

# The economic benefits of point-of-care testing

Point-of-care testing carries the potential of improved patient care and economic savings in the hospital, in general practice and in remote areas

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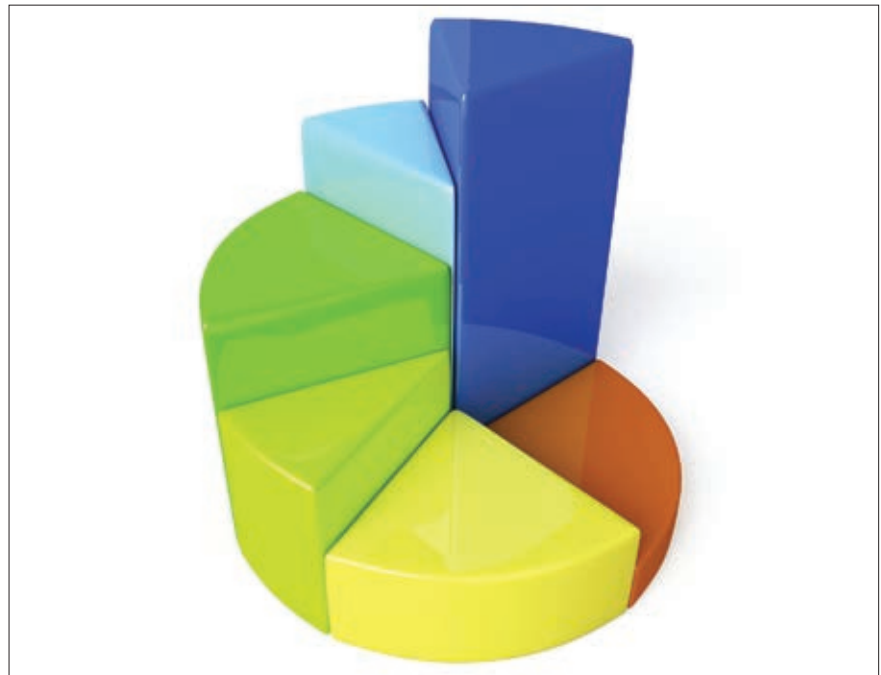
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**P**oint-of-care (POC) testing has the potential to positively impact patient care. Yet, its usefulness is strongly debated with experts in both fields, ranging from the general refute of POC testing to an indisputable support of the technology. The arguments commonly used in this debate are accuracy, clinical impact in practical care, and costs.

With the accuracy of POC testing being subjected to similar regulations as central laboratory analysis for approval by the authorities, a discussion on this subject seems of rather limited value. The clinical impact of POC testing has been shown and discussed in a number of reports, and has been shown to be directly related to the setting and implementation of the technology for maximum benefit of the inherent advantages.

### Comparing costs

Interestingly, the commonly cited cost-aspect seems to be also related to adequate implementation. In this context, it has to



be mentioned that laboratory costs only contribute to total costs per patient to a limited extent, with estimates of between 3% and 6%. With the impact patient care testing has on current protocols, however, secondary costs arising due to laboratory analysis can be extensive. The costs of laboratory analysis thus can be divided into direct, indirect and secondary costs.

If comparing central laboratory and

POC testing, both direct and indirect costs have to be taken in account primarily, with secondary costs being a result of clinical decisions based on the analysis and resulting therapy, that is, related to accuracy and reliability of the results.

### Direct costs

The direct cost per analysis of POC testing

can be compared directly to the costs of core laboratory analysis. Depending on the local setting and standard at the core laboratory, costs of laboratory analysis are based on staffing, costs for chemical reagents, and costs for machines. If the laboratory is outsourced or centralised in another hospital, further costs arise for transport. These differences in costs are easy to calculate, and tend to vary in between larger and smaller hospitals due to the need of staffing for the core-laboratory 24/7. It is common that smaller units will benefit from savings in direct costs by POC testing, whereas larger hospitals will find equal, or even slightly, higher costs per analysis compared with POC testing and core laboratory, even if there are exceptions.

#### Indirect costs

The indirect costs of laboratory analysis are related to delay in time to result, diagnosis and therapy, which, in turn, contribute to patient outcomes with resulting costs, need for transport in between hospitals in cases of clinical doubt, unnecessary admission due to external targets of limitations of time in emergency departments, overcrowding resulting in the need of increased staffing, and the potential need for multiple analysis if different systems are used in the same hospital. These costs are higher than direct costs of analysis, with staffing resulting in the highest cost in modern healthcare, and the overall economic impact of POC testing could be shown in the indirect costs as early as 1999.<sup>1</sup>

Short turnaround times (TATs) and no requirement for dedicated laboratory staff for routine analysis are the major advantages of POC testing. TATs for POC testing are, on average, 46 minutes less than for central laboratory analysis, even in the best settings, minimising transport times, with clinically acceptable accuracy.<sup>2-5</sup> Any delay in time can be translated into economic impact, as each minute of waiting time for a patient will result in increased need of staffing and delayed therapy.

#### Savings through implementation of POC testing

Substantial savings have been related to the successful implementation of POC

Setting	Cost-reduction	Reference
ED, Sweden	€148.2/patient	6
Pretransfer, Canada	100 CDN/patient	8
ED, US	20% reduction in admission rate	9
CCU, US	25% reduction	10
Paediatric ED	18% reduction	12
ED, France	21.7% reduction, tetanus testing	13
Neonatal ICU	8.5% reduction	11
ED, Mozambique	US\$500/life year saved HIV screening	17
GP + ED, Uganda	76.5% reduction in screening costs HIV and syphilis	18
Primary care, UK	Chlamydia and gonorrhoea screening 10% reduction in total costs	15, 16
Patient self-measuring, UK	International normalised ratio self-monitoring in coumarin therapy, reduction of £118.7/patient/year	14

testing in different settings (Table 1).

- In a Swedish study in our university hospital emergency department (ED), the costs per waiting minute per patient were €1.25 (US\$1.5), that is, per 46 minutes at €57.5 per patient, and a substantial reduction in laboratory costs could be found due to the implementation of POC testing (€89.51 per patient, total savings €148.2/patient).<sup>6</sup> In the same setting, *ad hoc* core laboratory testing on presentation before the patient met the doctor resulted in a large increase of testing costs (+61.55%) without a significant impact on waiting times or crowding.<sup>7</sup>

resulted in fewer costly procedures, with a 25% saving on the costs per patient.<sup>10</sup>

- In cardiothoracic surgery with a high use of expensive blood products and coagulation factor concentrates, the introduction of coagulation measurement by POC testing resulted in savings of 56%.
- In the neonatal ICU, POC testing has been shown to reduce costs per patient by 8.3% as a result of reduced core laboratory testing and fewer transfusions.<sup>11</sup>
- In the paediatric ED, the introduction of POC testing for detection of human respiratory syncytial virus

*“Substantial savings have been related to the successful implementation of POC testing in a number of different settings”*

- In Canada, the use of POC testing during stabilisation of patients before inter-hospital transfer was calculated to result in savings of approximately 100 CDN/transfer, and substantial time-savings.<sup>8</sup>
- In the US, the implementation of POCT resulted in a 20% decrease in admissions to the chest pain unit, and concurrently substantial savings.<sup>9</sup>
- In the cardiac observation unit (US), the introduction of POC troponin testing reduced the length of stay, decreased admission rates and

significantly changed patient triage and impacted therapeutic decisions as well as isolation procedures to such an extent that significant capacity could be liberated during epidemic periods, with major savings as a consequence.<sup>12</sup>

- In the context of tetanus revaccination at the ED, the introduction of a POC testing to confirm vaccination status reduced vaccination costs by 21.7%.<sup>13</sup>
- In a National Health Service (NHS)-driven analysis in the UK, the impact of patient self-monitoring

Table 2: Current protocols in chest pain<sup>21</sup>

Guideline/protocol	National Institute for Health and Care Excellence 2010	Global Task Force	Erlanger protocol	Reichlin	ADAPT
Biomarker	TNI/TNT on arrival and 12 hours after onset of symptoms	hs-TNT or hs-TNI on arrival, three and six hours	CK-MB + TNI on arrival and after two hours	hsTNT on arrival, after one hour	TNI on arrival and two hours
Further testing if no acute myocardial infarction/unstable angina	According to risk of acute coronary syndromes	No recommendation	Nuclear stress test	No recommendation	No recommendation
Cost	0.5 day admission TNI/TNT x 2 Stress test depending on risk	0.25 day admission hs-TNT/hs-TNI x 3	1/12 day admission CK-MB x 2 TNI x 2 Nuclear stress test	1/24 day admission Hs-TNT x 2	1/12 day admission TNI x 2
Potential patient flow per bed/day	2	4	12	24	12

of anticoagulation therapy by POC testing was found to save £118.7 per patient and year compared with standard care, and prevented further costs due to stroke and preventable death.<sup>14</sup>

- In another analysis for the UK NHS, the screening for sexually transmitted diseases by POC testing was found to reduce costs and waiting time per patient (£16 for gonorrhoea and £6 for chlamydia) and in clinical trials, it was estimated that 95,000 inappropriate treatments and 17,561 transmissions could be prevented annually in the UK besides significant annual savings of 10% for testing costs.<sup>15,16</sup>
- In ED and prehospital screening for HIV in epidemic countries (Mozambique), POC testing was cost-efficient by improving survival rates at US\$500/year of life saved.<sup>17</sup>
- In the primary care setting in Uganda, in screening for HIV and syphilis by POC testing instead of other analytical methods, a combined test reduced screening costs to US\$2 instead of US\$8.5 per patient (that is, 76.5%) and reduced waiting time by 25 minutes even if performed at a central laboratory.<sup>18</sup>

### Increasing costs?

However, some studies have shown that POC testing has the opposite effect and increases costs. Most notable is the RATPAC trial, a multicentre study testing the impact of POC troponin testing in the evaluation of chest pain. In the RATPAC trial, one out of six sites reported economic savings whereas other sites experienced elevated costs.<sup>19</sup> The authors

concluded that POC testing was more expensive than standard analysis. Under the auspices of all studies revealing that POC testing is economically beneficial, why is there not widespread realisation of its benefits?

In the majority of studies, cost analysis revealed savings of between 8% and 25% of the total costs during the patient flow. With no more than 6% of all patient costs being laboratory costs, the savings evidently cannot be due to testing costs alone. A reduction in testing costs by 20% (approximately -1.2% of total patient costs) could not result in these substantial savings, and POC testing is often reported to cost approximately the same as central laboratory analysis per test. This means that the absolute majority of POC testing-related savings must be found downstream in the process of patient care.

Analysing the studies reporting a successful implementation of POC testing resulting in improved care and/or economic savings shows the following contributing:

(1) The adaptation of clinical pathways to the technology, mostly the rapid TATs to result in improved decision times or more appropriate evidence-based decision-making in time-critical circumstances

(2) The complete analysis of the clinical patient flow including the downstream effects of POC testing rather than the test-analytic costs only

(3) In minor hospitals, primary care and in remote areas, the physical introduction of a local available laboratory based on POC testing instead of an outsourced, or only periodically

available, core laboratory

In the studies above, the use of the strength of POC testing as by those factors has been shown to be highly efficient. In the operating theatre, the immediate availability of coagulation test results reduced in unnecessary use of blood products, in primary care the inappropriate use of antibiotics could be avoided; in the paediatric ED, infectious patients were identified more rapidly and clinical pathways adapted accordingly; in the ED and the chest pain unit, patients could be ruled out more efficiently, saving time and money. In several of the studies, primary testing costs increased but an analysis of the complete patient pathway showed significant improvements in patient care and cost-efficiency. With the consistent finding that the results of POC testing are available at least 46 minutes earlier than for central laboratory analysis,<sup>20</sup> decision pathways can be made more efficient, and patient flow improved substantially. As a result, hospital resources can be used more economically and costs per patient can be reduced. The rapid rule-out protocols in chest pain are one example of such enhanced efficiency and reduced costs in the process of patient care (Table 2).<sup>21</sup>

To benefit from the technological advantages of POC testing, namely the rapid TATs, implementation should include the complete analysis of the patient workflow, the adaptation of rapid rule-in/rule-out protocols maximising the clinical impact of POC testing, the structured redesign of clinical decision pathways according to, and including, POC testing at the first point of entry and downstream, the compatibility of testing

throughout the clinical pathway, the analysis of the cost–return distribution within the local reimbursement system, the analysis of critical points in the hospital flow where POC testing could increase speed of decision, and the thorough education of all staff involved.

### Conclusions

POC testing carries the potential of improved patient care and economic savings in the hospital, in general practice and in remote areas. The realisation of this potential depends on implementation by adaptation of the clinical pathways towards the benefits of the technology, mostly the rapid TATs. The most beneficial way of using POC testing must be determined for each hospital and setting. As delayed diagnosis and therapy increase morbidity, mortality and costs, the effective implementation of POC testing has the potential to result in major economic savings. ♦

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