

Cost Utility Analysis in Pathology Laboratory Testing: Review of Literature and Proposal of New Descriptive Model for Cost Analysis

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Abstract

In recent decades, the adoption of diagnostic laboratory techniques in clinical practice has accelerated. The cost of undertaking the care of an increasingly growing population of chronic systemic illnesses and malignancies is agonizing the health care system. A more health conscious population also demands sophisticated laboratory detection technology. From a consumer's point of view, they want accountability for both quality and safety. Laboratories can no longer rely only on efficient testing to meet their needs.

The value of laboratory tests has been determined largely by payers, and until recently, many assumed that the tests were commodities. Payers are increasingly inquiring about the tests' value, which is defined as quality per unit of expense. Laboratories must also demonstrate that their tests are also cost-effective. The incremental cost-effectiveness ratio (ICER) is a cost-effectiveness analysis statistic used to summarize the cost-effectiveness of a health care intervention.

The impact of an intervention on patient mortality and morbidity is included in cost-utility analysis (CUA), a type of CEA in which the benefits of an intervention are quantified in terms of quality-adjusted life years (QALYs) gained.

This article will provide an in-depth review of literature on the various cost effectiveness of oral pathology laboratory testing and a new descriptive model for assessing the quality and value of latest laboratory tests. This new proposal can be used to efficiently evaluate the effectiveness of a new laboratory protocol against the gold standard.

Keywords: Pathology lab testing, Laboratory management, cost utility analysis, cost effectiveness

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INTRODUCTION

In recent decades, the adoption of diagnostic laboratory techniques in clinical practice has accelerated. The cost of undertaking the care of an increasingly growing population of chronic systemic illnesses and malignancies in India is agonizing the health care system[1]. Almost all of these patients require laboratory tests to identify and to monitor diseases. In addition, the need for advanced laboratory equipment is largely driven by a quenchless search to detect diseases at an earlier stage[2].

A more health conscious population will demand for sophisticated laboratory detection technology. From a consumer's point of view, they will want accountability for both quality and safety. Treatment for any pathology begins with accurate diagnosis that solely depends on accurate laboratory testing. Along with expenditures for imaging studies, laboratory testing accounts for a significant percentage of health care expenses, despite efforts by insurers to limit payments for laboratory testing. Laboratories can no longer rely on efficient testing to meet their needs. Payers are increasingly inquiring about the tests' value, which is defined as quality per unit of expense. Laboratories must demonstrate that tests are cost-effective to payers. Physicians are being urged to stop overusing and misusing laboratory tests. In many countries, cost-effectiveness analysis (CEA) is used to influence payment and coverage choices since it is a standard, well-accepted methodological tool for establishing whether a health intervention is cost-effective[2,3][4].

The impact of an intervention on patient mortality and morbidity is included in cost-utility analysis (CUA), a type of CEA in which the benefits of an intervention are quantified in terms of quality-adjusted life years (QALYs) gained[5][6]. In traditional CUAs, laboratory test information is often valued solely to the extent that it helps patients and physicians make better medical decisions[7,8].

However, patients and health-care professionals may value diagnostic test information even if it does not influence treatment options. Cancer screening, for example, was recommended by 87 percent of adults in a recent research, even in the absence of good treatment alternatives[9,10]. Of course, test results can cause problems that are unrelated to treatment outcomes, such as anxiety about test results. Many specialists in health economics and outcomes research propose CUA for a wide range of health interventions, including medications, surgical procedures, and diagnostic imaging[9].

Cost-effectiveness analysis (CEA) is a form of economic analysis that compares the relative costs and outcomes (effects) of different courses of action. This article will provide an in-depth review of literature on the various cost effective measures involved in oral pathology laboratory testing and a descriptive model for assessing the quality and value of latest laboratory tests.

Cost Utility Analysis - Functionality In Pathology Laboratory

Cost utility analysis helps in establishing and governing a pathology laboratory. CUA, can help the pathologist build a more efficient laboratory, if used in the early stages of establishment[11]. The establishment of a pathology laboratory itself takes multiple factors into play. The planning starts from making a basic landscape or a blueprint for the required pathology laboratory, necessary equipment and materials, technicians and other staff and trained pathologists[12]. All of these factors will play a major role in influencing the quality of a soon to be established pathology laboratory. Other factors include storage spaces, electricity and water supply, biomedical waste management, establishment license and insurances[13]. These will have an overall influence on the laboratory. CUA can help in assessing the best available option for establishing a pathology laboratory with high quality output for the lowest cost.

For an already established pathology laboratory, CUA can help in assessing the current state of the lab and help in improving the outcome or maintaining the same outcome with less expense. Most of the laboratories stick to the factors such as maximal sensitivity, specificity, accuracy, and reliability as being sufficient and that clinicians would not want anything more from the laboratory. But running a cost effective testing laboratory is also important as it will reduce the total investment needed for the lab and also the expense the consumer has to give for each testing. Various tests are conducted in a pathology laboratory. These include basic histopathological diagnosis, special stains, immunohistochemistry, gene and protein expression, microbiological culture and sensitivity testing, hematological analysis and various biochemical analysis[14].

Almost all of these tests require standardized equipment and trained technicians to run the tests and an expert pathologist to interpret the results. Many of these equipment and materials can cost a lot. Hence, careful analysis of these equipment before acquiring it is important. CUA can help in acquiring the best equipment for the required test that allows to reduce the overall cost per test and improve the quality of the results.

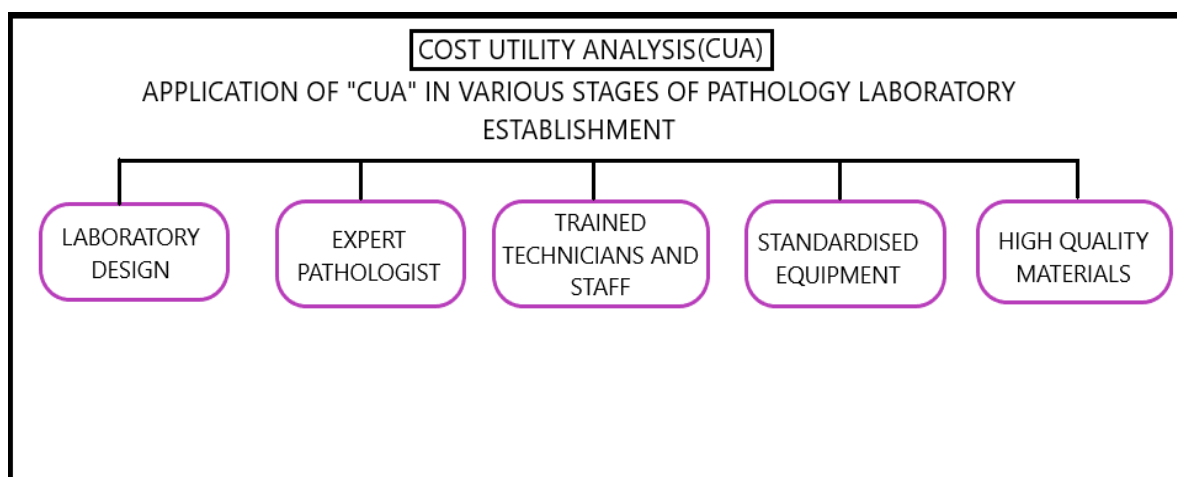


Figure 1: Application of cost utility analysis in various stages of pathology laboratory establishment.

Incremental Cost-Effectiveness Ratio

The incremental cost-effectiveness ratio (ICER) is a cost-effectiveness analysis statistic used to summarize the cost-effectiveness of a health care intervention. It is defined as the cost difference between two possible interventions divided by the effect difference[15]. It represents the average incremental cost of adding one more unit of the measure of effect. The ICER can be estimated using the following formula:

$$\text{ICER} = (C1 - C0) / (E1 - E0)$$

Where C1 and E1 are cost and effect in the intervening group and where C0 and E0 are in the control care group.

Costs are typically expressed in monetary units, whereas effects can be expressed in terms of health status or another outcome of interest[16]. The ICER is commonly used in cost-utility analysis, where it is synonymous with the cost per quality-adjusted life year (QALY) gained. The ICER can be used as a resource allocation decision rule. If a decision-maker can establish a willingness-to-pay value for the outcome of interest, this value can be used as a threshold. If the ICER for a given intervention is greater than this threshold, the intervention will be deemed too expensive and thus should not be funded, whereas if the ICER is less than the threshold, the intervention will be deemed cost-effective.

In the context of India's per capita GDP, the cost-effectiveness threshold could range somewhere between Rs. 90,688 to Rs. 272,064 per DALY (disability adjusted life quality) based on 2014 GDP per capita estimates, which is two and half times higher than the annual median income that an Indian earned in 2013[17]. This means more effective techniques are required to decrease the cost of laboratory testing.

Cost Effective Analysis

Cost-effectiveness analysis (CEA) is a form of economic analysis that compares the relative costs and outcomes (effects) of different courses of action[18]. In the field of health services, where it may be inappropriate to monetize health effects, cost-effectiveness analysis is frequently used. The CEA is typically expressed as a ratio in which the denominator is a health gain from a measure (years of life gained, premature births avoided, sight-years gained) and the numerator is the cost associated with the health gain[19].

Cost-effectiveness analyses are frequently represented on a plane with four quadrants, with the cost represented on one axis and the effectiveness represented on the other.

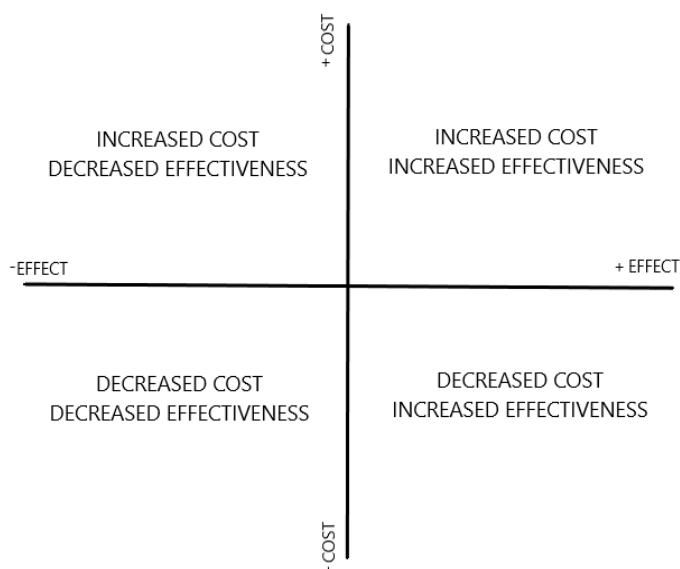


Figure 2: Cost effective analysis

For obtaining the best outcome, a highly effective method with decreased cost should be utilized[19,20]. In a pathology laboratory setting, equipment of higher quality and consumable materials with higher shelf life should be used. Higher quality equipment may be more expensive, but it will last longer and will not necessitate the purchase of new equipment as frequently. Consumable materials with a longer shelf life can help prevent material waste if the consumption rate is low. Frequent quality control of consumables and non-consumables will allow assessment of commonly used materials, which can be replaced if found ineffective or inefficient. This will greatly influence the cost effectiveness of the laboratory.

Cost Minimization Analysis – New Adaptation for Cost Minimization for Pathology Laboratory

In pharmacoeconomics, cost-minimization is a tool used to compare the cost per course of a treatment when alternative treatments have demonstrably equivalent clinical effectiveness[21]. This method is usually used during clinical trials where they have to test the ability of a new drug against existing treatment methodology. Although used for clinical set up, this analysis can be extrapolated and used for laboratory settings. This method strictly follows the thought process that only if the effectiveness is on par with the existing regimen, only then should the cost effectiveness be compared[22].

In the pathology laboratory, many tests and analysis are done for diagnosing various pathologies. Most of these pathologies are life threatening and if immediate treatment is not provided, mortality will ensue. In such circumstances, the specificity of said tests and analyses should be as accurate as possible. This means even if the cost is above acceptable level, if that is the only available test with high level of competence, then the test is accepted. In such scenarios, when a new test is being proposed as a cost effective alternative, its competence is what is first analyzed. Only if the new proposed test is on par with the existing test in terms of sensitivity and specificity, it is examined for its cost minimization values.

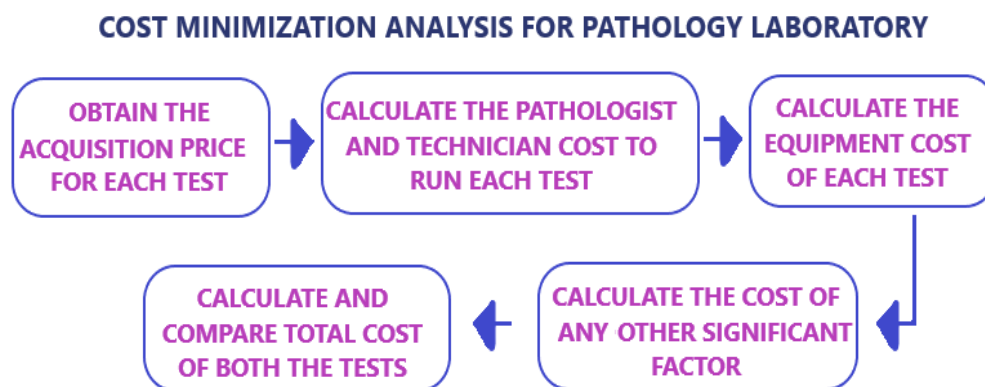


Figure 3: New proposal - Steps in Cost minimization analysis for pathology laboratory

The disadvantages of cost minimization analysis is that only two tests can be compared at a time. If a diagnostic equivalence cannot be obtained, then the analysis cannot be performed. It only compares alternative tests of the same outcome. It is more time consuming.

Table 1: Comprehensive evaluation of various analyses used to calculate cost utility.

S.No	ANALYSIS	ADVANTAGE	DISADVANTAGE
1.	INCREMENTAL COST-EFFECTIVENESS RATIO	Incremental values can be calculated. Can be used as a guide to allocate fundings.	Patient's benefit from the test is not given importance.
2.	COST EFFECTIVENESS RATIO	Both the cost effectiveness and testing quality are given equal importance.	Patient mortality and morbidity are not taken into consideration
3.	COST MINIMIZATION ANALYSIS (NEW ADAPTATION)	Efficiency of the test and its benefit to the patient is given first preference.	Only two equipments can be compared at a time.

Determining The Value of a Laboratory Test

Originally, the value of laboratory tests was likely to be judged by the tests' end-users, the physicians themselves[23]. Payers now have more influence in deciding where laboratory tests should be sent. The value of laboratory tests has been determined largely by payers, and until recently, many assumed that the tests were commodities.

According to the Institute of Medicine (IOM), public and private purchasers should develop payment policies that reward quality because current methods provide little financial reward for improvements in health-care delivery quality. Employers of pathology laboratories are demonstrating that they are increasingly concerned about the quality of healthcare and are willing to use their financial capability to lead their employees to health care systems that demonstrate quality and safety[24].

Because there haven't been enough studies done to calculate the cost effectiveness of pathology laboratories, it's still too early to tell who exactly determines the value of a test.

Conclusion

Many factors are putting strain on the health-care system, including an increasing number of ill patients and increased demand for more sophisticated medical technologies. Laboratories are no different. Pathologists and lab technicians must demonstrate the clinical significance, efficiency, and effectiveness of laboratory testing strategies, including cost-effectiveness. Purchasers of healthcare are demanding that laboratories account for the value of health care money spent on behalf of their employees.

Conflict of interest

None

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