An-Najah National University
Faculty of Graduate Studies

ASSESSMENT OF THE COST OF SELECTED CHEMISTRY LABORATORY TESTS USING ACTIVITY-BASED COSTING: A CASE STUDY FROM AN-NAJAH NATIONAL UNIVERSITY HOSPITAL

By
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Dedication

الى أولئك الذين كانوا نورًا في مسار حياتي، أهدي هذا العمل بكل تقدير وعرفان، فبدونكم لما كان هذا الإنجاز ليكتمل.

إلى والديّ الأعزاء، اللذين كانا دائمًا مصدرًا لا ينضب من العطف والإرشاد. لا تكفي الكلمات للتعبير عن تقديري، فأنتم الدافع لي في أصعب الأوقات والموجهين في كل خطوة. أدرك تمامًا أن نجاحي ليس سوى انعكاسًا لتضحياتكما وجهودكما العظيمة. أنتما الأساس في كل ما وصلت إليه.

إلى زوجتي الحبيبة، التي كانت وما زالت الصديقة والرفيقة الأقرب. كنتِ دومًا ملاذي في أوقات الشدة ونعمة في أيام الفرح. أنتي لست فقط شريكتي في الحياة، بل شريكتي في تحقيق هذا النجاح. منكِ استمددت القوة والأمل، وجعلتِ لكل خطوة معنى عميقًا.

إلى إخوتي وأخواتي الأعزاء، الذين كانوا لي الدعم في كل الأوقات، وساهموا في بناء قوتي عند الأزمات. كان وجودكم في حياتي له الأثر العميق في تحفيزي للتقدم نحو أهدافي، فأنتم الركيزة الأساسية التي ساندتني في كل مرحلةإ

الى والدَيّ زوجتي، اللذين لطالما كانا مصدرًا للسكينة والمساندة. أشكركم جزيل الشكر، فقد كان لدعمكم وتشجيعكم الدور الكبير في استمرار رحلتي. لا يمكنني أن أنسى ما قدمتموه لي من حب واهتمام، وهذا الإنجاز هو جزء من دعواتكم المباركة.

إلى معلميني الكرام، الذين علموني أن العلم ليس مجرد معلومات، بل هو شعاع من النور يغذي الروح ويحفز العقل. لقد أنرتم لي دروب الحياة، وبهذا العلم تعلمت الإصرار، والتفوق، وتحدي الصعاب. لم تقتصر جهودكم على التعليم الأكاديمي فقط، بل كانت دروسًا حية في الحياة والمثابرة.

إلى أطفالي الأعزاء، الذين ملأوا حياتي بحبهم وبراءتهم. في عيونكم أرى المستقبل المشرق، وفي ابتساماتكم أجد مصدرًا لا ينضب من الأمل. أنتم السبب في أن أتمكن من المضي قدمًا، ففيكم تتجسد كل الآمال والطموحات.

إلى كل من ساهم في مسيرتي، إلى من قدم لي يد العون بكلمة طيبة أو فعل صادق، إلى من آمن بي ودعمني في كل خطوة، أقول لكم: شكراً من القلب. بفضلكم، أتممت هذا العمل، فأنتم من منحني القوة والعزيمة للاستمرار رغم كل التحديات.

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أود أن أعرب عن خالص شكري وتقديري لجميع الأشخاص الذين ساعدوني ودعمني في إتمام هذا العمل. أخص بالذكر مشرفي الكريم، الدكتورة رايا صوالحه، التي قدمت لي التوجيه والإرشاد طوال فترة البحث. كما أشكر أعضاء لجنة المناقشة على ملاحظاتهم القيمة التي ساهمت في تحسين جودة هذا العمل.

كما أتوجه بالشكر إلى ادارة مستشفى جامعة النجاح الوطني الجامعي الذين قدموا لي الدعم اللوجستي والفني، بالإضافة إلى أسرتي وأصدقائي الذين كانوا دائمًا مصدر تشجيع لي في الأوقات الصعبة.

Declaration

I, the undersigned, declare that I submitted the thesis entitled:

ASSESSMENT OF THE COST OF SELECTED CHEMISTRY LABORATORY TESTS USING ACTIVITY-BASED COSTING: A CASE STUDY FROM AN-NAJAH NATIONAL UNIVERSITY HOSPITAL

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

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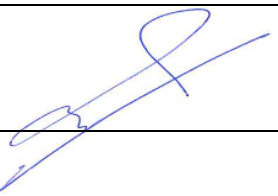
Signature: 

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ASSESSMENT OF THE COST OF SELECTED CHEMISTRY LABORATORY TESTS USING ACTIVITY-BASED COSTING: A CASE STUDY FROM AN-NAJAH NATIONAL UNIVERSITY HOSPITAL

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Abstract

The objective of this research is to investigate the process of implementing an Activity Based Costing (ABC) system in the chemistry laboratory in An-Najah National University Hospital in order to learn how it increases the accuracy of cost allocation and resource management. This research used a descriptive cross-sectional design. Subsequently, it applied the "Cooper" model's steps, specifically cost analysis and activity analysis. For the model, indirect costs were determined, and activity that caused those indirect costs were allocated.

The hospital documents and interviews with finance managers and laboratory personnel were used as data sources for this study. The study analyses showed that with the implementation of the ABC system the Department can now more accurately allocate costs and emphasize transparency, improved resource utilization, and more significantly an increased understanding of the various activities in the laboratory. Moreover, this research found that use of the ABC system also increases efficiency of processes through gaining an understanding of the costs of activities performed in the laboratory which, in turn, allows for managers to optimize activities and minimize waste.

However, the research also mentioned taking on additional initial time and effort to implement an ABC System - mainly to train administrative and financial personnel who will work with the new system, but also to 'delete' information systems in order to allow the monitoring of activities and their costs.

Research suggests the widespread application of ABC system in other areas of the hospital, particularly those with high levels of accuracy of cost allocations, such as operations and intensive care, to explore restructuring the hospital's accounting systems to match current day practices in financial management as well as building human

capacity and providing contextually appropriate information systems for effective implementation.

Finally, the evidence presented above supports studying an ABC system should be a good way to improve financial transparency and reduce wasteful spending in the multiple layers of hospitals, while it does require some more upfront resources, it has tremendous benefits down the line with regards to resource management and more accurate cash flow decision-making.

Keywords: Chemistry laboratory tests; activity-based costing; An-Najah national university hospital.

Chapter One

Introduction and Theoretical Background

1.1 Introduction

Recently, the world has experienced rapid growth and advances in many technological and technical areas. These enhancements have affected managers and their styles, aligning to the speed of the development.

As competition among local and global institutions becomes ever more fierce, the focus has shifted to cost accounting, both as a theory and practice. This shift is attributed to the significant role it plays in gaining a competitive advantage.

Prior to these developments in the business environment, indirect costs held little significance in product cost calculation. Indirect costs were frequently disregarded or excluded from calculation methodologies (الغبان و الغبان، 2022). However, due to advancements across various industries, the proliferation of automation, and a shift towards reliance on machinery and software over human labor, the importance of indirect costs has surged. These costs now constitute a substantial portion of the total expenses associated with any product or service (Bodendorf & Franke, 2024).

The traditional cost system obscures the relationship between cost elements and their underlying causes. (Bodendorf & Franke, 2024) The assumption that machinery costs increase solely based on the number of hours or base units is inaccurate when dealing with numerous indirect costs. The root cause of this discrepancy lies in the aggregation of cost elements that exhibit varying behaviors and causes. (Werner & Xu, 2012) Consequently, these elements are allocated using a single criterion.

The adoption of production centers as the primary units for aggregating cost elements has driven this imbalance. However, this approach yields unreliable cost information and triggers undesirable outcomes. These outcomes encompass distorted product pricing, an uneven distribution of costs among products or services, and errors in cost data. The culmination of these issues exerts a negative impact on both control and decision-making processes (الغبان و الغبان، 2022).

This situation manifests in two major ways. Firstly, some products or services might be

overpriced, diminishing their competitiveness or leading to their discontinuation. Secondly, the failure to allocate costs adequately can perpetuate the production of unprofitable products. Consequently, the viability of the enterprise is jeopardized (Sharma, 2023).

Among the various systems that address the allocation of indirect costs, the Activity-Based Costing (ABC) system stands out.

The Activity-Based Costing (ABC) system has significantly contributed to the accurate measurement of costs associated with products and services, enabling stakeholders to make managerial decisions based on precise information.

This system is a comprehensive costing approach that was developed in the 1980s in the United States. It allows for the classification of costs into two categories: direct and indirect costs, with a greater focus on creating larger pools of indirect costs and identifying cost-driving factors. This contributed to a more accurate measurement of the cost of products and services, thereby enabling sound managerial decisions (Sánchez-Rebull, Niñerola, & Hernández-Lara, 2023).

In order to solve the problem of incorrectly identified costs, the Activity-Based Costing (ABC) method was developed. By taking into account the particular tasks and supplies required to provide services, it provides a more accurate estimate of costs. Healthcare organizations can make more informed decisions regarding pricing, resource management, and cost control when they employ the ABC system. As a result, their financial decisions become more understandable (Sánchez-Rebull, Niñerola, & Hernández-Lara, 2023).

Calculating the cost of services rendered and determining the activities and their significance are two key benefits of using the ABC system in the healthcare industry. By identifying cost-consuming activities and implementing cost-reducing improvements, healthcare institutions are better equipped to decide how best to allocate resources and set prices.

Overall, the use of the ABC system in the healthcare sector has the potential to improve cost analysis and significantly increase efficiency within healthcare organizations (Rajabi & Dabiri , 2012).

It is now more challenging to gather and evaluate data using conventional techniques due to the substantial technological advancements. In order to address this issue, the Activity-Based Costing (ABC) system was developed, providing a bright future for the field of healthcare cost estimation (Emmuel Prayer Waruwu, 2024).

Also, as healthcare organizations learn more about the benefits of the ABC system, especially for controlling costs and distributing resources, more people are accepting it and are more willing to use it. Ongoing research and development in this field bolster the system's contribution to improving the quality and efficiency of healthcare services (Shaheen & Khreisat, 2024).

For the ABC system to be used more often in healthcare, there must be a need for good tools to make it work. Healthcare providers must also keep learning to make sure they know how to use the system well and get the best results. Also, working together across healthcare organizations and sharing knowledge are both important ways to improve the quality of implementation. Last but not least, ongoing performance assessment and monitoring are very important for getting insights that can lead to new ideas and improvements in this area (F. Amato, 2015).

The healthcare sector is important because it provides therapeutic and diagnostic services and helps keep the community healthy. This is why it is important to look for ways to implement an ABC system in this sector. The Health field is also important to the state budget, especially since donor countries are putting more pressure on the Palestinian National Authority to be open about how they get and spend these funds.

1.2 Problem statement

The traditional costing system currently used in Palestinian hospitals, including An-Najah National University Hospital, results in inefficient resource utilization and inaccurate cost allocation. This inadequacy prevents an accurate reflection of the actual costs of healthcare services, leading to suboptimal decision-making and potential financial losses. This study addresses this problem by developing and applying the Activity-Based Costing (ABC) model within the Chemistry Laboratory of An-Najah National University Hospital. The ABC approach will be compared to the traditional costing system in order to evaluate its accuracy, transparency, and ability to optimize resource allocation. By implementing the ABC model, the study aims to provide practical insights into its

applicability in a hospital setting, highlight the discrepancies between the two systems, and demonstrate how ABC can lead to improved cost control and informed managerial decisions. Thus, this research directly contributes to solving the identified problem by offering a tested framework for implementing ABC in the hospital's laboratory department, which can later be extended to other departments to enhance cost accuracy and resource efficiency

1.3 The significance of this study

The importance of this study stems from its triadic impact, academic, practical, and societal. In an academic scope, this research enriches the literature related to healthcare organization with regard to the application of the Activity Based Costing (ABC) system. The study provides empirical evidence with a comparison of ABC and the traditional costing system used in Palestinian hospitals Given the complexity of health care services and technology improvements; this study aims to ascertain how well ABC enhances indirect cost allocation. It will stimulate conversations on hospital cost management tactics and provide as a resource for more study.

Significant operational and financial benefits are anticipated from the implementation of the ABC system in the Chemistry Laboratory at An-Najah National University Hospital, which takes managerial and financial factors into account.. The system's implementation will increase fiscal accountability and transparency, improve budgeting accuracy, help achieve better financial governance, reduce financial waste, support the use of financial resources, and strengthen the development of pricing strategies for healthcare services—all of which will help to protect sustainability and lessen financial drains. In the end, implementing the ABC method in Palestinian hospitals could result in significant long-term cost savings, improved operational efficiency, and more strategic managerial choices.

The study is significant because it may change practice and policy contours. The observation could lead to a transition to activity-based costing (ABC) as a strategic cost management strategy for hospital administrators and legislators to consider ending outdated cost accounting systems while encouraging improved efficiencies and compliancy and the best use of scarce resources in healthcare. ABC could complement sound decision-making processes, improve financial transparency, and open up other

departments for ABC use in the hospital.

Further opportunities that emanate from this research focus on correlating ABC with other health information systems, extending the ABC system to intensive care and surgery, and cross-regional and cross-national comparative studies in difference healthcare organizations.

Honestly, this study hits right where it matters for society. I mean, hospitals aren't just some random buildings—they're the backbone for both our health and the economy. If they nail down cost accuracy and figure out how to use their resources smarter, it's not just about saving a few bucks or making the admin happy. We're talking better care for people, keeping folks healthy and working, and leveling up on both the economic and social fronts. It's way bigger than just the bottom line.

1.4 Objectives

1. To calculate the actual cost of selected chemistry laboratory tests at An-Najah National University Hospital using the Activity-Based Costing (ABC) method.
2. To identify the main cost drivers and resource consumption associated with each selected test under the ABC approach.

1.5 Study hypothesis

H1: The implementation of an Activity-Based Costing (ABC) system for calculating the cost price of selected chemistry laboratory tests at An-Najah National University Hospital will lead to more accurate and transparent cost measurement, improved resource allocation, and enhanced financial management.

H2: The Activity-Based Costing (ABC) system will enable a more precise allocation of indirect costs for the selected chemistry laboratory tests.

1.5.1 Hypothesis explanation

1. Improved Cost Accuracy: In this case, implementing an Activity Based Costing (ABC) system on specific chemistries laboratory tests at An-Najah National University Hospital was expected to increase the accuracy of the cost estimates. The ABC method of costing allocated the costs to activities, including laboratory tests, equipment use, nursing activities, and administrative work, according to the

resources used for each. This method improves the accuracy of service cost measurement which aids in setting the right price and improves financial decision making.

2. The ABC system is anticipated to enhance transparency by delineating costs linked to specific activities. With better insight into the resource requirements for different laboratory services, administrators can enhance efficiency, improve resource allocation, and ensure alignment of expenditures with service delivery priorities.

1.6 Definition

private hospital: is a hospital not owned by the government, including for-profits and non-profits. Funding is by patients themselves ("self-pay") or by insurers.

Activities-based costing system (ABC system) : It is an analytical system designed to analyze the activities conducted by an organization to achieve specific services or products. This is achieved through the classification of indirect costs, which are then grouped into internally homogeneous cost complexes based on their characteristics. The system further determines the volume of resources consumed by these activities and calculates the cost of each individual activity. These costs are subsequently allocated to the respective products or services, based on the specific activities employed in their production. This allocation involves various methods of assigning costs, utilizing appropriate cost vectors (Cooper & Kaplan, 1988).

The traditional costing system: " The approach to allocating indirect costs based on the transfer of costs of cost centers to final products using some volume-triggered allocation base, while ignoring that much of the cost elements of indirect costs have no link to volume. This can result in incorrect amounts for cost elements involved in determining the final cost of the end product. Further, this allocation of indirect costs does not consider the use of resources, which may reduce the usefulness of the traditional method as a principal" (الغبان و الغبان، 2022).

1.7 Literature review

A study on Activity-based cost analysis of laboratory tests in clinical chemistry (Declerck et al., 2021) The study discovered that ABC can be used for knowing the cost of each lab test, tracing the cost back to its origin, and then working toward reducing these costs and automating the work. The study has also discovered that, in common with the core laboratory, automated tests and high-volume tests are low unit cost tests. Through automation or use of outside agencies for low-volume tests that cannot benefit from economies of scale, ABC also identifies high-average cost tests that require attention.

Applying ABC system for calculating cost price of hospital services case study: Beheshti hospital of Hamadan (Niasti, Fazaeli, Hamidi, & Viaynchi, 2019).

The article treats the issue of service costing and accounting to calculate the cost price of radiology services in Beheshti hospital of Hamadan using activity-based costing (ABC) system. In 2015, the study was carried out, having gathered data by means of information forms. The hospital was subdivided into various cost centers with five cost buckets established for costs: wage, equipment, space, material, and overhead costs, in order to apply the ABC method. Human resources accounted for the highest costs 65.2%, while the energy conduits costs accounted for the lowest 0.4%. The study found discrepancies between real prices of radiology services and approved tariffs. The ABC being applied offers a worthwhile accounting system to the hospital officials so as to view the real organizational costs of their department.

Cost analysis of Medical diagnostic Services of Hormone section of the central laboratory in Iran's East Azerbaijan Province using activity-based costing method in 2013 (Imani et al, 2018).

A study conducted in Iran highlighted the significance of employing the (ABC) method to assess the costs incurred for medical Diagnostic Services of the Hormone section in the central laboratory of East Azerbaijan Province, Iran as it assists with budgeting, allocating costs, strategizing, employing accrual accounting, and making decisions. The study highlighted various mechanism costs in the hormone sector of the laboratory. The labor and the depreciation elements were shown to be the highest mechanisms. The labor costs represented 59% of the overall costs incurred, while depreciation expenses accounted for only 1.25%. The study concluded that EACL could experience a budget

shortfall given the number of testing operations conducted in the hormone sector, because of the use of skilled human resources and the level of specialized equipment, unless the tariff pricing is adjusted to reflect reasonable laboratory costs.

Application of the Activity-Based Costing Method for Unit-Cost Calculation in a Hospital (Javid et al., 2015).

Conducted a cross-sectional study of 2013 Iran Kashani Hospital accounting data based on accounting reports' figures for the year 2012 and other relevant sources at the end of 2012.

The study compared Traditional Cost System (TCS) and Activity-Based Costing (ABC) in determining the unit cost of medical services in Kashani Hospital in Iran. ABC was used in two steps, costing activities and allocating the activities to cost objects, with five narrowly defined cost categories. The results showed that ABC has a total unit cost of $187.95 USD, more than TCS's $137.70 USD, showing its strength to list key cost factors. ABC generally provides significant information to hospital managers, giving a more precise view into organizational costs and aiding cost management and decision-making.

A Comparative Study of Activity-Based Costing vs. Current Pricing System for Pathology Examinations at Okmeydani Training and Research Hospital, Turkey (Yarikkaya et al., 2016).

The primary aim of the research was to obtain correct cost data for pathology tests through the use of the activity-based costing approach in line with benefiting the healthcare departments, administrators, and the social security organization through enhancing cost control, quality of care, and financial planning. Cost data of histopathological tests conducted in August 2014 at Okmeydanı Training and Research Hospital were gathered and calculated through the use of the activity-based costing approach. These costs were then compared to both the Healthcare Implementation Notification Tariff and traditional volume-based costing. Outcomes from the research showed that a significant 77.4% of the pathology tests examined were higher in cost than tariffs, showing an inconsistency between tariff prices and actual costs in Turkey. The study supports the modification of the tariff to better mirror the actual costs, emphasizing making use of activity-based costing towards improved financial planning, quality of health care services, as well as

cost management within the health care system.

A study by Rajabi, & Dabiri (2012) on "Applying the Activity Based Costing (ABC) Method to Calculate Cost Price in Hospital and Remedy Services".

The study used Activity-Based Costing (ABC) to find out the cost price of the remedial services in Shahid Faghihi Hospital. The work';s main steps included classificatons of the hospital unit as administrative, diagnostic, and hospitalized departments, identifying activity centers in these departments, allocating costs from administrative centers to other centers based on cost drivers, and finally, determining the cost of medical services based on resource use . The findings outlined some disagreements made by the ABC cost price and the tariff methodology, which indicated problems with the latter's model. Moreover, the Diary of the pathology department made it seem indirect costs dominated, which the authors pointed out may lead to inefficient resource use in the hospital. Ultimately, this study determined that ABC was both more valid and reliable than the tariff methodology to account for costs associated with healthcare services, while also showing much more insight into the cost structures, nature of indirect costs, and degree of efficiency with resources being used.

The revenue generated from clinical chemistry and hematology laboratory services as determined using activity-based costing (ABC) model (Adane, Abiy, & Desta, 2015).

This Study, conducted at Tikur Anbessa Specialized Teaching Hospital, Ethiopia, sought to investigate the economic component of laboratory service in hematology and clinical chemistry. From the investigation, it was discovered that there was a discrepancy between charges of these services and costs. Fees charged for laboratory tests could not cover 10% of the total cost of services being offered and maybe the hospital may not have collected a lot of money from patients because it was below-cost pricing. The study concluded that 18 of the 20 laboratory tests sampled were under-charged below their costs, but the cost of offering free Anti Retro-viral Therapy (ART) placed a heavy burden on hospital finance. Overall, the study showed that the hospital needed to adjust its lab pricing strategy to break even and ensure that the sustainability of the lab remained in the long run without compromising the quality of services.

Cost Analysis with Activity Based Costing Method on Coronary Heart Catheterization at Dr. Sardjito Hospital Yogyakarta (Bayu Aji, 2018).

This study aimed to calculate the unit cost of coronary angiography in the form of Activity Based Costing (ABC) and compare it with the stipulated charges at RSUP Dr. Sardjito Yogyakarta. Using a qualitative study design with a descriptive manner, this study gathered primary data in the form of interviews and secondary data from 2016 financial reports. The ABC method, consisting of comprehensive activity-based costing, was applied for cost analysis. The results indicated that the ABC estimated per-unit cost for coronary angiography was significantly more than the current hospital costs, revealing a potential anomaly. Importantly, the hospital rates had not been updated since 2014 and were not suitable for use with the financial conditions of 2016. Also, personnel cost comprised the maximum 44%, which added further to the increased ABC calculated unit cost. An important message in this study is that hospital rates need to be periodically updated and revised to accurately capture actual healthcare costs.

Literature Study : Activity-Based Costing System (Setyaning & Fara Dita, 2020).

This literature study explores the significance of being competitive in a world of growing competition in the marketplace. It also emphasizes that the Activity Based Costing System (ABC) is a solid cost management methodology. This study is organized in three sections consisting of the ABC concept, the implementation levels, and the costs and benefits of ABC.ABC is considered a method of costing by examining the usage of resources using a wide range of activities that help provide goods and services. The authors look at the literature about ABC and see some similarities and differences in perspectives and applications.

The important conclusion or message is that companies use the ABC system to gain more accuracy of calculations on production costs in order to maximize profits. It is stressed that companies with varied products and competitive pressure from similar products are most suited to implementing ABC. It is further suggested that the cost for companies to implement ABC are quite reasonable in cost and practical to use.

To conclude, based on the findings of the literature, this literature review emphasized the role of ABC as a tool for companies to improve cost accuracy, so they are able to compete

in a highly competitive environment. The literature review shows the various selection criteria that will best suit companies to adopt ABC and that it is a cost-effective tool to manage costs.

1.8 The theoretical framework of the study

1.8.1 Introduction

Certainly, the traditional cost allocation process has some limitations in its ability to assign indirect costs to products and services, as the process is ripe with challenges through many years of institutional knowledge. These limitations result from the effects of globalization in the service and manufacturing areas of our economy, along with supporting technology developments related to processes, systems, and production capabilities, which are related to the overall cost accuracy of the cost accounting systems.

Now that traditional cost accounting systems can no longer support developments from a manufacturing or service perspective organizations are moving to current and sophisticated systems that support technologies and developments that account for exacting costs on products or services. This is necessary so that organizations can create exact costing information for the medium and long term. The ability to cost measure and then appropriately build an accurate costing system is required to compete within the very competitive business environment that we work in today. Accurately measuring costs establishes a more effective planning and control process within organization.

The issues mentioned have forced organizations in every iteration to overhaul their management and production methods. This necessity is the result of severe criticism leveled at the old cost accounting system for its net inability to provide relevant, helpful, and consistent cost information and manage many indirect costs. Old accounting systems are responsible for measuring the costs of products or services, but they have failed measures to provide the accounting of product costs required to enable the organization to grow in the new era. These systems fail as a result of improper estimates, and hence tangible expense allocation and assignment aligns to be misguided. Consequently, these accounting systems do not provide management with the data and information to execute actual management: planning, controlling, and monitoring process management is systematically envisioned and prescribed (Kihuba, Gheorghe, Bozzani, English, & Griffiths, 2016).

Under these circumstances, new developments in costing systems have led to a new method of assigning indirect costs that meet the information needs of management far more reasonably than traditional systems of cost measurement. This method is referred to as the Activity-Based Costing (ABC) system and the basis of the ABC system in an assignment system. ABC is considered a more appropriate alternative to allocate to products or services as compared to the traditional method (Setyaning & Fara Dita, 2020).

The Activity-Based Costing system has garnered significant attention in both accounting and administrative spheres. It serves as a vital tool for accurately and realistically determining and reporting production costs, while also It avoids inefficiencies in the system " the deficiencies and criticisms" often directed at the current (traditional) cost system, particularly in light of the prevailing economic and technological changes in today's business landscape (Setyaning & Fara Dita, 2020).

1.8.2 Cost accounting objectives

Cost accounting is not confined solely to industrial activities; rather, it extends its application to any entity with defined objectives. It can be employed not only in industrial settings but also in commercial or service-oriented establishments, whether their objectives are profit-driven or not. In the realm of cost accounting, accountants assume a significant role in the decision-making process, albeit not at the same level as decision-makers themselves. They provide recommendations and suggestions regarding which decisions should be accepted or rejected, contributing valuable insights to the decision-making process.

There are many purposes of cost accounting and will vary as to the multiple goals of an organization. Cost an accounting is not a goal itself but it is a method or means of accomplishing many goals.

Cost accounting serves several important purposes within an organization (Cost Accounting: Definition and Types With Examples, 2023):

- Cost Assessment: One of the primary goals of cost accounting is to determine the cost of production of products or service provision. This involves identifying and assigning costs for individual cost components like material, labor, and overhead.

- Cost Control: Cost accounting helps in controlling costs by monitoring expenses and identifying areas where cost savings can be achieved. This is crucial for improving profitability and efficiency.
- Product Pricing: Cost accounting gives insight into product or service costs, allowing businesses to price competitively and profitably.
- Budgeting and Forecasting: Cost accounting plays a key role in preparing budgets and forecasts, as it allows organisations to prepare realistic budgets and forecasts based on a history of costs.
- Performance Evaluation: Cost accounting allows organisations to evaluate the performance of departments, products, or projects. Managers compare actual costs to budgeted costs to see how they differ from the budget and take corrective action, where warranted.
- Decision Making: Cost accounting provides timely relevant cost information to inform decision-making. Examples include product cancellation, make-or-buy decisions, acquiring capital expenditures, and more.
- Resource Allocation: Also, cost accounting helps in resource allocation by showing department or activity and how much resources each department or activity consumes to better allocate resources to achieve maximum productivity.
- Profitability Analysis: Cost accounting allows for the analysis of the profitability of specific products, services, or customer segments. This information can guide strategic decisions.
- Tax Compliance: Cost accounting ensures accurate financial reporting, which is essential for tax compliance and financial transparency.
- Inventory Valuation: Cost accounting methods are used to value inventory, which impacts financial statements and tax liabilities.
- Performance Measurement: It provides benchmarks for measuring and improving performance over time.
- Regulatory Compliance: Cost accounting helps organizations comply with regulatory requirements by accurately reporting costs and financial data.

1.8.3 Cost Types

Absolutely, costs in accounting are often categorized into two main types based on their relationship to a product or service: direct costs and indirect costs. explore each type: (What Are the Types of Costs in Cost Accounting?, 2023).

Direct Costs

Definition: Direct costs are expenses that can be traced directly and specifically to a particular product, project, department, or cost center. These costs are directly attributable to the production or provision of a specific item or service.

Examples: Direct labor (wages of workers directly involved in production), direct materials (raw materials used in manufacturing a product), and manufacturing supplies directly used in production are common examples of direct costs.

Characteristics: Direct costs vary with the level of production or the amount of service provided. If you produce more units or offer more services, direct costs increase proportionally.

Indirect Costs (Overhead)

Definition: Indirect costs, also known as overhead costs, are expenses that cannot be traced directly to a specific product or service. Instead, they support the overall operation of the organization and are incurred for the benefit of multiple cost centers or activities.

Examples: Rent for the entire facility, utilities, salaries of supervisors, depreciation of machinery, and office supplies that are not directly used in production are typical examples of indirect costs.

Characteristics: Indirect costs tend to be fixed or semi-variable. They do not vary in direct proportion to changes in production levels or the number of units produced.

The distinction between direct and indirect costs is essential for accurate cost allocation, cost analysis, and decision-making within an organization. It allows businesses to better understand the true cost of producing specific products or providing certain services, which, in turn, helps in pricing strategies, budgeting, and overall financial management.

Generally, Indirect costs encompass various expenses incurred in the production, storage, selling, distribution, and administrative activities associated with a product or service. They cover everything spent on these activities until the product is sold and its value is realized, excluding the costs of raw materials and direct wages, which are considered direct costs. Indirect costs are often referred to as overhead and include items such as rent, utilities, salaries of non-production employees, depreciation, office supplies, and other operational expenses.

When focusing on indirect costs, we notice many challenges, including (Carvalho, 2020) (Schmied, Gebhardt, Mörtl, & Lindemann, 2017):

1. Diversity in Nature and Behavior

   Indirect costs encompass a wide variety of elements, such as indirect materials, indirect wages, and industrial services, each with its own distinct characteristics and responses to changes in activity levels.

   Some indirect costs remain relatively stable within a certain activity range, while others, like electricity usage, are directly tied to production volume. Additionally, some costs exhibit a combination of fixed and variable behavior.

2. Lack of Clear Relationship to Production Units

   Unlike direct costs, which are directly attributable to specific production units or products, indirect costs lack a clear one-to-one relationship with production units.

   This lack of direct correlation can make it challenging to determine the precise allocation of these costs to individual units or projects.

3. Occurrence in Different Facility Areas

   Indirect costs occur in different parts of a facility or organization. Indirect costs are not solely assigned within specific departments or cost centers; they are incurred across many departments or cost centers.

   Therefore, the owner of the cost is spread over many centers/departments as well as added complexity for planning and control.

4. Planning and Control Complexity:

   It is often difficult to manage indirect costs when the indirect cost is unrelated to the individual or persons responsible for the indirect costs occurring. Planning and control for indirect costs may require coordination across departments and clear costs allocation methods.

To mitigate these issues, organizations often use cost allocation methods such as activity-based costing (ABC) to assign indirect costs to a greater extent at specific cost centers, products, or services. In addition, sound cost management and budgeting practices which control and reduce indirect costs will strengthen planning in other direct cost categories, thereby improving financial performance and decision making.

1.8.4 The Traditional Costing System and how it allocates costs

Cost accounting is important, and will be more important, in today's economy. It serves as the base for determining whether investment projects will be viable based on economic feasibility studies. It also one of the most critical tools for planning and controlling. Cost accounting is especially important today, and needs to focus on indirect cost allocation to products or services. In this section, the indirect cost allocation methods and principles of traditional systems will be examined.

The Chartered Institute of Management Accountants (CIMA) states that "cost is the monetary measurement of the amount of resources used for some purpose, or in carrying out an activity". This definition captures, at a minimum, the financial measure of resource consumption in the context of various business activities which is a primary objective in both cost accounting and management accounting.

Cost accounting can be defined as one of the branches of financial accounting and serves as an analytical tool within it. It comprises a set of established accounting principles and rules aimed at quantifying aggregate amounts related to cost elements. These cost elements are linked to specific cost centers to calculate the unit cost of production within each production department it traverses, thereby facilitating control over these elements and aiding management in the processes of planning and control (Cost Accounting: Definition and Types With Examples, 2023).

1.8.4.1 Stages of cost allocation according to the traditional system

The traditional cost allocation system typically involves two main stages:

1. Allocation of Indirect Costs to Cost Centers:

   In this initial stage, indirect costs (commonly referred to as overhead costs) are allocated to various cost centers within an organization. The allocation is typically based on some predetermined allocation base or measure that reflects the relationship between the use of resources and the cost centers. Examples of allocation bases might include machine hours, labor hours, square footage, or any other appropriate measure. The purpose of this stage is to distribute the indirect costs to the specific areas or departments where they are incurred or consumed.

2. Assignment of Costs to Final Products or Services:

   The second stage involves the assignment of costs from the cost centers to the final products or services produced by the organization. This is done using predetermined rates or charging bases that are related to the volume of production. Common allocation bases at this stage include direct labor hours, machine hours, or the cost of direct materials. However, as you mentioned, many indirect cost elements may not have a direct correlation with these volume-based measures, and their allocation can be somewhat arbitrary. This stage aims to attach a portion of the indirect costs to each unit of production to determine the total cost of each product or service.

Legacy cost allocation methods are imperfect; they never examine the directness of the complexity inherent in indirect cost elements. Besides, they do not accurately capture the cost drivers or cause and effect relationships that appraise results, consequently achieving the wrong outcome resulting in bad decisions. So, it is not surprising that legacy methods do not stand up well when allocating costs based on activities and processes related to facilities, especially in complex production environments that require evaluations based on volume, count of units produced, activities performed, and or product or customer specifications.

Traditionally cost allocations were calculated based on the number of labourers assuming product units consumed resources in a direct fashion. This form of pricing was very simplistic and any model could easily misstate the allocation of indirect costs.

Clearly, the performance management requirements of today's world make traditional accounting methods—based on how to calculate the cost of actual products or services—questionable, as they do not provide the necessary information flow on planning, control, monitoring, and operational development. Because of technological advancement in the labor market, direct costs have suffered significant reductions with indirect costs now the major component of achieved costs. Health care, when mechanization has been introduced in other areas, has changed the base of costs, which have fallen in regard to direct labor, but indirect costs from various departments of service could be a higher portion. With this situation, the way that traditional cost systems allocated indirect costs does not apply to the present administration, and cannot be relied upon due to its ineffectiveness.

In practice, in spite of the criticism of the traditional cost system, it is still used by organizations today to allocate indirect costs:

1.8.5 Cost allocation is an activity-based costing system

Organizations of all types are experiencing many obstacles in the allocation of indirect costs. The majority of these challenges are a result of advancements in information systems, the increase in activities, and the growing complexity of work processes. Consequently, there has been a shift in the relative significance of cost components. This transformation has been spurred by a decline in direct labor volume brought about by industrial advancements, the automation of manual tasks, the diminishing interaction between workers and production units, as well as the obsolescence of cost reports.

Furthermore, traditional cost reports have proven to be insufficient in terms of content and require lengthy preparation periods. In light of these developments, modern businesses find themselves in need of real-time information for prompt decision-making. This necessitates a swift transition to cost accounting systems that are bolstered by administrative activity and, in particular, emphasizes the implementation of activity-based costing systems.

In 1987, two researchers introduced a novel allocation system, subsequently recognized as the Cooper and Kaplan Activity-Based Costing System. This system, distinguished by its numerous advantages over the traditional approach, particularly in terms of supplying pertinent data for both operational and strategic decision-making, garnered widespread

acceptance among scholars and executives. Consequently, it began to witness widespread adoption, notably in prominent industrial establishments globally (Quesado & Silva).

Activities-based costing system (ABC system): It is an analytical system designed to analyze the activities conducted by an organization to achieve specific services or products. This is achieved through the classification of indirect costs, which are then grouped into internally homogeneous cost complexes based on their characteristics. The system further determines the volume of resources consumed by these activities and calculates the cost of each individual activity. These costs are subsequently allocated to the respective products or services, based on the specific activities employed in their production. This allocation involves various methods of assigning costs, utilizing appropriate cost vectors (Cooper & Kaplan, 1988).

The activity-based costing system places a greater emphasis on activities and processes rather than on products. In contrast to categorizing indirect costs by cost centers, this approach organizes costs according to activities. The fundamental premise of this system is that activities consume resources, and costs are allocated based on the utilization of resources within these activities.

From the preceding definitions, it becomes evident that the foundation of the activity-based costing system involves:

1. Defining activities.
2. Calculating the costs associated with these activities.
3. Allocating these costs to products or services.

In essence, activities serve as the bridge connecting raw materials and the cost objectives, which can be products, services, customers, and so on. The activity-based costing system commences by identifying the activities employed in the production and distribution of products or services. Subsequently, it calculates the expenses incurred across various activities in the production process and ultimately associates them with the products or services by aligning the cost drivers with the respective products or services.

It should be noted that the activity-based costing system is not restricted to industrial facilities alone; Rather, it can also be applied to service companies and non-profit organizations, as well as government establishments.

1.8.5.1 Advantage of ABC

The advantage of the activity-based costing (ABC) system lies in its ability to enable more precise calculation of production costs, which in turn leads to enhanced company profitability. ABC specifically calculates the costs associated with various activities in the production of goods and services, resulting in a more accurate comprehension of the necessary resources. This system proves especially advantageous for businesses characterized by extensive product diversity and intense market competition, as it facilitates the communication of product value to consumers at more competitive prices. Furthermore, the cost of implementing ABC is relatively modest (Sudarso, 2022).

1.8.5.2 Disadvantage of ABC

The ABC (activity-based costing) system provides many benefits including better costing accuracy and useful decision-making information, however there are some disadvantages as well. The ABC system can be complicated, and have various designs which may lead to difficulties with implementation and maintenance. These issues may also require certain specific skills and knowledge not typically required with traditional costing systems. Moreover, the high implementation costs, including expenses related to data collection and technology adoption, may be prohibitive for smaller companies. Additionally, ABC may not always support comprehensive system-level analysis and effective communication between various systems within an organization. In the context of small and medium-sized enterprises (SMEs), where cost efficiency is critical, the resource-intensive nature of ABC implementation may not be the most efficient cost measurement method. Thus, organizations should carefully assess their specific needs and resources when considering the adoption of ABC (Durana, 2019).

Despite the aforementioned disadvantages, the benefits of employing an activity-based costing system generally outweigh its limitations, as it provides valuable support for informed and objective decision-making within an organization. When considering the implementation of such a system, management should carefully assess the availability of the necessary resources and components to ensure the achievement of desired outcomes.

1.8.5.3 Allocating costs under an activity-based costing system

ABC involves a two-stage allocation process (Huang, 2018).

The first stage involves allocating resources to activities. In this phase, various aspects of activities are identified, whether they are individual or group centers. This necessitates dividing the facility into a set of fundamental activities, each of which describes an aspect of the facility's operations. An activity is defined as any action taken by the organization that consumes time to produce outputs or perform tasks. The primary function of an activity is to transform resources, including raw materials, labor, and technology, into outputs, which can be products or services.

In the second stage, the cost of these activities is attributed to the outputs. This entails assigning the costs of activities to the units of output, whether they are products or services, based on the quantity of units to be completed. This allocation is achieved using cost drivers, which serve as a measurement of demand. Product demand for activities is gauged by the number of transactions or requests generated for the purpose of fulfilling orders or meeting specific demands promptly.

1.8.6 The main differences between the traditional costing system and the Activity-Based Costing (ABC) system

The activity-based costing (ABC) system and the traditional costing system share similarities in their accounting treatment of direct materials and direct wages. However, they diverge significantly when it comes to accounting for indirect costs. To illustrate the qualitative shift introduced by the ABC system, it's essential to highlight the fundamental differences between these two systems.

Table 1

The main differences between the traditional costing system and the Activity-Based Costing (ABC) system

Aspect	Traditional Costing System	Activity-Based Costing (ABC) System
Cost Allocation Basis	Costs are allocated based on simple criteria like direct labor hours or machine hours.	Costs are allocated based on activities and their associated cost drivers.
Accuracy and Precision	Typically, less accurate, leading to potential distortions in product or service costs.	Aims to provide more accurate and precise cost information by linking costs directly to the activities that drive them.
Complexity	Generally simpler and easier to implement.	More complex due to detailed analysis of activities and cost drivers, which may require specialized skills.
Resource Utilization	May not provide a clear picture of resource usage across different activities.	Provides better insight into how resources are utilized within various activities, aiding resource optimization.
Cost Management and Decision-Making	May not offer accurate cost information for effective cost management and decision-making.	Offers more relevant and actionable cost data, supporting cost control, pricing decisions, and product or service profitability analysis.
Applicability	Widely used and suitable for organizations with relatively simple cost structures.	Particularly beneficial for organizations with diverse product lines, complex activities, and where accurate cost information is critical.

Note: (Durana, 2019; Huang, 2018; Kihuba, Gheorghe, Bozzani, English, & Griffiths, 2016; Quesado & Silva).

While the traditional cost system has faced criticism, it's essential to note that these critiques do not fundamentally invalidate the system's theoretical framework. Rather, the criticisms are primarily a response to the evolving landscape of modern production environments and the rapid advancements in information technology applied across diverse sectors. The limitations inherent in the traditional costing system have motivated many organizations to transition towards the adoption of activity-based costing as a tool to support decision-making. Consequently, it can be argued that the activity-based costing system represents an evolution of the traditional cost system, adapting to the contemporary developments in production environments to meet the decision-making requirements across industrial, commercial, and service sectors (Kocakulah, 2017).

A pertinent question arises: Can the cost measurement approach based on an activity-based costing system, which yields numerous advantages when applied in industrial facilities, be extended to the service sector, particularly in the context of hospitals? If such an extension is feasible, does it result in similar benefits as those observed in industrial settings? This inquiry sets the stage for the researcher's exploration in the forthcoming chapter.

1.8.7 Activity-based costing system in hospitals

The application of costing systems in service establishments developed later compared to industrial establishments. This delay occurred despite the unique characteristics of service establishments, which are characterized by a wide range of activities, significant overlap between these activities, substantial capital investments, extensive market coverage, and a high degree of societal importance for their outputs. These distinctive features served as a driving force for researchers to delve into the study, design, and implementation of activity-based costing systems in these facilities. Their aim was to assess the suitability of such systems in accurately evaluating the outputs of service establishments.

Hospitals play a crucial role in the healthcare industry and are significant contributors to the economy in many countries around the world. Cost accounting in hospitals holds particular importance for hospital managers and administrators for several reasons: (Malmmose, Lydersen, & Landbobank, 2020; Olyan Ajam, Ghasemizad, & Gholtash, 2020; Shahnaz, Alireza, & Abbas, 2019; Yadin & Ernest; Carroll & Lord, 2016; Marcinko & Hetico, 2013):

- Cost Awareness: Hospital managers need to have a clear understanding of the costs associated with the services they provide. This includes not only medical treatments but also administrative and operational expenses.
- Performance Evaluation: Cost accounting helps evaluate the performance of various departments and operational divisions within the hospital. with the aim of identifying areas that need improvements.
- Budgeting: Hospitals often operate on tight budgets. Accurate cost data provides a realistic basis for budget estimates. Cost accounting helps hospital managers plan future expenditures, allocate resources efficiently.
- External reporting: Hospitals often receive funding from outside agencies, such as

government agencies, insurance companies, or charitable organizations. To maintain funding, these third parties require hospitals to submit regular reports, including cost reports.

- Cost Control: Hospitals face significant pressures due to high healthcare costs from technological development, population aging, etc. Cost accounting helps maintain the continuity of health care within an acceptable profit margin.

1.8.8 An overview of hospitals in Palestine

Palestine, which includes the West Bank, Gaza Strip, and East Jerusalem, has a complex healthcare system. It operates under challenging circumstances due to political conflicts, resource constraints, and limitations on movement, which affect the delivery of healthcare services.

In Palestine, the types of hospitals available are influenced by the unique political and healthcare context of the region. While there are several hospitals in both the West Bank and Gaza Strip, the distinctions between types of hospitals, such as public, private, and specialty hospitals, may not be as clear-cut as in some other countries.

In 2022, there were a total of 93 hospitals in Palestine, with a combined capacity of 6,900 beds, including those in psychiatric and neurological hospitals, as indicated in the table provided (Health Annual Report, Palestine , 2022).

Table 2

Distribution of hospitals and bed

District	MOH		UNRWA		NGOS		Private		PMIMS		Total	
	No. of Hospital	No. of Beds	No. of Hospital	No. of Beds	No. of Hospital	No. of Beds	No. of Hospital	No. of Beds	No. of Hospital	No. of Beds	No. of Hospital	No. of Beds
West Bank	18	1.898	1	58	22	1.592	17	738	0	0	58	4.286
Gaza Strip	13	2.011	0	0	17	440	3	69	2	94	23	2.614
Palestine	31	3.909	1	58	39	2.032	20	807	2	94	93	6.900

Note: (Health Annual Report, Palestine , 2022).

The Palestinian Ministry of Health (MoH) operates a total of 31 hospitals across the region, with a collective capacity of 3,909 beds. This accounts for approximately 56.7% of the total number of beds available in Palestine.

Specifically, within the West Bank (WB), there are 18 MoH hospitals providing healthcare services, and these hospitals have a combined capacity of 1,898 beds. In the Gaza Strip (GS), there are 13 MoH hospitals, offering medical care, and they have a total of 2,011 beds.

Based on the data provided earlier, it is evident that the healthcare sector in the West Bank predominantly depends on the private sector. There are a total of 40 non-governmental hospitals in the region, with a combined bed capacity of 2,388.

In 2022, the total number of referrals outside Ministry of Health (MoH) facilities amounted to 110,810, marking an 11.8% increase when compared to the 99,064 referrals recorded in 2021.

With the adoption of the Diagnosis-Related Group (DRG) system by the Palestinian Ministry of Health, which refers to the aggregation or grouping of medical cases with similar or related diagnoses, and is used to estimate the cost in fixed compensation for determining the cost of healthcare, it has become essential to enhance the capacity of private sector hospitals to understand and analyze the costs associated with each medical diagnosis and attempt to reduce costs without compromising the quality of healthcare.

To determine the true cost of any medical service, it is necessary to begin by identifying the cost of everything that contributes to delivering that service. One of the most critical components in this regard is laboratory tests.

When examining private Palestinian hospitals, particularly in the West Bank, regarding their capacity to adopt an activity-based costing system, it becomes evident that An-Najah National University Hospital stands as a model suitable for the implementation of such a system. This is attributed to the presence of diverse resources that greatly facilitate the effective deployment of the system, with one of the most crucial resources being a financial and administrative system that furnishes essential information required for its application.

1.8.9 Applying the activity-based costing system in hospitals using the " Cooper model "

The study approach will be based on the "cooper" model, and the model's application mechanism is based on two stages within eight steps:

Stage one:

- Step One: This initial phase entails the analysis of costs incurred by the hospital, specifically related to the laboratory. These costs are then organized into cost pools, with each pool containing elements that share similar characteristics and qualities.
- Step Two: In this stage, the hospital identifies and examines the core activities conducted to deliver various medical services within the Medical Analysis Department (laboratory). These activities are grouped into activity pools or considered individually, ensuring that each group of activities corresponds to a specific cost center within the hospital.

Stage Two:

Cost Apportionment to Activities and Services: This stage encompasses steps three through eight. Here, the costs within the cost pools are assigned to activities or activity pools, employing the previously identified cost drivers from the first step for each set of cost pools. Subsequently, the costs associated with each activity within the Medical Analysis Department (laboratory) for therapeutic services are allocated based on the cost drivers established in the second step. It is crucial to note that this process relies on establishing a cause-and-effect relationship between costs and activities or between costs, activities, and the services provided.

Chapter Two

Methods

2.1 Study Design

An observational cross-sectional, descriptive study designed to compare the effectiveness and the efficiency of the ABC system with TCS.

The study approach was based on the "cooper" model, and the model's application mechanism is based on two stages within eight steps. The first stage includes the first and second steps. The first stage is to examine the costs incurred by (NNUH) as a result of the laboratory department, and then group these costs into groups with homogeneous characteristics. The second phase is to gather and analyze all laboratory activities, which culminate in the provision of laboratory services within groups with homogeneous features. The second stage contains steps three through eight. The costs gathered in the first stage are charged to the activities, and the overall costs are charged to the services. It should be highlighted that the causal relationship between costs and activities or between activities and services will be used here.

2.2 Study setting

The study conducted in the Chemistry laboratory section of An Najah National University Hospital, the only accredited academic medical center in the West Bank that belongs to Al-Najah National University, one of the largest universities in Palestine.

2.3 Sample and Sampling

The study targeting the Laboratory Department, particularly the Chemistry Department. Specific conditions were established for the inclusion of examinations in the study sample:

-The examination must have been conducted in the year 2022.

-The examination must have been performed a minimum of 365 times within the year.

The selection of the Chemistry Department for the study was based on various factors, with a primary consideration being that the largest volume of tests conducted in the laboratory of An-Najah National University Hospital is associated with the Chemistry Department. Successfully applying the model to a specific department and a distinct set

of tests suggests the potential for its application to all other tests and departments within the laboratory. The study will include laboratory staff members, financial managers, and hospital administrators directly involved in cost management and operations of the laboratory department.

An-Najah National University Hospital Chemistry Laboratories department aims to provide analytical services to a high standard, and to aid the medical practitioners in diagnosing and monitoring patients' health issues. The department's activities include, the Chemistry Laboratory section provides an analysis of several biological samples including blood, urine, plasma and other body fluids, in order to evaluate levels of levels of hormones, vitamins and chemicals used to provide their patient's health status and concerns. The Chemistry Laboratory Department achieves safe and scientific results by using innovative techniques and methodologies that are reliable and are reproducible. These laboratory results support the doctor's ability to make appropriate treatment decisions based on timely and reliable results. Also, when possible, the Chemistry Laboratory Department actively continues to engage with other complex and specialized healthcare teams to share information in order to enhance therapy and achieve the best possible patient outcomes. As a department, the Chemistry lab fulfills national/international quality and safety standards through a continued methods of monitoring policy. The Chemistry department has options available through the use of laboratory professionals, with skilled laboratory technicians and state of the art equipment and these components work together to ensure the reliability of the results, timely.

2.4 Data Collection

To achieve the objectives of the study, data was collected from An-Najah National University Hospital through the analysis of records and reports related to activities and costs, as well as discussions held with the financial manager, the head of the Chemistry Laboratory Department, and several department and division heads.

At the beginning of the data collection phase, an interview was conducted with the head of the Patient Accounting Department at Al-Najah National University Hospital. He was queried about the number of laboratory tests conducted in the year 2022. Upon consulting their database, a comprehensive list was provided via email, containing all the tests conducted during the year 2022. The list included the following basic information:

- Test name.
- Date of test request for the patient.
- Test code in the computerized system.
- Laboratory test status.

Between January 01 2022 and December 31, 2022, 408,243 exams were done at the Chemistry Laboratories Out of 548,321 laboratory tests conducted in the laboratory as a whole of An-Najah National University Hospital. This enormous number of exams indicates the Chemistry Laboratories Department's role in providing health care, detecting ailments in the hospital, and successfully treating patients.

Appendix A shows the names and numbers of examinations conducted in the chemistry department throughout this period and the monthly rate of examination activity. The laboratory tests conducted in the Chemistry Lab constituted 74.5% of the total patient tests carried out during the year 2022. This underscores the importance of studying the costs associated with this vital department. Furthermore, these tests were distributed according to the coverage source, and the results are presented in the following table.

Table 3

Distribution of tests by coverage source

GUARANTOR_NAME	#
Ministry of Health – Palestine	317,107
Cash Guarantor	25,508
Palestinian Military Services	53,391
Private Health Insurance	12,237
Total	408,243

Referring to the mentioned conditions for including a test in the targeted sample for study, it is observed that tests conducted at an average rate exceeding 365 tests per year (i.e., at least once per day) are as provided in table 4:

Table 4

Tests Conducted at an Average Rate Exceeding 365 Tests per Year

#	SERVICE_CODE	SERVICE NAME	TOTAL NUMBER	MONTHLY RATE
1	CH 010	Creatinine, Serum	44701	3725
2	CH 300	Electrolytes, Serum	40335	3361
3	CH 007	Blood Urea Nitrogen – BUN	39431	3286
4	CH 001	Albumin, Serum	21774	1815
5	CH 026	ALT / SGPT	19896	1658
6	CH 025	AST / SGOT	19406	1617
7	CH 209	CRP (Quantitative)	17659	1472
8	CH 005	Total Bilirubin, Serum	17563	1464
9	CH 008	Calcium, Serum	15124	1260
10	CH 006	Direct Bilirubin, Serum	13560	1130
11	CH 013B	Glucose, Random	12811	1068
12	CH 002	Alkaline Phosphatase	12683	1057
13	CH 019	Magnesium, Serum	12510	1043
14	CH 022	Phosphate, Serum	11964	997
15	CH 023	Potassium, Serum	7763	647
16	CH 033	Carbon Dioxide - CO2	7651	638
17	CH 013	Glucose, Fasting	7061	588
18	CH 027	Sodium, Serum	6954	580
19	CH 011	Ferritin	5817	485
20	CH 052	Chloride, Serum	5421	452
21	CH 015	Iron, Serum	5083	424
22	CH 015A	TIBC (Total Iron Binding Capacity)	5027	419

2.5 Analysis

Application of the "Cooper model"

The first stage " The first stage is to examine the costs incurred by (NNUH) as a result of the laboratory department, and then group these costs into groups with homogeneous characteristics".

After tallying the numbers of laboratory tests conducted for patients during the year 2022, interviews were conducted with the Financial Manager and the head of the Accounting Department at Al-Najah University Hospital. This was done to obtain both direct and indirect costs associated with the laboratory. The relevant information was subsequently provided to me via email.

The first phase (cost identification and analysis): During this stage, the Chemistry Laboratory section direct and indirect costs were discovered, examined, and classified into their own cost pools if each of these groups had expenses with similar characteristics.

Pools of direct costs:

1. Consumables cost group, which comprises the following direct costs:

- costs of medical consumables: The expenses of medical materials and solutions used in the sample analysis procedure.
- General consumables expenses: These are the costs of syringes, tubes, gloves, and other items used to collect and examine samples.

2. Salary Costs Group: This group included the salaries of technicians working in the Chemistry Laboratory Department.

Indirect costs are categorized into several pools as follows:

1. General services costs group:

- Phone expenses
- Subscription fees
- Printing expenses
- Cleaning and security expenses

- Insurance expenses

2. Miscellaneous Costs:

- External lab test expenses
- Waste expenses
- General expenses

3. Group of Reception and Accounting Costs:

- All costs associated with the Financial Department

4. Depreciation Expense
5. Electricity Costs Group
6. Water Costs Group

Based on the classification of the groups and referring to the cost records available at the hospital, Table 5 below shows the value of these cost pools.

Table 5

Value of Cost Pools Based on Their Classification and the Cost Records in the Hospital

Cost pools	Total cost of chemistry laboratory department	Cost reasoned
In Direct Consumables cost group	645,841.46	Utilization rate
Salary Costs Group	581,568.00	Number of people working on the activity
General services costs group	292,896	Utilization rate
Miscellaneous costs group	227,840.77	Equally
Group of reception and accounting costs	311230.4866	Number of patients
Depreciation Expense	57,814	Utilization rate
Electricity Costs Group	136,704.46	Utilization rate
Water Costs Group	15,573.59	Utilization rate

Note: Prepared by the researcher.

The second phase (analysis of activities) is critical to the success of this stage, especially because the deployment of the activity-based pricing system depends on the effectiveness of the activity analysis process in the target facility or department. During this step, the activities performed in the Chemistry Laboratory Department—necessary for delivering its medical services—were examined through interviews with the laboratory director and

the head of the Chemistry Laboratory. Two categories of activities were identified: general activities and direct activities, as follows:

General Activities Group: These are activities carried out within the hospital's medical analysis department (laboratory), in which all laboratory departments participate. They include the following:

The process involves several key stages, beginning with the collection of specific substances or materials intended for analysis, referred to as Sample Collection. This is followed by Sample Registration, where the samples are logged upon arrival, assigned unique identifiers, and entered into the database. The final stage is Sample Receipt, which is comprised of the physical receipt of the samples and verification against the associated documentation.

Direct activities also encompass a wider range of activities specific to the Chemistry Laboratory section and are not shared with other laboratory departments. For example, The first activity is Sample Preparation - preparing samples for analysis after whatever procedures and treatments there are. The Daily Maintenance of Devices is a day-to-day activity, checking the device to make sure it is clean, and carrying out simple maintenance, to encourage the device to work correctly. The next activity is laboratory devices' calibration, or the use of known standards, to ensure the laboratory device is functioning properly, thus obtaining valid results. The Quality Control (QC) protocol ensures that testing is done with appropriate procedures. To monitor that each test is completed following accepted methods to openly measure accuracy and precision.

Performing Tests, which includes completing the testing experiments/analyses, and gathering the necessary data, according to the testing protocol, is the centre of the laboratory clinical testing analytical workload. This also covers the Concentration Measurement, which evaluates the amount or concentration of the substances within a sample using appropriate analytical techniques. Upon attainment of results, an Assessment of Logical Coherence is included to assess if the results are in agreement with scientific understanding and the logical thinking framework. Information is then Recorded in laboratory documentation to maintain accurate, trackable data and The step is Report Results in a manner that is easily interpretable by the stakeholders involved with decision-making regarding clinical diagnosis/treatment.

Lastly, once the analysis mentioned above has occurred, there are post-analysis activities. For example Sample Storage where samples are stored in conditions for future use or re-analysis if warranted. Sample Disposal means that the sample is safely and properly disposed of, especially the samples that might be a biohazard and/or chemical hazard, to follow safety standards.

Table 6 presents a concise summary of the various activities conducted within the chemistry Department, along with the associated cost drivers for each activity. This table serves as the basis for allocating the costs of these activities to the medical examinations offered within the department. The determinants for these costs were identified through a field visit, collaborating closely with the Laboratory Director, the Head of the Chemistry Department, and the Head of the Accounting Department.

Table 6

***S**ummary of Activities in the Chemistry Department and Their Cost Drivers*

Activity	Cost Driver
Registration	Personnel time, administrative labor
Sample Collection	Personnel time, consumables used for collection
Sample Preparation	Consumables, equipment usage, personnel time
Calibration	Calibration materials, personnel time
Quality Control	Quality control materials, personnel time
Performing Tests	Consumables, equipment usage, personnel time
Sample Disposal	Hazardous waste management process, personnel and resources for disposal

The table provided highlights that the primary cost factor for most activities is the time needed to complete each task (Personnel time). This is particularly significant because these activities are carried out by human staff within a computerized laboratory to deliver medical analysis services. Consequently, time stands as the most appropriate cost factor for managing the expenses associated with these activities in the service provision

The second stage (allocating costs to activities and services): This stage encompasses the remaining six steps, which we list as follows.

the third stage involves linking costs with activities. This connection was established by associating the cost groups within the Chemistry Laboratory Department with the performed activities, relying on direct or indirect cause-and-effect relationships between costs and activities. This was achieved through the development of a matrix known as the Cost-Activity Dependence Matrix (CADM). The matrix, designated as Table 7 or Matrix No. (1), illustrates the correlation between the monthly cost pools and activities within the chemistry department. The relationship is depicted using the (✓) symbol to express this association.

Table 7

Matrix No. (1) *Cost-Activity Dependence Matrix (CADM): Correlation Between Monthly Cost Pools and Activities*

Activity	Consumables Cost Group	Salary Costs Group	General Services Costs Group	Electricity Expenses	Water Expenses	Miscellaneous Costs	Depreciation Expense	Group of Reception and Accounting Costs
Registration		✓						✓
Sample Collection	✓	✓	✓	✓	✓	✓		
Sample Preparation	✓	✓	✓	✓	✓	✓	✓	
Calibration	✓	✓	✓	✓	✓	✓	✓	
Quality Control	✓	✓	✓	✓	✓	✓	✓	
Performing Tests	✓	✓	✓	✓	✓	✓	✓	
Sample Disposal	✓	✓	✓	✓	✓	✓	✓	

The matrix highlights the presence of cost groups that are shared across all activities. For instance, the category of salaries and wages directly impacts activities, whereas other costs are dispersed among activities, albeit indirectly. Additionally, the matrix reveals that certain cost groups are linked to specific activities, excluding others due to the absence of a direct or indirect relationship. An illustrative example is the lack of connection between the drawing and sample collection activity and the costs associated with reception and accounting.

This underscores the significance of establishing a causal relationship between costs and activities. Any lapse in accurately interpreting this relationship could result in an error in determining the actual activity cost. Consequently, this error would extend to the overall cost of the service or product.

Step Four involves determining the percentage of consumption in the dependency matrix between cost and activity:

Following the establishment of relationships between cost pools and activities within the Chemistry Department, a dependency matrix was created to connect them. Each symbol in this matrix was then replaced with a percentage, indicating the proportion of activity consumption from the assigned cost pools. These percentages were derived through interviews with relevant personnel and the utilization of identified cost drivers mentioned in Table 5 during the initial step of the first stage. These drivers played a crucial role in allocating costs to specific activities.

It is important to note that the summation of percentages in each column of this matrix equates to one, ensuring accurate allocation and representation of the overall consumption of cost pools by respective activities.

The Activity-Based Costing tool validity was maintained by detailed coverage of all elements of costs and types of activities implicated in laboratory tests, as proposed in the theoretical model of Cooper. Face and content validity were maintained by expert advice from finance and lab managers. To enhance reliability, standardized cost drivers were used equally across activities and information sources were cross-checked with institutional records and interviews with stakeholders.". Although no full inter-rater reliability test was done, consensus among several departmental representatives was used to validate time and resource assignments.

Table 8

Matrix No. (2) Cost-Activity Dependence Matrix (CADM): Correlation Between Monthly Cost Pools and Activities

Activity	Consumables Cost Group	Salary Costs Group	General Services Costs Group	Electricity Expenses	Water Expenses	Miscellaneous Costs	Depreciation Expense	Group of Reception and Accounting Costs
Registration		5%						100%
Sample Collection	22%	13%	17%	8%	16%	17%	0%	
Sample Preparation	17%	18%	17%	13%	17%	17%	12%	
Calibration	11%	15%	17%	11%	15%	17%	17%	
Quality Control	6%	13%	17%	13%	15%	17%	15%	
Performing Tests	31%	28%	17%	53%	19%	17%	47%	
Sample Disposal	11%	11%	17%	5%	17%	17%	9%	

Note: Kaplan, R. S., & Anderson, S. R. (2004). *Time-driven activity-based costing*. Harvard Business Review, 82(11), 131–138.

Step Five (Activity Cost Calculation): In this step, the cost of each activity from the activities listed in the cost-activity matrix for the Chemistry department is calculated. This is done by applying the following equation (Jassim & Ansari , 2011).

$$T_r = \sum_{l=1}^{n} M_l x_{r,l} \dots\dots\dots\dots\dots\dots\dots (1)$$

Where:

T_r = Total cost of activity r.

n = Number of cost pools.

M_l = Value of cost pool l.

$x_{r,l}$ = The ratio in the cell corresponding to active r and cost pool l.

In accordance with the preceding equation, the total annual cost for Patient registration is as follows:

Patient registration Cost : (0.05* 29078.4)+(1* 311230.4866) = 340308.886 ILS.

As illustrated in Matrix No. 3 / Table B.1 (see Appendix B), which presents the annual cost of the remaining activities, the total of each column corresponds to the monthly cost of its respective cost group, while the sum of each row reflects the overall cost of the activity.

The sixth step involved establishing a connection between the Chemistry Laboratory Department's activities and the services it offers. This was achieved by identifying direct or indirect cause-and-effect relationships between specific activities and the corresponding services. To illustrate these relationships, Table B.2 / Matrix No. 4 (See Appendix B), titled Activity-Service Dependence Matrix (ASDM): Relationships Between Activities and Services, was developed. In this matrix, dependencies are represented using the symbol (✓). The relationships were determined based on detailed input and clarifications provided by the head of the Chemistry Laboratory Department, forming the foundation for accurately representing the interdependencies between activities and services in the ASDM.

The seventh step involved determining the percentages of effort expended within the dependency matrix between each activity and the corresponding service. In this stage, each check mark (✓) in the Activity-Service Dependence Matrix was replaced by a percentage indicating the proportion of effort allocated to that activity in completing a specific examination.

These percentages were derived by dividing the total number of each examination by the overall number of examinations, yielding what is referred to as the benefit percentage. For example, the benefit percentage for the Albumin Serum test was calculated as (21,774 / 408,243) × 100% = 5.33%. This is illustrated in Table B.3 / Matrix No.5 (See Appendix B), titled Percentage of Effort Expended in Activity-Service Dependence Matrix (ASDM).

The eighth step involves calculating the cost of the service in the Activity-Based Costing system. The final results obtained in this step represent the culmination of the application of the system. The cost of each service is determined by examining the dependency matrix between the activity and the service within the Chemistry Laboratory Department. To carry out this step, the researcher utilizes the percentages from Matrix No. 5 in Table B.3 (See Appendix B). as well as the annual cost of the Chemistry Laboratory Department from Matrix No. 3 (See Appendix B). These two matrices are integrated for the calculation. As an illustration, the total annual cost for the Albumin Serum examination service is determined to be 5.559 shekels, as per the following equation:

(340308.8866*0.0533"+"314341.14775*0.0533"+"325056.05365*0.0533"+"273316.79
3335714*0.0533"+"229125.918221429*0.0533"+"551626.530821429*0.0533"+"23569
2.936221429*0.0533)= 121044.089

By dividing the total sum by the number of annual tests, which is 21,774, the cost per test is 5.55911 ils .

"The cost of all the remaining tests was calculated in the same manner and is presented in the appendices under appendix number E.

When incorporating the indirect costs for each examination, the total cost for each examination amounts to 5.559 shekels. Additionally, by including the reagent fee for each examination as outlined in the following table, the total examination cost is elucidated.

Table 9

Table of Final Cost Value Using Activity-Based Costing for the Studied Examinations

#	SERVICE_CODE	TEST NAME	Costs assessed through the Activity-Based Costing (ABC) system	The cost price of the reagent	Final cost price
1	CH 010	Creatinine, Serum	5.559111281	0.1712821	5.7303934
2	CH 300	Electrolytes, Serum	5.559111281	0.15102122	5.7101325
3	CH 007	Blood Urea Nitrogen – BUN	5.559111281	0.1940738	5.753185031
4	CH 001	Albumin, Serum	5.559111281	0.3744490	5.933560264
5	CH 026	ALT / SGPT	5.559111281	0.2420633	5.801174614
6	CH 025	AST / SGOT	5.559111281	0.2420633	5.801174614
7	CH 209	CRP (Quantitative)	5.559111281	2.9716943	8.530805609
8	CH 005	Total Bilirubin, Serum	5.559111281	0.3711268	5.930238108
9	CH 008	Calcium, Serum	5.559111281	0.5289899	6.08810115
10	CH 006	Direct Bilirubin, Serum	5.559111281	0.3706105	5.929721811
11	CH 013B	Glucose, Random	5.559111281	0.2808483	5.839959614
12	CH 002	Alkaline Phosphatase	5.559111281	0.28761724	5.84672852
13	CH 019	Magnesium, Serum	5.559111281	1.6538545	7.212965803
14	CH 022	Phosphate, Serum	5.559111281	0.28761724	5.84672852
15	CH 023	Potassium, Serum	5.559111281	0.15102122	5.7101325
16	CH 033	Carbon Dioxide – CO2	5.559111281	3.8755319	9.434643143
17	CH 013	Glucose, Fasting	5.559111281	0.5095522	6.068663469
18	CH 027	Sodium, Serum	5.559111281	0.5095522	6.068663469
19	CH 011	Ferritin	5.559111281	7.9398026	13.49891393
20	CH 052	Chloride, Serum	5.559111281	0.4744951	6.033606392
21	CH 015	Iron, Serum	5.559111281	0.6159750	6.175086281
22	CH 015A	TIBC (Total Iron Binding Capacity)	5.559111281	3.6062669	9.16537822
23	CH 342 A	Transferrin Saturation	5.559111281	0.0000000	5.559111281

Chapter Three

Result

3.1 Analyze Results and Test Hypotheses

After studying the cost reality of An-Najah National University Hospital through the application of the activity-based costing system using the (Cooper) model in two stages for the Chemistry Laboratory Department, it was found that the goal of the accounting system in which An-Najah National University Hospital operates is to collect all costs and classify them according to the items of the general budget, with the aim of following up and monitoring the implementation of the budget. This is confirmed by the fact that the Financial Department records expenditures in appropriate accounts according to the classification approved in the account classification structure. Additionally, in order to organize the budget and financial affairs, it is prohibited to spend on any expense that has not been allocated in the general budget, and allocations may not be used for purposes other than those for which they were adopted.

In this context, it is considered that implementing the activity-based costing system at An-Najah National University Hospital brings several benefits and objectives, the most significant of which include:

- Accurately determining the costs associated with the medical services offered by the hospital, thereby establishing the appropriate service pricing based on solid scientific principles.
- Enhancing the oversight function through the application of this system, which effectively monitors resource consumption across activities involved in delivering treatment services. This leads to a more effective cost management system for these resources.
- Achieving efficiency in utilizing economic resources by optimizing performance and eliminating unnecessary activities through operational re-engineering. This results in cost savings and greater efficiency in delivering medical services, especially given the constraints of available resources.

3.2 Addressing the Challenge of Managing and Controlling Costs at An-Najah National University Hospital

Several challenges were encountered during the implementation of the activity-based costing system at An-Najah National University Hospital. These challenges primarily arose from the inadequacy of the cost information required for the effective application of the system. The available data consisted of expenses that were not specifically allocated to individual hospital departments. For instance, all expenditures related to the laboratory department's medical services were treated as general expenses for the entire laboratory, except for salaries, wages, and medical supplies, which were directly assigned to their respective departments within the Medical Analysis Department. This lack of detailed cost breakdown at the department level led to the need to initially organize and adapt the data to meet the requirements of the activity-based costing system. Consequently, both direct and indirect costs were allocated to the Chemistry Laboratory Department to facilitate the application process.

Based on the findings, several key results were highlighted:

- It was found that the current costing system at An-Najah National University Hospital does not provide accurate information regarding the cost of its medical services. The system primarily serves to categorize costs for budgetary purposes, as evidenced by field visits and interviews conducted during the study preparation phase.
- Implementing the activity-based costing system provided more accurate cost data on the services performed by the Chemistry Laboratory Department. This allowed hospital management to price health service charges and manage overhead costs in a more informed manner
- The activity-based costing system, by analyzing the activities in the Chemistry Laboratory Department, provided important information for planning and decision-making around workflow of departments.

An important obstacle to successfully implementing the activity-based costing system at An-Najah National University Hospital was a lack of information organized for the system's requirements, which delayed and complicated the implementation process.

The results show potential benefits to the use of activity-based costing, and challenges associated with moving away from traditional costing.

3.3 Testing Hypothesis

Hypothesis 1 (H1):

chemistry laboratory tests at An-Najah National University Hospital will lead to more accurate and transparent cost measurement, improved resource allocation, and enhanced financial management.

Testing Approach:

The Activity-Based Costing (ABC) methodology to estimate the costs of the selected chemistry laboratory tests was performed by first identifying the required activities for each test, assigning both direct and indirect resources to the activities using suitable cost drivers. The calculations were then analyzed based on the accuracy, transparency, and usefulness of the produced cost data to assist decisions about pricing, budgeting, and financial management.

Findings:

The activity-based costing system created a clearer and more precise measure of laboratory test costs because they connected resource consumption directly to activities. The results demonstrated the ABC system improved decision-making by allowing managers to direct their resources more effectively and have improved cost control. H1 is confirmed.

Hypothesis 2 (H2):

H2: The Activity-Based Costing (ABC) system will enable a more precise allocation of indirect costs for the selected chemistry laboratory tests.

Testing Approach:

Indirect or overhead costs (e.g., depreciation of laboratory instruments, utilities, and administrative charges) were identified and assigned to the selected laboratory tests by employing reasonable cost drivers (number of tests, machine hours, or working hours by staff within the test) in a reasonable clear and fair manner. In this way, the overhead was assigned to each laboratory test in a detailed and defensible manner.

Findings:

The findings confirmed that the ABC method resulted in an equitable and realistic allocation of indirect costs related to an activity that consumed resources. This resulted in a new understanding of the true cost structure of the tests. This substantiates H2.

Chapter Four

Discussions and Conclusions

4.1 Results Discussions, Recommendations, and Future Studies

The implementation of the Activity-Based Costing (ABC) system in the Chemistry Laboratory Department at An-Najah National University Hospital has yielded several key results and recommendations, summarized as follows:

4.1.1 Results Discussions

1. Successful implementation of the ABC system at An-Najah National University Hospital requires more than an accountant familiar with hospital costs. It demands a highly experienced and knowledgeable team capable of linking activities to services. This team is generally available but needs guidance and training to provide accurate information that explains the relationship between cost and activity. Additionally, the hospital must have information systems capable of supplying any necessary data to the team.
2. The ABC system can provide more accurate cost information for medical services than traditional costing systems, aiding decision-makers in making correct and timely decisions.
3. The service sector generally lacks cost systems that determine the cost of services for setting selling prices. Many selling prices are currently determined by personal estimates without a scientific basis.
4. The ABC system can reduce costs without compromising quality through process re-engineering. This involves analyzing activities, creating a flowchart to deliver medical services faster by merging or eliminating non-beneficial activities. This approach optimizes the use of scarce resources to achieve operational goals efficiently.
5. Identifying and selecting cost drivers is the backbone of the ABC system. This was clearly demonstrated during its application in the Chemistry Laboratory Department at An-Najah National University Hospital.
6. Effective cost control in the Medical Analysis Department, specifically in the Chemistry Laboratory Department, results from analyzing activities and linking them

to their costs, identifying weaknesses and improving them, and enhancing strengths.

7. Despite the benefits of the ABC system, some limitations may hinder its application, such as high implementation costs, practical and economic difficulties in analyzing activities, and challenges in studying and analyzing the costs of some activities.
8. The ABC system, with its benefits, can be applied not only to industrial establishments but also to service establishments, whether private or governmental.
9. One of the main challenges facing hospital management in implementing the ABC system is the lack of necessary information. This requires significant changes in accounting and information systems to shift from random data to accurate classification of cost information.
10. The ABC system is not designed for immediate decision-making but to provide more accurate information about the medical services provided. This enhances performance efficiency by calculating the cost of medical services at any time and helping management build a database for higher-level decision-making.
11. Cost-based pricing benefits hospital management, the Palestinian Ministry of Health, and stakeholders by raising cost awareness and influencing the economic use and operation of available resources to achieve desired goals.
12. The information provided by the ABC system can be utilized in various areas, particularly in planning and estimating activity costs, preparing multi-level planning budgets, cost control, decision-making processes, performance evaluation, and responsible accounting.
13. The ABC system can be applied to other medical departments in the hospital similarly to its application in the Chemistry Laboratory Department, provided the necessary elements for success are available. Although implementing the ABC system throughout the hospital may be costly and time-consuming, the benefits gained after implementation outweigh these efforts.

By comparing the results of my study with some other studies, the following becomes evident:

A comparison of the results of my study with the study by (Shaheen & Khreisat, 2024) titled “Enhancing Financial Management in Healthcare: The Impact of Activity-Based

Costing and Time-Driven Activity-Based Costing Methodologies in Jordan's Private Sector in Jordan", reveals several similarities and differences. Both studies highlighted the effectiveness of the Activity Based Costing (ABC) system to address cost control and to improve the accuracy of the cost/measure, both of which facilitate the best possible allocation of resources, and limits the occurrence and incidence of expected demands for wasteful expenditure. Both studies looked at the application of the system in private hospitals to address the issue of fair pricing of healthcare services, while examining the objective of financial efficiency.

Despite the fact that the Jordanian study included one additional system, Time-Driven Activity-Based Costing (TDABC), thereby introducing a new cost measurement and management dimension, it must also be noted that the Jordanian study emphasized training financial staff as part of the success factors for implementation, while the current study illustrated more the issues surrounding the lack of detailed data at the departmental context and the challenges associated with the variability of operational contexts, and proposed solutions for implementing modern costing systems in the healthcare setting. When comparing the results of my study with the (Ali, 2024) It can be concluded from the "Activity-Based Costing Model in the Laboratory of Care Hospital" study that both studies relate to the benefits of using the Activity-Based Costing (ABC) system and applications of resource management, as well as reducing unnecessary costs when accurate costing information is readily available.. In my study, the focus was on how the ABC system improves the accuracy of medical service cost determination and better resource management at An-Najah National University Hospital, while the Care Hospital study showed that applying the ABC system enhanced the accuracy of determining costs for different activities, which contributed to improving financial decision-making. However, some differences emerge between the two studies. The Care Hospital study compared the traditional costing system with the ABC system and emphasized the greater transparency provided by the latter in cost allocation, which enhances operational efficiency—an aspect that was not strongly emphasized in my study. My study, on the other hand, focused more on the challenges related to the lack of precise data for implementing the system, which impacted the implementation process at An-Najah National University Hospital, while the Care Hospital study concentrated more on operational efficiency and financial decision-making.

4.2 Recommendations

Based on the analysis of the results, the researcher recommends the following:

1. Implementation of ABC System: Given the current costing system's inability, particularly in the public sector, to provide highly accurate information on the costs of medical services, An-Najah National University Hospital should implement the ABC system. This system will offer precise cost information, facilitating objective annual planning.
2. Utilization of Computer Programs and IT: The hospital should use computer programs and supporting information technologies to train the accounting staff on designing and implementing the ABC system. This will reduce the system's costs while ensuring accurate outputs by leveraging the hospital's computerized system to design the costing system. It will also facilitate the application of the system across various departments and administrative levels. Additionally, the introduction and development of automated and electronic data processing will capitalize on the computer's capabilities for the ABC system's numerous mathematical adjustments that are challenging to perform manually.
3. Proper Planning and Expert Consultation: Effective planning is crucial for implementing the ABC system in the hospital sector. Consulting with experts and consultants who are qualified and experienced in implementing advanced systems is essential.
4. Training and Budget Allocation: Hospital budgets should allocate sufficient funds for specialized training courses for decision-makers, administrators, and employees. These courses should emphasize the role and importance of cost systems, particularly the ABC system, in terms of implementation mechanisms, benefits, and advantages, including its ability to provide more accurate information compared to traditional cost systems.
5. System Integration and Accounting Changes: If the hospital intends to implement the ABC system and integrate it into its accounting system, it should begin making the necessary changes to its accounting and information systems to support the ABC system's requirements.
6. Workflow Analysis and Quality Improvement: The workflow in the Chemistry

Laboratory Department should be studied and analyzed. Necessary changes should be made to these departments to ensure improved service quality at the lowest possible costs.

7. Curriculum Development in Universities: Encourage faculties of commerce, administrative sciences, economics, and management in Palestinian universities to develop their curricula, focusing on modern decision-making tools, including the ABC system, in cost accounting and management accounting courses.
8. Designing a Cost Accounting Program: Utilize the available database in the hospital to design a cost accounting program tailored to the hospital's needs.

Third: Future Studies

1. Applying the activity-based costing (ABC) system integrated with quantitative analysis tools and studying the impact of this integration on the cost of service or product, and whether this type of integration is feasible.
2. Conducting a study to apply the ABC system to private (for-profit) hospitals.
3. Studying the role of applying the ABC system in reengineering processes in the industrial and service sectors.
4. Examining the influence of the ABC system on the behavior of strategic decision-makers.
5. Evaluating the efficiency of the ABC system in identifying value-adding and non-value-adding activities.
6. Investigating the role of the ABC system in assessing the performance of economic units.
7. Assessing the economic return of the information provided by the ABC system and its impact on the behavior of decision-makers in public sector institutions and non-profit organizations.

List of Abbreviation

Abbreviation	Meaning
ABC	Activity-Based Costing
TCS	Traditional Costing System
NNUH	An-Najah National University Hospital
CADM	Cost-Activity Dependence Matrix
ASDM	Activity-Service Dependence Matrix
DRG	Diagnosis-Related Group
SMEs	Small and Medium-sized Enterprises
USD	United States Dollar
CH	Code prefix for Chemistry lab tests

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Appendices

Appendix A

List of all laboratory tests

#	SERVICE _CODE	SERVICE NAME	TOTAL NUMBER	MONTHLY RATE
1	CH 010	Creatinine, Serum	44,701	3,725
2	CH 300	Electrolytes, Serum	40,335	3,361
3	CH 007	Blood Urea Nitrogen – BUN	39,431	3,286
4	CH 001	Albumin, Serum	21,774	1,815
5	CH 026	ALT / SGPT	19,896	1,658
6	CH 025	AST / SGOT	19,406	1,617
7	CH 209	CRP (Quantitative)	17,659	1,472
8	CH 005	Total Bilirubin, Serum	17,563	1,464
9	CH 008	Calcium, Serum	15,124	1,260
10	CH 006	Direct Bilirubin, Serum	13,560	1,130
11	CH 013B	Glucose, Random	12,811	1,068
12	CH 002	Alkaline Phosphatase	12,683	1,057
13	CH 019	Magnesium, Serum	12,510	1,043
14	CH 022	Phosphate, Serum	11,964	997
15	CH 023	Potassium, Serum	7,763	647
16	CH 033	Carbon Dioxide – CO2	7,651	638
17	CH 013	Glucose, Fasting	7,061	588
18	CH 027	Sodium, Serum	6,954	580
19	CH 011	Ferritin	5,817	485
20	CH 052	Chloride, Serum	5,421	452
21	CH 015	Iron, Serum	5,083	424
22	CH 015A	TIBC (Total Iron Binding Capacity)	5,027	419
23	CH 342 A	Transferrin Saturation	4,913	409
24	CH 241	Arterial Blood Gases , ABGs	4,242	354
25	SCH 422	Troponin T ,High Sensitve(HS)	4,240	353
26	CH 031	Uric Acid, Serum	3,057	255
27	V 006	Hepatitis C Virus (HCV) Antibodies	2,629	219
28	V 005	Hepatitis B Surface Ag	2,618	218
29	V 004	Hepatitis B Surface Ab	2,454	205
30	CH 012	Gamma Glutamayl transdferase – GGT	2,405	200
31	SCH 220	Parathyroid Hormone (PTH),Intact	1,982	165
32	CH 014	Glycohemoglobin – HbA1c	1,956	163
33	SCH 202	TSH (Thyroid Stimulating Hormone)	1,855	155
34	CH 017	Lactate Dehaydrogenase – LDH	1,735	145
35	CH 029	LDL , Direct Cholesterol	1,704	142
36	CH 028	Triglycerides	1,646	137
37	CH 150	Vancomycin Trough Level	1,624	135
38	CH 030	HDL Cholesterol	1,566	131
39	CH 009	Cholesterol,serum	1,374	115
40	CH 004	Amylase, Serum	953	79
41	SCH 051	Vitamin D Total , 25-Hydroxy	884	74
42	CH 018	Lipase	739	62
43	CH 500	D-Dimer	687	57
44	CH 240	Venous Blood Gases , VBGs.	633	53
45	V 003	Hepatitis B Core Ab, Total	596	50

46	SCH 201	T4, Free	515	43
47	SCH 215	PSA, Total	454	38
48	CH 024	Protein , Total/ Serum	436	36
49	V 019	HIV I&II Antigens and antibodies	364	30
50	SCH 225	Vitamin B12	359	30
51	SCH 200A	T3, Free	347	29
52	CH 016	Lactate,Sample On Ice	325	27
53	CH 063D	Protein / creatinine Ratio , Spot Urine	304	25
54	SCH 218	Carcinoembryonic Antigen (CEA)	304	25
55	SCH 415	Procalcitonin, Serum	246	21
56	CH 032	Creatin Kinase – CK	245	20
57	CH 057	Glucose, Fluid	238	20
58	CH 153	Methotrexate Level(MTX) ,24 hrs after dose	221	18
59	V 032	COVID-19 Antibodies (Quantitative; Anti-S)	218	18
60	CH 504	Creatinine ,Serum – for patient 18 years and older&EGFR calculation	218	18
61	CH 034	Creatine Kinase – MB (CK-MB)	203	17
62	CH 067	Sodium – Random Urine	190	16
63	CH 109	RF	189	16
64	SCH 212	CA 15-3	181	15
65	CH 156	IgG level	179	15
66	CH 165	Measured Serum Osmolality	164	14
67	V 020	CMV, IgM, Serum	158	13
68	CH 062	Protein, Fluid	152	13
69	CH 056	Creatinine, Fluid	149	12
70	CH 336	Urea Nitrogen ,Body Fluid	134	11
71	CH 060	LDH, Fluid	134	11
72	SCH 146	Tacrolimus (Prograf)	134	11
73	V 002	Hepatitis B Core Ab, IgM	128	11
74	CH 166	Measured Urine Osmolality	127	11
75	CH 152	Gentamicin Trough Level	123	10
76	CH 151	Amikacin Trough Level	121	10
77	CH 501	Albumin , Body Fluids	120	10
78	CH 102	C3	116	10
79	CH 158B	IgA Level	114	10
80	CH 054	Creatinine – Random Urine	113	9
81	CH 157	IgM level	111	9
82	CH 081	Lambda	107	9
83	CH 080	Kappa	107	9
84	CH 103	C4	107	9
85	V 021	CMV, IgG, Serum	106	9
86	V 017	Varicella zoster Virus Antibodies, IgM, Serum	96	8
87	V 014	Herpes Simplex Virus (HSV) I & II Antibodies, IgM, Serum	94	8
88	CH 514	Sodium,Fluid	89	7
89	SCH 205	FSH	88	7
90	CH 330	Pregnancy Test/Serum	88	7
91	SCH 210	Alpha fetoprotein	87	7
92	SCH 211	CA 125	86	7
93	SCH 204	Prolactin	85	7
94	SCH 214	CA 19-9	84	7
95	CH 003	Ammonia, sample on ice	83	7

96	V 018	Varicella zoster Virus (VZV) Antibodies, IgG, Serum	82	7
97	SCH 400	Testosterone ,Total	81	7
98	CH 058	Glucose, CSF	81	7
99	CH 066	Protein, CSF	81	7
100	CH 108	Haptoglobin	79	7
101	SCH 216	B-HCG, Quantitative, Serum	74	6
102	V 001	Hepatitis A Ab, IgM , Serum	73	6
103	CH 041	Amylase, fluids	71	6
104	V 016	Toxoplasma gondii Antibodies, IgM, Serum	69	6
105	V 013	Herpes Simplex Virus (HSV) I Antibodies, IgG, Serum	68	6
106	V 015	Toxoplasma gondii Antibodies, IgG, Serum	67	6
107	SCH 206	LH	66	6
108	CH 100	Transferrin	64	5
109	SCH 046	ProBrain Natriuretic Peptide – BNP	64	5
110	CH 082	Beta2 Microglobulin	63	5
111	SCH 050	Folate,Serum	61	5
112	SCH 203A	Cortisol-AM(6:00 am- 10:00am)	55	5
113	CH 506	Kappa & Lambda Light Chains test	41	3
114	SCH 159B	IgE Level	40	3
115	CH 083	Serum Protein Electrophoresis	40	3
116	CH 160	Ceruloplasmin, Serum	34	3
117	CH 065	Protein, 24 hr Urine collection	34	3
118	CH 072	Potassium, Spot Urine	31	3
119	CH 055	Creatinine – 24 hr Urine	29	2
120	CH 153A	Methotrexate Level(MTX) ,48 hrs after dose	29	2
121	CH 335	Acetaminophen, (Paracetemol)	28	2
122	V 007	Hepatitis B e Ag	26	2
123	V 031	COVID 19 Antibodies (Total)	25	2
124	CH 229	Cyclosporin Level	25	2
125	CH 073	Chloride, Spot Urine	24	2
126	CH 044	Calcium, Urine	24	2
127	CH 028A	Triglycerides, Body Fluids	24	2
128	CH 043	Total Bilirubin, Body Fluid	24	2
129	CH 085	Hemoglobin (HB) Electrophoresis	22	2
130	SCH 154	Digoxin Level	21	2
131	CH 063	Protein, Randome urine	20	2
132	CH 340	Oligoclonal Banding ,Serum &CSF(1ml CSF&1 ml serum)	18	2
133	SCH 051B	Vitamin D , 1,25-Dihydroxycholecalceferol	17	1
134	CH 153B	Methotrexate Level(MTX) ,72 hrs after dose	17	1
135	CH 053	Cholesterol, Fluid	16	1
136	SCH 222	Aldosterone, Serum	16	1
137	V 008	Hepatitis B e Ab	15	1
138	CH 250	17- Beta- Estradiol (E2),Serum	14	1
139	CH 115B	Calcium, 24 hour urine	14	1
140	SCH 420	Thyroglobulin level	13	1
141	CH 084	Serum Immunofixation Electrophoresis	12	1
142	CH 071	Sodium, 24hr urine	12	1
143	CH 170	Phenytoin, Total, Serum	12	1
144	CH 036	Oxalic Acid, 24 Hr Urine	12	1
145	CH 117	Potassium, 24 hour urine	12	1
146	SCH 030	Vanillylmandelic acid ,VMA ,Spot Urine	12	1

147	V 009	Rubella, Antibodies, IgG	11	1
148	CH 064B	Albumin /Creatinine Ratio, Spot Urine	11	1
149	SCH 199	Adrenocorticotropic Hormone (ACTH), Sample on Ice	11	1
150	CH 021	Calculated Urine Osmolality	11	1
151	SCH 401	Erythropoietin	11	1
152	CH 089A	Plasma Renin Activity(PRA)	11	1
153	CH 035	Citric acid, 24h urine	11	1
154	CH 118	Chloride, 24 hour urine	11	1
155	CH 119	Phosphorous, 24 hour urine collection	11	1
156	V 010	Rubella Antibodies, IgM	10	1
157	CH 111	Zinc, Serum	10	1
158	SCH 215B	Prostatic Specific Antigen (PSA), Free	10	1
159	CH 049	Carbamazepine(Tegretol), Serum	10	1
160	CH 088	Angiotensin Converting Enzyme (ACE), Serum	10	1
161	CH 320	Albumin, 24 Hr Urine	10	1
162	CH 318	Copper,24 Hr Urine	10	1
163	CH 070	Uric Acid, 24Hr urine	10	1
164	CH 013C	Glucose Tolerance Test – GTT (75 gm)	9	1
165	CH 075	Bence Jones Proteins, Urine	9	1
166	CH 104	Anti-Thrombin III	9	1
167	V 025	Hepatitis A Virus Antibodies ,Total,Serum	9	1
168	CH 007B	Urea Nitrogen ,Spot Urine	9	1
169	CH 106	Homocystein ,sample on ice	9	1
170	CH 089	Total Renin,Plasma	9	1
171	CH 116	Magnesium, 24 hour urine collection	9	1
172	CH 242	Stone Analysis	7	1
173	SCH 410	Testosterone, Free	7	1
174	CH 061	Magnesium, Urine	7	1
175	CH 059	Lactate, CSF	7	1
176	SCH 416	Metanephrines Total & Normetaphrines Total ,Plasma	7	1
177	CH 512	Lipase ,Body Fluids	7	1
178	SCH 337	Growth Hormone , Serum	7	1
179	CH 509	IgG-CSF	7	1
180	V 013A	Herpes Simplex Virus II (HSV II) Antibodies, IgG, Serum	6	1
181	SCH 203P	Cortisol – PM /Serum(4:00pm -8;00 pm)	6	1
182	V 027	Measles Virus Antibodies, IgM	5	0
183	V 026	Measles Virus Antibodies, IgG	5	0
184	SCH 207	Insulin, Fasting	5	0
185	CH 155	Valproic Acid	5	0
186	CH 020	Calculated Serum Osmolality	5	0
187	SCH 290	Toxicology Screen	5	0
188	CH 120A	Urine Urea Nitrogen, 24 hr urine	5	0
189	CH 121	Amylase, Spot Urine	4	0
190	SCH 020	Metanephrines ,24 Hrs Urine	4	0
191	SCH 226	C-Peptide, Serum	4	0
192	SCH 028	Immunofixation, 24 hr Urine	4	0
193	SCH 100	Insulin-Like Growth Factor 1	4	0
194	SCH 023	Phenobarbitol(Luminal),Serum	4	0
195	CH 083B	Protein Electrophoresis, 24 hr urine	3	0
196	SCH 405	Dry Copper weight	3	0

197	SCH 037	Progesterone ,Serum	3	0
198	SCH 289	Vitamin A (Retinol)	3	0
199	SCH 403	Bile Acid,Serum	3	0
200	CH 171	5 – Hydroxy Indole Acetic Acid (5 -HIAA) , 24 Hrs, Urine	3	0
201	SCH 036	Dehydroepiandrosterone Sulphate (DHEA-S)	3	0
202	CH 507	Creatinine ,Serum / For patient(0 -17) years old	3	0
203	CH 161	Immunoglobulin G subclasses	3	0
204	SCH 031	Vanillylmandelic acid ,VMA ,24 Hrs Urine	3	0
205	SCH 032	Homovanillic Acid (HVA),24 Hrs Urine	3	0
206	CH 345	Glucose ,Spot Urine	3	0
207	CH 069	Uric Acid, Random Urine	3	0
208	CH 124	Lead, Whole Blood	3	0
209	SCH 402	Vitamin B1 (Thiamine)	3	0
210	SCH 016	Catecholamines, Fractions,24 Hr Urine	2	0
211	SCH 035	Pro-insulin ,Serum . 12 hrs Fasting	2	0
212	CH 341	Phosphorus, Spot Morning Urine	2	0
213	CH 159	Complement Hemolytic Activity (CH 50)	2	0
214	CH 230	Fat in Stool	2	0
215	CH 348	Levetiractam Trough Level (Keppra level)	2	0
216	CH 074	Porphobilinogen , Spot Urine	2	0
217	CH 513	Chloride ,CSF	2	0
218	CH 123	Copper, Serum	2	0
219	SCH 022	Catecholamines,Total,24 Hrs Urine	2	0
220	SCH 162	17-Hydroxyprogesterone(17 -OH progesterone)	2	0
221	SCH 165	C1Esterase Inhibitor(C1s),Serum		0
222	SCH 017	Aldosterone, 24 Hr Urine	1	0
223	V 023	Parvovirus (B-19) Antibodies,IgM	1	0
224	SCH 421	Vitamin E (Alpha Tocopherol)	1	0
225	V 030	Coxsackie Virus B1-6 Antibodies ,IgM , Serum	1	0
226	V 028	Adenovirus Antibodies,IgM ,Serum	1	0
227	SCH 012	Fecal Elastase-1	1	0
228	CH 347	Potassium,Watery Stool	1	0
229	CH 346	Sodium,Watery Stool	1	0
230	CH 013H	Glucose Challenge Test (GCT)	1	0
231	CH 001A	Albumin, Spot Urine	1	0
232	CH 097	Carnitine, Free Serum	1	0
233	CH 098	Carnitine, Total, Serum	1	0
234	V 024	Hepatitis Delta Virus , Antibodty(Total IgG&IgM)	1	0
235	CH 086	Myoglobin Quantitative, Serum	1	0
236	SCH 033	Antidiuretic hormone (ADH) / EDTA Plasma & Serum	1	0
237	SCH 208	Insulin, Random	1	0
238	CH 110	Myoglobin, Qualitative, Spot Urine	1	0
239	CH 310	Creatinine Clearance	1	0
		Total	408,243	34,020

Note**:** Conducted in the Chemistry Laboratory at An-Najah National University Hospital during the year 2023.

Appendix B

Tables

Table B.1

Matrix No. (3): Annual Cost Distribution of Activities and Correspondence with Cost Groups

Activity	Consumables cost group	Salary Costs Group	General services costs group	Electricity Expenses	Water Expenses	Miscellaneous costs	Depreciation Expense	Group of reception and accounting costs
Registration	0	29078.4	0	0	0	0	0	311230.4866
Sample Collection	142085.1212	72696	48816	10252.8345	2517.730383	37973.46167	0	0
Sample Preparation	109793.0482	101774.4	48816	17088.0575	2673.466283	37973.46167	6937.62	0
Calibration	75655.71389	84327.36	48816	14353.9683	2361.994483	37973.46167	9828.295	0
Quality Control	41518.37957	72696	48816	17088.0575	2361.994483	37973.46167	8672.025	0
Performing Tests	202978.7446	159931.2	48816	71769.8415	2984.938083	37973.46167	27172.345	0
Sample Disposal	73810.45257	61064.64	48816	6151.7007	2673.466283	37973.46167	5203.215	0
Total Cost Pools	645841.46	581568	292896	136704.46	15573.59	227840.77	57813.5	311230.4866

Table B.2

Matrix No. (4): Activity-Service Dependence Matrix (ASDM): Relationships Between Activities and Services

#	SERVICE_CODE	ACTIVIY TEST name	Registration	Sample Collection	Sample Preparation	Calibration	Quality Control	Performing Tests	Sample Disposal
1	CH 010	Creatinine, Serum	✓	✓	✓	✓	✓	✓	✓
2	CH 300	Electrolytes, Serum	✓	✓	✓	✓	✓	✓	✓
3	CH 007	Blood Urea Nitrogen – BUN	✓	✓	✓	✓	✓	✓	✓
4	CH 001	Albumin, Serum	✓	✓	✓	✓	✓	✓	✓
5	CH 026	ALT / SGPT	✓	✓	✓	✓	✓	✓	✓
6	CH 025	AST / SGOT	✓	✓	✓	✓	✓	✓	✓
7	CH 209	CRP (Quantitative)	✓	✓	✓	✓	✓	✓	✓
8	CH 005	Total Bilirubin, Serum	✓	✓	✓	✓	✓	✓	✓
9	CH 008	Calcium, Serum	✓	✓	✓	✓	✓	✓	✓
10	CH 006	Direct Bilirubin, Serum	✓	✓	✓	✓	✓	✓	✓
11	CH 013B	Glucose, Random	✓	✓	✓	✓	✓	✓	✓
12	CH 002	Alkaline Phosphatase	✓	✓	✓	✓	✓	✓	✓
13	CH 019	Magnesium, Serum	✓	✓	✓	✓	✓	✓	✓
14	CH 022	Phosphate, Serum	✓	✓	✓	✓	✓	✓	✓
15	CH 023	Potassium, Serum	✓	✓	✓	✓	✓	✓	✓
16	CH 033	Carbon Dioxide – CO2	✓	✓	✓	✓	✓	✓	✓
17	CH 013	Glucose, Fasting	✓	✓	✓	✓	✓	✓	✓
18	CH 027	Sodium, Serum	✓	✓	✓	✓	✓	✓	✓
19	CH 011	Ferritin	✓	✓	✓	✓	✓	✓	✓
20	CH 052	Chloride, Serum	✓	✓	✓	✓	✓	✓	✓
21	CH 015	Iron, Serum	✓	✓	✓	✓	✓	✓	✓
22	CH 015A	TIBC (Total Iron Binding Capacity)	✓	✓	✓	✓	✓	✓	✓

Table B.3

Matrix No. (5): Percentage of Effort Expended in Activity-Service Dependence Matrix (ASDM)

#	SERVICE_CODE		Registration	Sample Collection	Sample Preparation	Calibration	Quality Control	Performing Tests	Sample Disposal
1	CH 010	Creatinine, Serum	0.109496	0.109496	0.109496	0.109496	0.109496	0.109496	0.109496
2	CH 300	Electrolytes, Serum	0.098801	0.098801	0.098801	0.098801	0.098801	0.098801	0.098801
3	CH 007	Blood Urea Nitrogen - BUN	0.096587	0.096587	0.096587	0.096587	0.096587	0.096587	0.096587
4	CH 001	Albumin, Serum	0.053336	0.053336	0.053336	0.053336	0.053336	0.053336	0.053336
5	CH 026	ALT / SGPT	0.048736	0.048736	0.048736	0.048736	0.048736	0.048736	0.048736
6	CH 025	AST / SGOT	0.047535	0.047535	0.047535	0.047535	0.047535	0.047535	0.047535
7	CH 209	CRP (Quantitative)	0.043256	0.043256	0.043256	0.043256	0.043256	0.043256	0.043256
8	CH 005	Total Bilirubin, Serum	0.043021	0.043021	0.043021	0.043021	0.043021	0.043021	0.043021
9	CH 008	Calcium, Serum	0.037047	0.037047	0.037047	0.037047	0.037047	0.037047	0.037047
10	CH 006	Direct Bilirubin, Serum	0.033216	0.033216	0.033216	0.033216	0.033216	0.033216	0.033216
11	CH 013B	Glucose, Random	0.031381	0.031381	0.031381	0.031381	0.031381	0.031381	0.031381
12	CH 002	Alkaline Phosphatase	0.031067	0.031067	0.031067	0.031067	0.031067	0.031067	0.031067
13	CH 019	Magnesium, Serum	0.030644	0.030644	0.030644	0.030644	0.030644	0.030644	0.030644
14	CH 022	Phosphate, Serum	0.029306	0.029306	0.029306	0.029306	0.029306	0.029306	0.029306
15	CH 023	Potassium, Serum	0.019016	0.019016	0.019016	0.019016	0.019016	0.019016	0.019016
16	CH 033	Carbon Dioxide - CO2	0.018741	0.018741	0.018741	0.018741	0.018741	0.018741	0.018741
17	CH 013	Glucose, Fasting	0.017296	0.017296	0.017296	0.017296	0.017296	0.017296	0.017296
18	CH 027	Sodium, Serum	0.017034	0.017034	0.017034	0.017034	0.017034	0.017034	0.017034
19	CH 011	Ferritin	0.014249	0.014249	0.014249	0.014249	0.014249	0.014249	0.014249
20	CH 052	Chloride, Serum	0.013279	0.013279	0.013279	0.013279	0.013279	0.013279	0.013279
21	CH 015	Iron, Serum	0.012451	0.012451	0.012451	0.012451	0.012451	0.012451	0.012451
22	CH 015A	TIBC (Total Iron Binding Capacity)	0.012314	0.012314	0.012314	0.012314	0.012314	0.012314	0.012314

Table B.4

Service Cost Calculation in the Activity-Based Costing System

#	SERVICE_CODE	TEST NAME	Registration	Sample Collection	Sample Preparation	Calibration	Quality Control	Performing Tests	Sample Disposal
1	CH 010	Creatinine, Serum	37262.48	34419.12	35592.36	29927.11	25088.39	60400.93	25807.45
2	CH 300	Electrolytes, Serum	33623.01	31057.36	32116.01	27004.10	22637.97	54501.50	23286.80
3	CH 007	Blood Urea Nitrogen - BUN	32869.44	30361.29	31396.22	26398.87	22130.60	53280.00	22764.89
4	CH 001	Albumin, Serum	18150.67	16765.66	17337.15	14577.59	12220.63	29421.49	12570.89
5	CH 026	ALT / SGPT	16585.18	15319.63	15841.83	13320.28	11166.61	26883.89	11486.66
6	CH 025	AST / SGOT	16176.72	14942.34	15451.67	12992.23	10891.60	26221.80	11203.76
7	CH 209	CRP (Quantitative)	14720.44	13597.17	14060.66	11822.62	9911.09	23861.21	10195.16
8	CH 005	Total Bilirubin, Serum	14640.41	13523.25	13984.22	11758.35	9857.21	23731.50	10139.73
9	CH 008	Calcium, Serum	12607.27	11645.26	12042.21	10125.45	8488.33	20435.87	8731.61
10	CH 006	Direct Bilirubin, Serum	11303.53	10441.00	10796.90	9078.36	7610.53	18322.56	7828.66
11	CH 013B	Glucose, Random	10679.17	9864.28	10200.53	8576.91	7190.16	17310.49	7396.24
12	CH 002	Alkaline Phosphatase	10572.47	9765.72	10098.61	8491.21	7118.32	17137.54	7322.34
13	CH 019	Magnesium, Serum	10428.26	9632.52	9960.86	8375.39	7021.22	16903.78	7222.46
14	CH 022	Phosphate, Serum	9973.12	9212.11	9526.12	8009.84	6714.78	16166.01	6907.23
15	CH 023	Potassium, Serum	6471.19	5977.40	6181.15	5197.29	4356.97	10489.53	4481.85
16	CH 033	Carbon Dioxide - CO2	6377.83	5891.16	6091.97	5122.31	4294.12	10338.19	4417.19
17	CH 013	Glucose, Fasting	5886.01	5436.87	5622.19	4727.31	3962.98	9540.97	4076.56
18	CH 027	Sodium, Serum	5796.81	5354.48	5537.00	4655.67	3902.92	9396.39	4014.79
19	CH 011	Ferritin	4849.02	4479.01	4631.68	3894.45	3264.78	7860.05	3358.36
20	CH 052	Chloride, Serum	4518.91	4174.09	4316.37	3629.33	3042.53	7324.97	3129.73
21	CH 015	Iron, Serum	4237.16	3913.84	4047.25	3403.04	2852.83	6868.26	2934.59
22	CH 015A	TIBC (Total Iron Binding Capacity)	4190.48	3870.72	4002.66	3365.55	2821.40	6792.59	2902.26

جـامعـــة النجاح الوطنية
كليـــة الدراســـات العليـــا

تقييم تكلفة بعض الفحوصات الكيميائية المختارة باستخدام نظام حساب التكاليف على أساس الأنشطة: دراسة حالة من مستشفى النجاح الوطني الجامعي

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قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجه الماجستير في إدارة الصحة العامة، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس– فلسطين.

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الملخص

تهدف هذه الدراسة إلى تقييم تطبيق نظام التكاليف المبني على الأنشطة (ABC) في مختبر الكيمياء بمستشفى النجاح الوطني الجامعي، وذلك بهدف قياس فعاليته في تحسين دقة حساب التكاليف وإدارة الموارد. اعتمدت الدراسة على منهجية وصفية مقطعية باستخدام نموذج "كوبر" الذي يتكون من مرحلتين أساسيتين: تحليل التكاليف وتحديد الأنشطة، حيث يتم تحديد التكاليف غير المباشرة وربطها بالأنشطة المسببة لها.

تم جمع البيانات من خلال السجلات المالية للمستشفى، بالإضافة إلى مقابلات مع المديرين الماليين وطاقم المختبر. وأظهرت النتائج أن نظام (ABC) يوفر دقة وشفافية أكبر في توزيع التكاليف من خلال تحديد الأنشطة التي تستهلك الموارد وربطها مباشرة بالتكاليف، مما ساعد على تحسين استخدام الموارد وتقديم رؤى قيمة حول عمليات المختبر.

كما أوضحت الدراسة أن نظام (ABC) ساهم في تعزيز عملية اتخاذ القرارات المالية والإدارية، من خلال تزويد المسؤولين بفهم دقيق لتكاليف الأنشطة المختلفة داخل المختبر، مما ساعد على الكشف عن الأنشطة غير الضرورية أو التي تستهلك موارد دون تحقيق قيمة مضافة، وأدى ذلك إلى تحسين العمليات وتقليل الهدر.

ومن ناحية أخرى، بينت الدراسة أن تطبيق نظام (ABC) يتطلب وقتًا وجهدًا إضافيًا في المراحل الأولى، وخاصة فيما يتعلق بتدريب الكوادر المالية والإدارية على استخدام النظام الجديد، بالإضافة إلى ضرورة توفير أنظمة معلوماتية مناسبة لتسهيل تتبع الأنشطة وتكاليفها.

توصي الدراسة بتعميم استخدام نظام (ABC) في أقسام أخرى داخل المستشفى، لا سيما الأقسام التي تتطلب دقة عالية في تخصيص التكاليف مثل قسم العمليات الجراحية والعناية المركزة. كما تؤكد على أهمية تحديث الأنظمة المحاسبية في المستشفى لمواكبة التطورات الحديثة في مجال الإدارة المالية، إلى جانب تطوير الكوادر البشرية وتوفير الأنظمة المعلوماتية اللازمة لضمان نجاح تطبيق النظام.

وفي الختام، تشير الدراسة إلى أن نظام (ABC) يعد أداة فعّالة لتحسين الشفافية المالية وتقليل التكاليف غير الضرورية في بيئة المستشفيات المعقدة. ورغم أنه يتطلب موارد إضافية في البداية، إلا أنه يوفر فوائد كبيرة على المدى الطويل من حيث تحسين إدارة الموارد وتمكين اتخاذ قرارات مالية أكثر دقة.

الكلمات المفتاحية: الفحوصات الكيميائية المختارة، نظام حساب التكاليف، مستشفى النجاح الوطني الجامعي