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Economic evaluation as a tool in emerging technology assessment

Nataša Bogavac-Stanojević

Department of Medical Biochemistry, University of Belgrade-Faculty of Pharmacy, Belgrade, Serbia

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Corresponding author:
Nataša Bogavac-Stanojević
Department of Medical Biochemistry
Faculty of Pharmacy
POB 146, 11000 Belgrade
Serbia
Phone: +381 11 3951279
Fax: + 381 11 3972840
E-mail: naca@pharmacy.bg.ac.rs

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ABSTRACT

Medical technologies are part of health technologies and they include medical devices (MD) and in vitro diagnostics (IVD). They have become a vital part of modern healthcare. Framework for introduction of new technology in the healthcare system includes a few steps: analytical and clinical accuracy assessment, clinical utility determination and economic evaluation. In addition, payers are interested whether new technology is adequate for reimbursement. There are fairly enough specific guidelines for implementation of economic methods at the early stage of IVD development. Searching the available literature in this field, this paper discusses the economic evaluations of emerging medical technologies with focus on point of care testing (POCT) and genetic testing.

Results of POCT economy studies depend on investigated perspective (payers, policy makers or society), used effectiveness values (utility, effectiveness or consequence estimated as monetary value) and understanding of clinical pathway. There is a need for better understanding of the care pathway, resource utilisation and how they change with the introduction of POCT.

Introduction of genetic testing before drug therapy was recommended with the aim to improve treatment benefit and to reduce costs of adverse drug reaction.

Clinical utility and cost-effectiveness analyses should be considered for novel genetic testing – guided treatments. Most of the studies considering genetic testing – guided treatments showed that those combinations were cost-saving or cost-effective compared to standard care.

For medical tehnology there is no universal guidance for outcomes measurement, cost calculation, performance requirements, use of a certain type of economic studies and economic thresholds.

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INTRODUCTION

Medical technologies consist of both medical devices (MD) and in vitro diagnostics (IVD) and represent an important group of health technologies. It was estimated that more than 500,000 medical technologies are available today (1, 2). They have become a vital part of modern healthcare and practically no diagnosis or treatment is possible without them.

Introduction of medical technologies in the healthcare system and their reimbursement is the result of available evidence assessment with the scope of ensuring rational resources allocation (3). Payers are now requiring data about both clinical and economic value before they will consider reimbursing and using any new technology. They initially assess the clinical benefit of the technology with purpose to determine whether it is adequate for reimbursement. Payers then evaluate the added clinical benefit of the technology in comparison to existing or alternative technologies (4). This approach is obstructed by small number of available clinical studies for emerging technologies. European Union regulations consider premarket evidence, but because of the lack of appropriate data about new MD and IVD effectiveness, expectations of decision makers included in reimbursement process have rarely been met (5). Consequently, numerous applications submitted to the payers each year get rejected or withdrawn due to insufficient data (6). In addition, there is a lack of information concerning how, whether or not stakeholder should perform economic evaluations for MD and IVD or how cost-effectiveness should be applied in the health care setting (3). Number of factors, depending on medical technology, complicate economic evaluation and limit its informative value. Some of these factors are result of the fact that technologies have multiple indications or purposes and so they have distinctive features. All those require different or modified methods for economic evaluation compared to pharmaceuticals (7). Consequently, in 2016 the National Institute of Health and Care Excellence (NICE) in the United Kingdom published 50 pharmaceutical appraisals, but only 3 MD and 6 diagnostic technologies appraisals (2). The European parliament decided to reform the EU legislation for MD and IVD. In 2020, Europe's Medical Device Regulation and in 2022 In Vitro Diagnostic Regulation will come into effect, which will impact all medical technologies (8).

There are fairly enough specific guidelines for implementation of economic methods at the early stage of test development. Drawing on the available literature in this field, this paper discusses economic evaluations of emerging medical technologies with focus on point of care testing (POCT) and genetic testing.

ECONOMIC EVALUATION OF POINT OF CARE TESTING

In 2013, St John and Price published a review paper on economic evaluation of POCT. They analysed five studies which included classical cost effectiveness analysis and two studies which applied cost consequence analysis (9). Few economic studies also analysed self-monitoring

(SM) POCT. Simon et al. applied cost – utility analyse to evaluate SM of blood glucose in patients with type 2 diabetes (10). The study showed that SM of blood glucose was more expensive than usual care. Patients had modest improvements in HbA1c levels and consequently non-significant health benefit. On the other hand in the study of Claes and colleagues, results of cost effectiveness analyses of various interventions related to INR testing by SM POCT showed that the intervention after INR levels measurement in GP surgery combined with multifaceted education was dominant over usual care. They showed increased quality (expressed as "more patients with INR values closer to the target value") and less cost (11). Contrary to the previous results, in the Parry et al. study, effectiveness of SM of INR which was expressed as "proportion of people with INR values in the therapeutic range" and costs were higher than standard care (12). Connock et al. developed a Markov model to evaluate cost-effectiveness of SM of INR in comparison to clinical care. They estimated costs from the UK NHS perspective and calculated incremental cost of SM per QALY. According to the results of Conneck study SM was cost effective using a threshold of £30,000 /QALY (13). Findings of St John and Price review study were confusing regarding economic analysis of POCT because of limited quality and availability of clinical effectiveness of POCT. Various studies used different effectiveness or utility values and compared them to costs of resource utilisation across different elements of the care pathway (9). In 2014, Ulf Martin Schilling explained main steps in calculation of direct and indirect POCT costs. He pointed out that major advantages of POCT are short turnaround times (TATs) and no requirement for dedicated laboratory staff for routine analysis (14). In addition, long TAT correlates with late diagnosis, less successful treatment and higher associated costs (cost for prolonged therapy, increased morbidity and mortality). Few studies have showed that primary testing costs are increasing while costs of complete patient pathway are decreasing and consequently adoption of POCT was cost effective (14, 15, 16). An Australian study published in 2018 examined cost effectiveness of POCT as a tool for triage of acutely ill patients in rural communities. Results showed that POCT for patients with acute chest pain, for patients with CRF who missed one or more dialysis sessions and for patients with acute diarrhea, were more expensive but more effective than Usual Care strategies. Adopting of POCT in these patients would lead to cost savings (due to unnecessary medical evaluations avoided) in rural communities (17).

Results of POCT economy studies depend on investigated perspective (payers, policy makers or society), used effectiveness values (utility, effectiveness or consequence estimated as monetary value) and understanding of clinical pathway. Most often the analysed effectiveness was from clinical studies with relatively short duration. Accordingly, main outcomes were not detected. There is a need for better understanding of the care pathway, resource utilisation and how they change with the introduction of POCT (9).

ECONOMIC EVALUATION OF GENETIC TESTING

In the USA, cost of adverse events has been estimated at US$177 billion per year and drug's efficacy was approximate on 50%. Potential waste of money related to low drug efficacy was approximately $700 billion (18). Introduction of genetic testing before drug therapy was recommended with the aim to improve treatment benefit and to reduce costs of adverse drug reaction. For novel genetic testing – guided treatments clinical utility and cost-effectiveness should be considered. The majority of genetic testing – guided

treatments were cost-effective or even dominant (cost saving), but with notification that there was large heterogeneity in methodology between studies (19, 20).

According to systematic review conducted by Verbelen and co-workers, from 68 drugs that met inclusion criteria for study (FDA-approved drugs along with the biomarker gene - presented in The FDA Table of Pharmacogenomic Biomarkers in Drug Labeling lists), only 10 were economically evaluated. 44 economic evaluations were implemented for those 10 drugs. Over half of the 44 economic evaluations took cost utility and cost effectiveness analyses and they favoured genetic testing-guided therapy (21). Most of the studies considering genetic testing – guided treatments showed that those combinations were cost-saving or cost-effective compared to standard care (22). Rest of publications found genetic testing was not cost-effective or did not reach a definitive conclusion (21). The majority of studies evaluated genetic testing for azathioprine, clopidogrel, irinotecan and clozapine with positive economic assessment. Warfarin was evaluated in most economic studies, but they reached diverging conclusions (21).

Verbelen and co-workers concluded that cost of genetic testing is an important parameter of economic evaluations because the price of genetic tests decreased over time. In addition, genetic testing costs may depend on the method used to determine genetic variants (for example, PCR or measuring enzyme activity). If alternative drug for test-positive patients is expensive and if genetic test has a high proportion of false positive results, genetic test is not cost effective (21).

HER2, EGFR and KRAS testing are reimbursed in the UK and such approval was sponsored by pharmaceutical industry. In 2008, a French transparency committee recommended the use of Amgen's (CA, USA) Vectibix for metastatic colorectal cancer treatment for wild-type *KRAS* patients only. Similarly, Herceptin has been reimbursement since 2007. In Italy, HER2 and *KRAS* are publicly funded and available via a network of public hospital laboratories. *HER2*, *KRAS*, *EGFR* and *BCR-ABL* test reimbursement involved pharmaceutical subsidization or sponsorship (18).

CONCLUSION

For medical tehnology there is no universal guidance for outcomes measurement, cost calculation, performance requirements, use of a certain type of economic studies and economic thresholds. There is no appropriate recommendation which medical technology should undergo formal national reimmbursement system. It is uncler how existing health technology criteria for medicines can be translated to medical tehnology reimbursment decision making. Whether it should be analysed using „real-world" observational evidence rather than experimental data? Assessment of cost-effectiveness is primarily of use to the policymaker and the purchaser, while healthcare provider needs to adopt technology in order to satisfy a recognised unmet need.

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