Case Study #4:

Cost Effectiveness of Automated Multichannel Chemistry Analyzers

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SUMMARY

General Findings

1. While the unit cost per chemistry determination has fallen considerably since multichannel analyzer technology first came into widespread use, the number of determinations and total costs have increased.

2. Automated multichannel chemistry analyzers are most efficient, relative to alternative methods, at high test volumes. This is because such analyzers tend to decrease variable costs per determination while increasing fixed costs for equipment and labor.

3. The cost effectiveness of multichannel analyzers depends on the incremental health benefits derived from the additional determinations that are required to make multichannel analyzers economically efficient compared to alternative methods. An important issue, not yet resolved, is whether it is necessary to demonstrate the cost effectiveness of multichannel chemistry screening (hospital or outpatient) in order to demonstrate the cost effectiveness of multichannel analyzers, or whether multichannel analyzers are the most efficient testing method even if such high-volume uses are excluded.

Product and Industry Characteristics

4. There are two classes of multichannel analyzers: continuous-flow analyzers and discrete-sample analyzers. One difference is that discrete-sample analyzers perform only the specific tests requested, whereas continuous-flow analyzers perform all tests on every sample. Many manufacturers produce discrete analyzers, but only one makes analyzers that use the continuous-flow process.

5. New developments in multichannel technology are likely to include the availability of more tests, more flexibility, and more automation of sample input and data output functions. Processing speed is no longer a major concern, largely because machine startup time, sample collection and coding time, and reporting time are now rate-limiting steps in the laboratory.

6. The rate of product turnover in this industry is rapid; industry representatives suggest that the state of the art is advanced significantly every 4 to 7 years. This high rate of product development contributes to equipment costs. The increase in fixed costs, despite the role of innovation in reducing variable costs per test, may or may not be desirable given society's interest in containing health care costs. The appropriate role of reimbursement policies in encouraging or discouraging product innovation and capital investment needs to be examined.

Quality of Measurement

7. The quality of measurement (i.e., accuracy and precision) in multichannel analyzers is generally regarded as quite good for most tests, although high interlaboratory variations have been reported for some tests. This consensus holds, despite the problem of sample cross-contamination. It is incumbent on those who interpret test results, however, to be aware of the range of interlaboratory variation.

Diagnostic Value

8. Diagnostic value depends not only on the sensitivity and specificity of the test in question, but also on the prevalence of the condition for which the test is performed. Where multichannel analyzers are used to screen for unsuspected abnormalities, the prevalence of each condition screened for will be quite low; therefore, the predictive value of any positive test will be quite poor. This state of affairs has led to increased induced costs for subsequent tests to rule out diagnoses following falsely positive test results.

Clinical Efficacy

9. Clinical efficacy of a laboratory test depends on the ability of the test results to influence a subsequent treatment decision and on the health benefits to be derived from such a decision. Evaluation of the clinical efficacy of the multichannel analyzer depends, therefore, on its uses. The clinical efficacy of routine chemistry profile screening is controversial, although some patients clearly benefit from such screening.

Economic Efficiency

10. The economic efficiency of any configuration of laboratory equipment may be defined as its ability to respond to a specified pattern of test orders at the lowest cost. Multichannel equipment is most efficient at high test volumes and in cases where the average number of determinations required per sample is high.

11. The economic efficiency of any particular number of channels, or of any particular combination of tests to occupy those channels, has not been analyzed systematically from a societal perspective.

Cost Effectiveness

12. A complete evaluation of the cost effectiveness of multichannel analyzers depends on cost effectiveness of each individual test for each of its major uses. Such analysis is feasible with use of decision-analytic methods.

13. A major consideration in evaluating the economic impact of the multichannel analyzer is the induced cost for diagnosis and treatment of patients with abnormal test results. Induced costs include costs of repeat chemistry profiles and individual tests, more specific laboratory tests to confirm a diagnosis, radiographic and other diagnostic tests, and therapeutic interventions. In the evaluation of cost effectiveness, these induced costs must be combined with the cost of the initial chemistry tests. However, many of these induced costs may be the result of inappropriate (i. e., cost ineffective) decisionmaking in response to abnormal test results; if so, the cost effectiveness of initial chemistry tests may depend on whether or not one assumes cost-effective decisionmaking will follow from the results.

14. The cost effectiveness of the multichannel analyzer depends on whether its uses at volumes sufficient to render the analyzer efficient are, themselves, considered cost effective. If health care resources are to be allocated optimally, the judgment as to whether a particular use is cost effective at the margin should depend on society's cost-effectiveness criterion value (i. e., the cost per unit of health benefit it is able or willing to pay, given the limit on total resources and competing health-care demands for those resources). The marginal, low-yield uses of chemistry tests, therefore, are cost effective only if resources are sufficiently plentiful to accommodate a high cost-effec-