the uniqueness of this study lies in its context-specific examination, scrutinizing the efficacy of ABC and TDABC within the distinct dynamics of Jordan's healthcare system as an area scarcely explored in existing literature (Al-Halabi & Al-Mnadheh, 2017).

In addition, the healthcare sector in Jordan experiences substantial challenges in managing costs effectively while simultaneously upholding the calibre of care provided to patients (Jalghoum, Tahtamouni, Khasawneh, & Al-Madadha, 2021). There exists a notable gap in their application and effectiveness within this context despite the potential of Activity-Based Costing (ABC) and Time-Driven Activity-Based Costing (TDABC) methodologies to address these challenges. The difficulties of implementing these advanced cost management approaches are coupled with the specific dynamics of Jordan's healthcare environment (Jalghoum & Khasawneh, 2016). Thus, there is a critical need for a deep investigation into the ABC and TDABC practical utility and impact. The primary objective of this study is to explore the implementation of ABC and TDABC methodologies within Jordan's private healthcare sector based on the aforementioned discussion. It aims to identify and analyze the underlying factors that influence their adoption and assess the resultant effects on cost management and operational efficiency. Therefore, this research attempts to provide a comprehensive understanding of the benefits and limitations of these methodologies in a context that has yet to be fully explored in the existing literature (Balakrishnan et al., 2018; Etges et al., 2020).

We aim to contribute by providing a detailed examination of how these cost management strategies can provide more accurate cost measurement, expense reduction and overall financial performance improvement. Thus, we use an empirical analysis to offer actionable insights and recommendations for healthcare administrators and policymakers to enhance healthcare service delivery in Jordan. Therefore, the contributions of this study are twofold: firstly, it enriches the existing body of knowledge by providing empirical data from a region that has been underrepresented in ABC research. Secondly, it offers practical insights that could inform policy decisions and managerial practices in Jordan's healthcare sector.

This paper is structured as follows: Section 2 depicts a comprehensive literature review to highlight prior studies on ABC and TDABC in healthcare. Section 3 describes the methodology employed to explore the effectiveness of these cost management approaches within Jordan's private healthcare sector. The findings are presented in section 4 followed by a discussion in section 5 that contrasts our results with existing literature. Finally, section 6 concludes the paper with key takeaways, implications for practice and directions for future research.

## **2. Literature Review**

The rising costs of delivering healthcare services combined with the need for increased quality of care is a problem faced by healthcare systems worldwide. One method that has been used to tackle this issue is activity-based costing (ABC). This method uses a granular and accurate process for assessing and managing costs in healthcare. This study shed light and shared the experiences of applying ABC to the task of cost control and evaluating and managing resources in healthcare systems from different regions worldwide.

In Jordan, Alqudah and Salleh (2023) highlighted the financing model of the Jordanian Ministry of Health. Their study reveals the importance of modernised accounting systems in hospital cost calculation as well as the superiority of a computerised system in calculating hospital-specific costs. This computerized information can enable studying healthcare spending patterns and addressing them. It was estimated that approximately 85 percent of the total spending on health in Jordan is devoted to the salaries of personnel, pharmaceuticals and medical consumables based on the data.

In the African continent, Mwai et al. (2023) suggest investing in Primary Health Care (PHC) from the perspective of Kenya. Mwai et al. (2023) demonstrated the benefits in the form of saving the additional costs of shifting services from the higher-level facilities to the PHC in Kenya and supported the belief that well-planned investment in healthcare could indeed bring both health and economic dividends by projecting the potential economic impact of scaling up the PHC interventions.

Lessons from South America are also proving useful. Etges et al. (2022) probed how better understanding the details of care delivery could be a source of efficiency gains that more clinical costing methods don't provide. They argue that time-driven activity-based costing (TDABC) can discover cost-saving opportunities even in standard efficient medical settings such as how a surgeon spends his time.

According to Hayati's (2022) research in Iran, ABC can also assist us in comprehending the pent-up demand that develops at other periods such as after a pandemic. The author compared the cost of imaging services before and during the COVID-19 pandemic. This study underlined the strain on healthcare infrastructures during such crises and underpinned the value of ABC in helping healthcare to continue to deliver its services during unexpected events.

In Europe, [Stefanini, Aloini, Benevento, Dulmin, and Mininno \(2020\)](#) studied the planning of interventions for lung cancer patients in an Italian hospital combining TDABC with process mining ethos to illustrate how integrating new approaches to methodologies can improve the granularity of resource allocation.

Hence, evidence worldwide suggests that TDABC can bring several benefits compared to the traditional approach. For example, the TDABC model was compared with the traditional Full-Time Equivalent (FTE) system in an outpatient unit at the Tawam Hospital. TDABC offered extra detailed insights into the daily activities of the nursing staff and can better manage human resource structure in the healthcare sector ([Amiria & Khmidia, 2019](#)).

In addition, some studies have investigated different clinical scenarios to illustrate where ABC might be used. [Dyas \(2018\)](#) gives an example of TDABC being used in relation to the choice of anaesthetic for epidural placement during major thoracic surgery to understand the true cost of services. The author suggests that this method could help inform decision-makers about the provision of anaesthesia. [Dyas et al. \(2015\)](#) investigated emergency departments and demonstrated how TDABC process changes may result in cost savings. [Aji, Yaya, & Kusumawati \(2018\)](#) give another example of the price for coronary angiography currently being up to 20 times higher than its true cost calculated using ABC. They argue that this example demonstrates the need for more transparent and competitive pricing structures in health systems. [Dwivedi and Chakraborty \(2015\)](#) also took the ABC discussion to India arguing that more life-saving and cost-effective healthcare services can be delivered if ABC is practised in public hospitals.

[Cannavacciuolo, Illario, Ippolito, and Ponsiglione's \(2015\)](#) proposal for a unified framework on how to embed ABC into existing hospital accounting systems provides a model of how this synthesis could be applied. This study aims to identify and correct discounted cost or capture loss inefficiencies. They find that a holistic framework with an embedded ABC can enable better process management. [Grant \(2015\)](#) raises the urge for a better costing system study to counter the economic burden resulting from unclear financial costs for diabetic patients in the UK.

In a systematic review study, [Keel, Savage, Rafiq, and Mazzocato \(2017\)](#) demonstrated the relevance of TDABC to the managers of the delivery of 11 different conditions. [French et al. \(2019\)](#) noted that TDABC can bring many benefits to the cancer outpatient clinic. They argue that TDABC can be used to evaluate care delivery processes for cancer patients and assess the effects of care changes. For example, the length of stay for patients in the Post-Anaesthesia Care Unit (PACU) was measured by TDABC as being reduced after the 2013 Port-a-Cath process improvement efforts implemented within the Information Technology Systems (ITS) in conjunction with a new electronic health record which streamlined operations and was able to be achieved over three years. In addition, [Demeere, Stouthuysen, and Roodhooft \(2009\)](#) focused on enhancing hospital cost accounting and underscored the importance of integrating ABC with standard costing to provide better planning and control of healthcare costs. [Holozada \(2022\)](#) proposes the application of the TDABC method for measuring healthcare costs in Qatar's hospitals targeting the Knee Arthroplasty Department. The thesis highlights that the accurate determination of resource utilization and cost can lead to better financial management and increased patient satisfaction. Hence, applying TDABC can contribute to more efficient patient care-delivery processes with both measurable and quantifiable improvements. Lastly, research on activity-based costing for hospitals emphasized the application of ABC in current healthcare practices and procedures showcasing its potential in providing accurate cost information ([Udpa, 1996](#)).

The literature review on studies that tackled the issue of ABC and TDABC in healthcare systems worldwide has strongly advocated for ABC and TDABC to be adopted in Jordanian healthcare as they confront the same problems (managing costs without sacrificing healthcare quality). Literature on these methodologies from Jordan, Qatar, Turkey, Iran, Oman, India, Kuwait, Brazil, Kenya, and Indonesia among others is all points towards the importance of ABC and TDABC in diverse healthcare settings worldwide. These studies also provide an understanding of the countries' healthcare systems, the developmental level, the countries' healthcare priorities, and the existing challenges with healthcare costs in various contexts. Hence, these findings as a whole ranging from the most efficient use of resources of the European healthcare system to the lowest cost of surgical operations in Africa and South America underline a potential for the implementation of ABC in Jordan. It is essential to comprehend the worldwide context of this study which has provided empirically supported and practically useful evidence on activity-based pricing to examine the details of ABC implementation in Jordan's private healthcare sector. Consequently, the following hypotheses were developed to critically examine the appropriateness and usefulness of ABC and TDABC in increasing the efficiency of costs, workload and physical resources as well as providing quality healthcare in private hospitals in Jordan.

*H<sub>1</sub>: The implementation of activity-based cost accounting significantly impacts the improvement of the cost of health services in private hospitals in Jordan.*

We develop the following supporting hypotheses which include the elements that determine the success of an ABC implementation which are defined as controlling, managing, allocating and reducing costs:

*H<sub>1.1</sub>: The application of activity-based cost accounting positively impacts the accuracy of cost measurement in private hospitals in Jordan.*

*H<sub>1.2</sub>: The utilization of activity-based cost accounting positively impacts the reduction of costs in private hospitals in Jordan.*

*H<sub>1.3</sub>: The adoption of activity-based cost accounting positively impacts the cost allocation in private clinics in Jordan at a significance level of  $\alpha \leq 0.05$ .*

*H<sub>1.4</sub>: Implementing activity-based cost accounting results in a statistically significant impact in managing diverse costs in private hospitals in Jordan.*

### 3. Methodology

In this study, we adopted a descriptive approach focusing on collecting and analyzing both qualitative and quantitative data related to the variables and dimensions of activity-based cost accounting in Jordanian private hospitals. Hence, we employed an analytical inferential method to test our hypotheses and extend the findings to the broader research community.

Hence, we adopted simple linear regression analysis to examine the relationship between the implementation of ABC (independent variable) and various financial management outcomes in healthcare (dependent variables). Simple linear regression was selected due to its suitability for analyzing the linear relationship between a single predictor and a single outcome variable. This method aligns with our research design and can quantify the degree to which ABC implementation can predict improvements in financial management within healthcare settings.

The choice of simple linear regression is justified by the nature of our hypotheses which posits direct linear effects of ABC on financial outcomes. We also adopted multiple linear regression (MLR) to study the impact of each element of measuring the cost of health services after ensuring that assumptions necessary for regression analysis such as linearity, independence, homoscedasticity and normal distribution of residuals were met. Data analysis was conducted using SPSS version 21 with results indicating a significant positive impact of ABC implementation on healthcare financial management outcomes.

Our study population comprised employees from the Financial Affairs Departments of private hospitals in Amman, Jordan. This group included financial managers, their deputies, department heads, internal auditors, and accountants totalling 4,225 individuals as per the Ministry of Health's 2021-2022 report. We selected a sample from 12 hospitals with over 100 beds each due to the large size of this population. These hospitals were chosen for their implementation of activity-based cost accounting systems representing a diverse range of private healthcare institutions in the Jordanian capital.

We used simple random sampling with a probability that all members of the population have an equal chance of being selected and free of personal sampling bias (Taherdoost, 2016).

Hence, the sample size of 213 respondents were asked to complete an electronic questionnaire to discuss activity-based costing (ABC) application and their contributions to healthcare costs. Accordingly, the respondents completed this questionnaire using Google Drive with a completion rate of 100%.

Furthermore, we relied on the work of Serdar, Cihan, Yücel, and Serdar (2021) and it is clearly suggested that “for most administrative and humanitarian studies,” it is adequate to use sample sizes ranging from 30 to 500 in the determination of the sample size. Similarly, the adequacy of the sample was further evaluated through the Kaiser-Meyer-Olkin (KMO) test.

Shrestha (2021) suggests that the KMO test is considered a simple and versatile way to test the compositional quality of data before analyses. Hence, Table 1 shows that the KMO value is 0.900 which suggests that the study’s sample is deemed to be statistically representative of the larger population.

**Table 1.** Analysis of sample size adequacy based on the Kaiser-Meyer-Olkin test for sampling adequacy.

Tests	Value	Description
Kaiser-Meyer-Olkin (KMO)	0.922	Measure of sampling adequacy
Bartlett's test	N/A	Test of sphericity
Approximate chi-square	903.66	
Degrees of freedom (DF)	231	
Significance (Sig.)	0.000 (or <0.05)	Level of significance

### 4. Descriptive Results

Data collection relied on the following two primary sources: primary data collected through questionnaires targeting the employees in the financial departments of the selected hospitals and secondary data comprising relevant books, scientific reports, literature and university theses. The questionnaire was structured into the following three sections: the first capturing general information about the respondents, the second focusing on activity-based cost accounting (seven items) and the third examining the cost of health services (twenty items).

**Table 2.** Degrees of correlation of the paragraphs of the scale with the total degree.

#	Statement	Correlation coefficient
1.	The application of the costing method according to the activity makes it easy to provide detailed information about the activities.	0.711
The second dimension: Cost reduction		
2.	Determining indirect costs leads to a reduction in the cost of health services.	0.610
3.	Excluding the cost of activities that do not add value to the product reduces the cost of services.	0.745
4.	One of the best ways to reduce indirect costs is to demonstrate their behavior and know the activities that cause their cost.	0.801
5.	Cost based on activities is relied upon in the allocation of service costs.	0.795
6.	Success in reducing the cost of services leads to improving the competitive position of the hospital.	0.794
Third dimension: Cost allocation		
7.	Using the causes of activities as a basis for allocating indirect costs is a fair basis for allocation.	0.782
8.	Using activity-based cost is the perfect way to allocate.	0.765
9.	Indirect costs are precisely allocated.	0.794
10.	The costs of the services that benefited from this cost are allocated accurately.	0.791
11.	Activities are identified and indirect costs are grouped for each activity.	0.652
Fourth dimension: Cost control		
12.	The activity-based costing system provides information on the cost of each activity in the hospital which helps to effectively control costs.	0.751
13.	The use of cost factors for activities is a fair basis for the distribution of indirect costs and helps to effectively control costs.	0.792
14.	The use of an activity-based cost system leads to easy tracking of cost flow and linking it to cost purposes and controlling them.	0.740
15.	The use of an activity-based costing system leads to effective control in a highly competitive health service environment.	0.814
16.	Deviations are extracted by comparing estimated costs with actual costs.	0.835

The empirical data presented in Table 2 robustly endorses the efficacy of Activity-Based Costing (ABC) within the healthcare sector underscored by substantial correlation coefficients ranging from 0.610 to 0.835 across various dimensions. A notable correlation of 0.711 associated with the facilitation of detailed operational insights through ABC underscores its significant and positive impact on the precision of cost allocation and management within hospital settings. This is critical for the strategic financial planning and resource optimization in healthcare institutions. Additionally, the range of correlations from 0.610 to 0.801 in the cost reduction dimension firmly establishes ABC's capability in the identification and mitigation of indirect costs. The apex correlation of 0.801 linked to the understanding of indirect costs and their causative activities highlights ABC's instrumental role in uncovering potential cost-saving opportunities, a key factor in financial optimization.

Furthermore, the robust correlations observed in service cost allocation (0.795) and in enhancing the competitive positioning of hospitals (0.794) indicate that ABC's utility extends beyond mere accuracy in cost allocation playing a crucial role in fortifying market competitiveness. In the domain of cost control, the correlations, particularly the significant 0.835 correlation for extracting deviations by comparing estimated to actual costs, emphasize ABC's central role in the effective monitoring and management of costs in a competitive healthcare environment. These findings not only validate the importance and effectiveness of ABC in healthcare but also highlight its role as a strategic tool for in-depth financial management directly impacting service quality and patient care. The adaptability and precision of ABC as reflected in the strong correlations across all dimensions advocate for its broader adoption in healthcare organizations. This approach transcends conventional cost calculation methods positioning itself as an integral component in enhancing operational efficiency and competitive advantage. Consequently, these insights carry significant implications for decision-making and policy formulation in healthcare promoting the adoption of ABC as a strategic approach to improve financial management and service delivery.

Table 2 presents the skewness (torsion coefficient) and kurtosis (hyperbole coefficient) values for various dimensions related to the application of activity-based cost accounting (ABC) and its impact on health services cost management.

Table 3. Normal distribution of data based on test (Skewness and kurtosis).

Apply activity-based cost accounting					
Skewness	-0.486				
Kurtosis	0.518				
	Cost measurement	Cost reduction	Cost allocation	Cost control	Cost of health services
Skewness	0.097	-0.730	-0.438	-0.600	-0.554
Kurtosis	-0.423	1.363	0.935	0.122	0.962

The skewness values in Table 3 are slightly negative indicating a slight leftward (negative) skew in the data. However, they are still relatively close to zero suggesting only a minor deviation from symmetry. The kurtosis values are also close to zero apart from cost measurement which has a slightly higher kurtosis indicating a somewhat more peaked distribution. Overall, these values suggest that the data is reasonably normally distributed which is favourable for statistical analysis.

Table 3 provides descriptive statistics for the general information of the respondents in the study. This includes data on gender, age, job qualification, years of experience and job title.

Table 4. Descriptive statistics for general information.

#	Statement	#	Category	Iteration	Ratio
1	Gender	1	Male	164	77%
		2	Female	49	23%
		Total		213	100%
2	Age	1	Less than 30 years	21	9.9%
		2	From 30 years to less than 40 years old	92	43.2%
		3	From 40 years to less than 50 years	75	35.2%
		4	50 years and more	25	11.7%
		Total		213	100%
3	Job qualification	1	Diploma	36	16.9%
		2	Bachelor	123	62%
		3	Master	42	19.7%
		4	Doctor	3	1.4%
		Total		213	100%
4	Years of experience	1	Less than 5 years	23	10.8%
		2	From 5 years to less than 10 years	85	39.9%
		3	From 10 years to less than 15 years	70	32.9%
		4	15 years and above	35	16.4%
		Total		213	100%
5	Job title	1	Financial manager	15	7%
		2	Deputy and assistant finance manager	13	6.1%
		3	Head of department	33	15.5%
		4	Internal auditor and accountant	148	69.5%
		5	Other	4	1.9%
		Total		213	100%

The respondents' demographic profile as shown in Table 4 provides an in-depth overview of the workforce in the private healthcare industry in Jordan and is essential for determining the acceptability and suitability of activity-based cost accounting (ABC). 77% of the sample is male which is an important characteristic that may have an impact on organizational dynamics and decision-making processes. This gender majority is reflected in the region's labor market patterns. The obvious gender divide in the results points to the need to adapt gender-sensitive approaches to implement and train for new financial systems, including ABC. Another important finding relates to the age profile of the respondents which is skewed towards the age group of 30-50. This means that most personnel are a combination of flair and experience, a mix that would be important for helping to cope with sophisticated accounting practices such as ABC.

Furthermore, the data clearly shows that in the area of professional qualifications along with experience level, the work force is well-educated and well-qualified. In particular, 62% of the staff has bachelor's degrees while master's and doctoral degrees exist in significant numbers. This educational background is consistent with a high level of professionalism, likely contributing to the understanding and use of complex accounting

systems such as ABC. In addition, respondents have significant experience (more than half have between 5 and 15 years' experience in this area) which signifies that the respondents have an extended practical experience that should be valuable in helping to navigate the actions required for the implementation of ABC. The fact that the most common job titles of the respondents were internal auditors and accountants suggests that the survey tapped the operational level of financial management and ensured the validity of the insights because they are rooted in the day-to-day realities of healthcare financial administration. A combination of advanced education and practice on the ground constitutes a powerful combination for the success of ABC in cost allocation and the fairness of financial management in healthcare.

### 5. Results

The primary focus of this study is that the use of ABC does not considerably improve health care in Jordan's private hospitals to evaluate the validity of the hypothesis. This includes critical aspects such as measuring and reducing costs, cost allocation and cost control. This was accomplished by measuring the specific impacts of ABC on the accuracy of cost measurement, the reduction of costs, the effectiveness of cost allocation and the management of diverse costs in private healthcare settings. Hence, we used a simple linear regression analysis to unravel the intricacies of ABC's influence on various dimensions of healthcare financial management.

Table 5. Regression analysis for the main hypothesis.

Model summary						
Adj R <sup>2</sup>	R <sup>2</sup>	R				
0.636	0.638	0.799				
Analysis of variance						
Model	Sum of squares	Degree of freedom	Average squares	F calculated	F Sig	
Regression	24.587	DF	24.587	371.836	0.00	
Constant	13.952	1	0.066			
Total	38.540	211				
Coefficients						
Dependent variable	Model	B	Standard error	Beta	Calculated	T sig
Improving the cost of health services	Constant	1.407	0.140		10.071	0.00
	Apply activity-based cost accounting	0.652	0.034	0.799	19.283	0.00*

Note: \* Tabular value at 1 degree of freedom = 1.960 (N-1)T.

\* D statistically at the level of (0.05)".

Optimizing the cost of health services = 1.407 + 0.652 \* Applying activity-based cost accounting.

The regression analysis in Table 5 describes the impact of Activity-Based Cost Accounting (ABC) on the optimization of health service costs regarding healthcare financial management. The model's robustness is illustrated by an adjusted R<sup>2</sup> value of 0.636 which suggests that a substantial 63.6% of the variance in the dependent variable (the optimization of health service costs) is explained by the independent variable (the application of ABC). This high adjusted R<sup>2</sup> value is indicative of the model's potent explanatory capacity. Additionally, the correlation coefficient (R) of 0.799 underscores a positive correlation between the implementation of ABC and the enhancement of cost efficiency in health services. The statistical significance of the model is further paved by an F-value of 371.836 with a p-value (sig) markedly below the conventional alpha threshold of 0.05, thereby the model's empirical robustness and the pivotal role of ABC in cost optimization endeavours. Further scrutiny of the regression coefficients within the transaction table reveals insightful notes. The t-values associated with both the intercept and the coefficient for ABC application exceed the critical value of 1.960 at 1 degree of freedom. Hence, there is a statistical significance within the model. The beta coefficient of 0.799 for the ABC application indicates a substantial positive impact on cost optimization in health services. The regression coefficient (B) of 0.652 reveals that an incremental application of ABC is expected to enhance the cost optimization in health services by 0.652 units, other things equal. This revelation is not merely of statistical significance but also of paramount practical relevance suggesting that the integration of ABC in healthcare settings can precipitate notable improvements in fiscal management and resource stewardship.

Table 6. Regressions analysis for the study's sub-hypotheses.

Sub-hypothesis	Adj R <sup>2</sup>	R <sup>2</sup>	R	F	Sig	Beta	B (Coefficient)	Dependent variable
First	0.365	0.368	0.607	122.853	0.000	0.607	0.624	Cost measurement
Second	0.412	0.415	0.644	149.422	0.000	0.644	0.642	Cost reduction
Third	0.385	0.388	0.623	133.703	0.000	0.623	0.588	Cost allocation
Fourth	0.414	0.416	0.645	150.589	0.000	0.645	0.752	Cost control

Table 6 shows the regression analysis for the study's variables. The analysis of the first sub-hypothesis, focusing on cost measurement reveals a moderate level of explanatory power with an adjusted  $R^2$  of 0.365. This indicates that around 36.5% of the variance in cost measurement can be attributed to the application of activity-based cost accounting (ABC). The R value of 0.607 suggests a moderate positive correlation between the implementation of ABC and the effectiveness of cost measurement in healthcare services. The F-value of the regression is 122.853 with a significant level of  $P=0.000$ . This indicates that the model is statistically significant. Moreover, the beta coefficient and B (coefficient) value are 0.607 and 0.624 which prove that any changes would have a positive influence on the results of cost measurement. In other words, the adoption of ABC has a significant and positive impact on the measurement of cost.

The second sub-hypothesis concerns cost reduction. The results illustrated that the adjusted  $R^2$  of 41.2% explains the variance of cost reduction that is attributed to the application of ABC. The R value of 0.644 also suggests that there is a stronger positive correlation in this context compared to cost measurement. The model's level of significance is confirmed by a high F-value of 149.422 and a small sig value of 0.000. The beta value of 0.644 and the B coefficient of 0.642 indicate the effectiveness of ABC in reducing costs within healthcare services. This finding suggests that ABC has a strong potential for accomplishing the crux of healthcare services especially in reducing unnecessary expenditures.

The third sub-hypothesis focuses on cost allocation in healthcare services. The results explain 38.5% of the variance in cost allocation (Adj R square = 0.385). The correlation coefficient (R) is 0.623 indicating a positive correlation, although it is slightly weaker than the correlation observed in the cost reduction. The model is statistically significant with an F value of 133.703 and a sig value of 0.000. The beta coefficient 0.623 and B value of 0.588 indicate that the implementation of ABC will positively contribute to the cost allocation of healthcare services. This result illustrates that ABC can improve the accuracy and fairness of cost allocation and the efficient and effective use of resources.

Finally, the fourth sub-hypothesis deals with cost control and the corresponding Analysis of Variance (ANOVA) statistical output shows an adjusted  $R^2$  of 0.414. This indicates that 41.4% of the variance in the cost control can be explained by the use of ABC. This is the highest among the four sub-hypotheses and the R value of 0.645 suggests that the model outcomes are quite strong and positive. The significance of the model outcomes is further corroborated by an F-value of 150.589 and a sig value of 0.000. The beta coefficient of 0.645 and the B value of 0.752 strongly suggest that ABC is quite effective in controlling the costs. This is an important finding as it brings to the fore the very crucial need of ABC in maintaining financial discipline within the healthcare service especially in preventing cost overruns.

## 6. Discussion

This study has conducted a regression analysis and reviewed the literature background to understand how ABC and TDABC are used in healthcare sector in Jordan. Most of our results are consistent with the previous literature and were supported by our analysis.

The results regarding our main hypothesis consist of broader literature. We found that the adoption of ABC can lead to better financial performance in hospitals. For example, Alqudah and Salleh (2023) and Stefanini et al. (2020) both point out how modernizing hospitals' cost accounting systems such as ABC is an enabler for tracking healthcare costs in a detailed manner and can allocate resources more efficiently. Our results showed a similar narrative as we found that ABC indeed makes a difference for hospitals especially in terms of cost-efficient.

Our analysis of the cost measurement hypothesis reveals a moderate positive impact of ABC implementation aligning with the findings of Alqudah and Salleh (2023). They emphasized the significance of modernized cost calculation systems in Jordanian hospitals, a theme that resonates with our finding of a 36.5% variance in cost measurement attributable to ABC. This correlation underscores the importance of precise cost accounting methods in healthcare as also highlighted in the broader literature, including the work of Cannavacciuolo et al. (2015) and Udpa (1996). These studies collectively advocate for the integration of sophisticated costing methodologies like ABC to enhance the accuracy and transparency of financial reporting in healthcare settings.

The findings for the cost reduction hypothesis were stronger with an adjusted  $R^2$  of 0.412 which is congruent with Mwai et al. (2023) explanation that investments in the Kenyan health system could benefit from cost reduction mechanism. Our study extends this narrative by quantifying the impact of ABC in cost reduction highlighting its efficacy in identifying and mitigating unnecessary expenditures. This is particularly relevant in the context of the financial challenges faced by healthcare systems as discussed by Dwivedi and Chakraborty (2015) where the adoption of ABC has been advocated for more cost-effective healthcare services.

We observe a beneficial relationship between cost allocation that is in line with our expectations and validates that our findings are consistent with those of Stefanini et al. (2020) found in the European context. Stefanini et al. (2020) describe the combination of TDABC with process mining is reflected in our results. Our results explain 38.5 per cent of the variance in cost allocation through ABC which demonstrates that it is a useful tool for improving the accuracy of cost allocation for allocating costs fairly according to the use of resources, an issue that appears frequently in the literature including the work of Amiria and Khmidia (2019).



Last and most importantly, the sub-hypothesis for the control of costs presents the highest predictive power (the adjusted  $R^2$  is 0.414). This result is consistent with Grant (2015) who found about the necessity of clear cost signals in health care systems. Our study suggests that ABC not only provides these signals but does so effectively, thereby aiding in maintaining financial discipline and preventing cost overruns. This is particularly pertinent in light of the financial strains experienced during crises as discussed by Hayati (2022) during the COVID-19 pandemic.

## 7. Conclusion

This empirical study focuses on ABC methods and TDABC in the private health sector of Jordan. The finding of the study gives a thorough explanation of the role of the ABC methods in improving the financial management of the Jordan hospitals. This study also uses descriptive and analytical analysis that explains the use of the ABC in cost measurement, reduction, allocation and control. The results of the study show how these activities can be balanced to escalating healthcare costs while ensuring the sustenance of quality care. Generally, this study brings the attention of industry managers in health fields to apply ABC methods.

### 7.1. Limitations

There are some limitations that should be considered before generalizing the findings of this study. The research focuses on ABC, TDABC in Jordan's private healthcare sector assessing the ABC and TDABC methodologies usefulness in cost management. The location specificity and the survey source selection could hamper the use of the findings in other fields of knowledge. The self-reported nature of the data collected might limit the way the results are generalizable to other healthcare contexts.

### 7.2. Implications of the Study

This study highlights the need for a paradigm shift for healthcare financial management with the adoption of ABC and TDABC methodologies. This practice seems to enable more accurate cost measurement and appropriate cost allocation, and enhance financial stewardship in general. Therefore, we call for further investment in training programs for the financial managers and accountants on these methodologies. Such training ensures effective implementation and maximization of the systems' benefits.

Furthermore, the study recommends the use of technological solutions to automate the allocation of ABC process and the use of modern software as an aid in calculating and managing costs to achieve more accurate and efficient cost calculations and management. Finally, this research recommends cost reduction approaches that are based on ABC data without compromising healthcare quality. This approach includes optimizing resource allocation and minimizing unnecessary expenditures.

### 7.3. Suggestions for Future Research

Some potential lines of future research are to conduct a further exploration of the geographical scope (i.e., application of ABC and TDABC to different healthcare systems) to study the universal applicability of ABC and TDABC. In addition, a longitudinal study focused on the potential long-term consequences related to how hospital managers are dealing with the engagement in ABC from an operational and financial management perspective. Finally, a comparative study to seek a deeper understanding about the difference in these two methodologies ABC compared with traditional costing.

Another area for future research is projecting how emerging technologies such as AI and machine learning could be utilised as an enabling tool to improve the implementation and the results of ABC and TDABC in healthcare. Bridging the gap between financial management and healthcare quality could also bring deeper insight about the direct and indirect impacts of ABC on patient outcomes.

## References

- Aji, N. B., Yaya, R., & Kusumawati, W. (2018). Cost analysis with activity based costing method on coronary heart catheterization at Dr. Sardjito Hospital Yogyakarta. *Jurnal Medicoeticolegal dan Manajemen Rumah Sakit*, 7(3), 228-237. <https://doi.org/10.18196/jmmr.7377>
- Al-Halabi, N. B., & Al-Mnadheh, Y. M. (2017). The impact of applying time-driven activity-based costing on improving the efficiency of performance in Jordanian industrial corporations: A survey study. *International Journal of Economics and Finance*, 9(12), 24-31. <https://doi.org/10.5539/ijef.v9n12p24>
- Alqudah, O. M., & Salleh, S. I. M. (2023). The realities and expectations of calculating government service costs: An analysis of Jordanian hospitals. *International Journal of Economics and Financial Issues*, 13(1), 65-72. <https://doi.org/10.32479/ijefi.13774>
- Amiria, N. A., & Khmidia, S. E. (2019). Implementing time-driven activity-based costing (TDABC) in out-patient nursing department: A case from UAE. *Management Science Letters*, 9(3), 365-380.
- Balakrishnan, R., Koehler, D. M., & Shah, A. S. (2018). TDABC: Lessons from an application in healthcare. *Accounting Horizons*, 32(4), 31-47. <https://doi.org/10.2308/acch-52242>
- Cannavacciuolo, L., Illario, M., Ippolito, A., & Ponsiglione, C. (2015). An activity-based costing approach for detecting inefficiencies of healthcare processes. *Business Process Management Journal*, 21(1), 55-79. <https://doi.org/10.1108/bpmj-11-2013-0144>

- Demeere, N., Stouthuysen, K., & Roodhooft, F. (2009). Time-driven activity-based costing in an outpatient clinic environment: development, relevance and managerial impact. *Health Policy*, 92(2-3), 296-304. <https://doi.org/10.1016/j.healthpol.2009.05.003>
- Dwivedi, R., & Chakraborty, S. (2015). Development of an activity based costing model for a government hospital. *Uncertain Supply Chain Management*, 3(1), 27-42. <https://doi.org/10.5267/j.uscm.2014.9.003>
- Dyas, S. R. (2018). Practitioner application: Using time-driven activity-based costing to model the costs of various process improvement strategies in acute pain management. *Journal of Healthcare Management*, 63(4), E86-E87. <https://doi.org/10.1097/jhm-d-18-00091>
- Dyas, S. R., Greenfield, E., Messimer, S., Thotakura, S., Gholston, S., Doughty, T., . . . Phillips, R. (2015). Process-improvement cost model for the emergency department. *Journal of Healthcare Management*, 60(6), 442-457. <https://doi.org/10.1097/00115514-201511000-00011>
- Etges, A. P., S., B. D., Polanczyk, C. A., & Urman, R. D. (2020). A standardized framework to evaluate the quality of studies using TDABC in healthcare: The TDABC in healthcare consortium consensus statement. *BMC Health Services Research*, 20, 1-15. <https://doi.org/10.1186/s12913-020-05869-0>
- Etges, A. P. B. D. S., Cruz, L. N., Schlatter, R. P., Neyeloff, J., Ferranti, E., Kopittke, L., . . . Polanczyk, C. A. (2022). Identifying cost-saving opportunities for surgical care via multicenter time-driven activity-based costing (TDABC) analysis as exemplarily shown for cholecystectomy. *Journal of Hospital Management and Health Policy*, 6, 14-14. <https://doi.org/10.21037/jhmhp-21-34>
- French, K. E., Recinos, I., Guzman, A. B., Aloia, T. A., Hernandez, M., Kee, S. S., . . . Cleckler-Hughes, K. V. (2019). Continuous quality improvement measured with time-driven activity-based costing in an outpatient cancer surgery center. *Journal of Oncology Practice*, 15(2), e162-e168. <https://doi.org/10.1200/jop.18.00394>
- Grant, P. (2015). How much does a diabetes out-patient appointment actually cost? An argument for PLICS. *Journal of Health Organization and Management*, 29(2), 154-169. <https://doi.org/10.1108/jhom-01-2012-0005>
- Hayati, H. (2022). Comparison of the unit cost of diagnostic imaging services before and during the COVID-19 pandemic using the activity-based costing (ABC) method. *Iranian Journal of Radiology*, 19(3), e123781. <https://doi.org/10.5812/iranjradiol-123781>
- Holozada, B. H. A. R. (2022). A framework for time-driven activity-based costing for orthopedic procedure. Master's Thesis. Qatar University.
- Jalghoum, Y., & Khasawneh, S. (2016). An empirical research of the challenges to E-health initiative in Jordan. *International Journal of Business and Social Science*, 7(11), 51-65.
- Jalghoum, Y., Tahtamouni, A., Khasawneh, S., & Al-Madadha, A. (2021). Challenges to healthcare information systems development: The case of Jordan. *International Journal of Healthcare Management*, 14(2), 447-455. <https://doi.org/10.1080/20479700.2019.1658159>
- Keel, G., Savage, C., Rafiq, M., & Mazzocato, P. (2017). Time-driven activity-based costing in health care: a systematic review of the literature. *Health Policy*, 121(7), 755-763. <https://doi.org/10.1016/j.healthpol.2017.04.013>
- Mwai, D., Hussein, S., Olago, A., Kimani, M., Njuguna, D., Njiraini, R., . . . Rotich, W. (2023). Investment case for primary health care in low-and middle-income countries: A case study of Kenya. *Plos One*, 18(3), e0283156. <https://doi.org/10.1371/journal.pone.0283156>
- Serdar, C. C., Cihan, M., Yücel, D., & Serdar, M. A. (2021). Sample size, power and effect size revisited: Simplified and practical approaches in pre-clinical, clinical and laboratory studies. *Biochemia Medica*, 31(1), 27-53. <https://doi.org/10.11613/bm.2021.010502>
- Shrestha, N. (2021). Factor analysis as a tool for survey analysis. *American Journal of Applied Mathematics and Statistics*, 9(1), 4-11. <https://doi.org/10.12691/ajams-9-1-2>
- Stefanini, A., Aloini, D., Benevento, E., Dulmin, R., & Mininno, V. (2020). A data-driven methodology for supporting resource planning of health services. *Socio-Economic Planning Sciences*, 70, 100744. <https://doi.org/10.1016/j.seps.2019.100744>
- Taherdoost, H. (2016). Sampling methods in research methodology; how to choose a sampling technique for research. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3205035>
- Udpa, S. (1996). Activity-based costing for hospitals. *Health Care Management Review*, 21(3), 83. <https://doi.org/10.1097/00004010-199622000-00009>