Rationalisation of Spending Public Resources in Healthcare, Example of Laboratory Services in Slovenia

Nejc Lamovšek[1], Maja Klun[2]

Abstract

The paper presents different sources of financing of laboratory services in Slovenia, according to the level of the service and potential influence on prices of selected tests. In the research, we compared prices for laboratory services at the primary and at the secondary level, which can differ by more than 100%; some of them are statistically different between both observed groups. At the same time, we investigated the influence of costs on the prices of selected tests. We used the costs of reagents and laboratory services as an indicator of the selected technology, which are the cause of the major part of ineffectiveness of spending resources for laboratory services in Slovenian healthcare. Inadequate use of the selected technology brings higher costs of services, and this consequently causes higher public expenditure for healthcare in Slovenia. The results show that the prices of reagents (which are bound by the selected technology) correlate with the prices of the selected services at primary level and not at secondary level. We also find out that the prices of laboratory services are higher at primary level. Therefore the more consolidated and larger laboratories are more efficient because of economy of scale.

POINTS FOR PRACTITIONERS

Our research results have shown the possibility of using the economies of scale to reduce the costs of laboratory services and further possible impact on rationalisation of spending public resources in healthcare.

KEYWORDS

Healthcare financing, Laboratory service, efficiency

[1], Researcher - Expert associate, University Medical Centre Ljubljana, Zaloška c.7, Ljubljana, Slovenia. Phone: +386 51 267 246. E-mail: nejc.lamovsek@kclj.si

[2] Full professor, University of Ljubljana, Faculty of Public Administration, Gosarjeva ul.5, 1000 Ljubljana, Slovenia. Phone: +386 1 5805400, Fax: +386 1 5805 521 E-mail: maja.klun@fu.uni-lj.si

1 INTRODUCTION

The system arrangement of laboratory services in Slovenia is rather diversified, because it is financed differently at the primary and at the secondary level. Even though financing laboratory services is mostly linked to financing from the health insurance fund (ZZZS), payment of laboratory services, linked to several models (DRG (diagnosis related group), points, poll tax, etc.), is what partially contributes to the inefficiency of spending resources for laboratory services in Slovenia (e.g. duplications of orders and payments for laboratory services, non-transparent payment of services, prevention of patient transfer between the levels of healthcare, etc.). Different systems of financing laboratory services force certain groups to be more efficient in spending funds for laboratory services or to transfer investigations to the secondary level. On the other hand, on the secondary level, probably particularly due to indirect financing through DRG, some laboratories invest in technology, which does not achieve adequate effectiveness of use, because a laboratory is not big enough, does not have qualified professionals, and consequently, the prices of their services are higher than it would be appropriate in consideration to the extent of investigations, due to higher prices of reagents and laboratory services.

According to the data, in Slovenia, 0.29% of healthcare expenditure is used on average for laboratory services in healthcare. The expenditure is stable, according to the data from EUROSTAT. In other comparable countries of Central and Eastern Europe, the percentage varies, e.g. Czech Republic (2.29%), Croatia (4.28%), Poland (0.33%), Austria (0.54%), Hungary (2.25%) and Slovakia (6.19%). In the period 2014 to 2016, the share of funds for laboratory services increased the most in Slovakia by 1.76 percentage points, but in the other mentioned countries, the share is the same over the years. (Eurostat, 2016).

With the presented research, we wished to determine whether the prices of laboratory services are influenced by different ways of healthcare financing at the primary and secondary level. In this regard, we compared the prices of selected laboratory tests between primary and secondary public institutes and determined the following hypothesis:The prices of laboratory services differ between primary and secondary levels. We also tried to find out whether the cost of reagents influenced the prices of the selected services and therefore determined the following hypothesis: The costs of reagents (which are bound by the selected technology) correlate with the prices of the selected services.

The paper is structured in such a way that we first introduce the healthcare financing system in Slovenia and consequently the financing of laboratory activities, followed by a short review of similar research. Methodology and verification of hypotheses are then presented. The paper is concluded with recommendations to improve the performance of laboratories.

2 HEALTHCARE FINANCING IN SLOVENIA

In Slovenia, healthcare of citizens and consequently the laboratory services are regulated based on the level of healthcare. Thus, patients first meet with the healthcare system at the primary level, where the doctor is the "gatekeeper" for entering a higher/more demanding level of healthcare. The primary level of healthcare thus covers basic healthcare, pharmaceutical activity, treatment and care at home, and the health education process (Petrič & Žerdin, 2013). Specialist outpatient clinics, hospitals, rehabilitation and consultation activities represent the secondary level of healthcare. The upgrading of both levels of healthcare activity is the tertiary level, which represents the scientific-research-educational activity and the implementation of the most demanding healthcare services that cannot be implemented at lower levels of healthcare. According to the Health Services Act (ZZDej, 1992), laboratory services must be provided at all three levels of healthcare. With this, the provision of laboratory diagnostics with the help of biomedical laboratories is one of the major stakeholders in patient care.

The financing of the primary level of healthcare is linked to the resources of the Health Insurance Institute of Slovenia (hereinafter ZZZS) and depends on the capitation, the minimum number of services and referrals to the secondary level of healthcare. The capitation can be defined as the model of payment for health services with the number of insured persons who have opted for a particular personal physician and is expressed as a quotient and represents approximately 50% of the income of an outpatient clinic. As much as 85% of the income of outpatient clinics in Health Centres comes from ZZZS transfers from compulsory health insurance. The amount of remittances to outpatient clinics depends on the realisation of the capitation, the number of services provided and, ultimately, the implementation of preventive examinations. The remaining 15% of the value of the services

is primarily remittances from voluntary health insurance (Vzajemna, Adriatic, etc.). According to the OECD (2015) study, voluntary supplementary health insurance plays an important role in healthcare financing, which means that this proportion is higher than in most other observed countries. Services include visits to outpatient clinics, at home and medical procedures (expressed in coefficients), and depend on the scope and the procedure.

Specialist outpatient clinics are treated as a healthcare programme of the secondary and tertiary levels and are financed by the fee for service, which is provided for in the General Annual Agreement. "The General Agreement is the result of partnership negotiations, which represents a legal basis for concluding contracts with public health institutions and private individuals" (SD, 2018). The model of payment for services with respect to a group of similar cases also accounts for up to 90% of revenues of public healthcare institutions at the secondary level, thus prevailing as the model for paying for acute hospital treatment and is based on the Australian model. In addition to the aforementioned, the secondary and tertiary levels of healthcare also include the model of payment for services with the number of hospital days and the number of cases.

In the General Agreement for 2018, Articles 26 and 24 state that healthcare providers will provide laboratory and other diagnostic services that are required in the diagnostic and treatment process, and that the resources for laboratory tests carried out by the provider are included in the price of healthcare services and are not accounted for separately. Financing, as an important lever for providing quality health services, is a challenge for the Government of the Republic of Slovenia. "Modified work in basic healthcare activities also requires a change in the way these services are financed. It is necessary to introduce a financing system that will support the strategy "money follows the patient", which will adequately finance the overall team treatment of the patient and additionally reward the quantity and quality of the work performed" (Susič et al, 2013, p. 17). In Slovenia, laboratory services within the so-called ancillary services in healthcare, according to EUROSTAT's statistics for 2017, cover 3.6% of healthcare expenditure, as already mentioned in the introduction.

At the primary level of healthcare, financing of laboratory services is included in the treatment of patients with the physician. Laboratory services at the secondary and tertiary levels of healthcare are also included in patient care and are not accounted for separately. Exceptions are more expensive tests, i.e. special tests, such as respiratory tests paid as a fee for service and with their annual number determined by the Annual General Agreement (in the General Agreement, the total range of health service programmes is defined in the light of global economic opportunities) with the Health Insurance Institute. The aforementioned funds for special tests are drawn directly into the budget of the health institution. The specialist outpatient clinics in hospitals account for the carried out laboratory tests according to the Green Book, i.e. according to the list of health services with defined staffing, and time norms and added point value. Thus, healthcare providers use a record point for the mutual charging of chemical and biochemical laboratory services, in accordance with the Annual Agreement with the Health Insurance Institute, and other laboratory services at the average price for a specialist outpatient activity of internal medicine, agreed in a contract with the Institute, unless the contracting authority and the laboratory service provider does not agree otherwise (SD, 2018).

In public biomedical laboratories, both basic and special diagnostics are performed. At the primary level of healthcare, basic laboratory biochemical and haematological diagnostics are carried out in the laboratory, while special and reference tests are carried out at the secondary and tertiary levels, in addition to the basic set of tests. Payments for laboratory services or funds intended for laboratory services are mostly indirectly linked to financing from sources of the Health Insurance Institute and partly from the market activity of the public healthcare institution. However, the calculation of the patient care of insured persons, and indirectly laboratory services (the organisation of laboratory activities based on levels), is linked to the level of healthcare (primary, secondary and tertiary healthcare). The organisation of laboratory activities based on levels and the associated method of paying for laboratory services, which are linked to several models (SPP, points, capitation, etc.), can have more disadvantages (duplication of orders and payments of laboratory services, transparent payment of services, preventing the transition of patients between levels of healthcare, etc.) (Lužnik & Možina, 2013).

Given that laboratory services are included in the entire cost of patient treatment, the financial resources of the laboratory are determined according to the annual number of tests carried out and achieving the internal realisation of the public healthcare institution. The volume of resources for the biomedical laboratory depends on the agreed scope of the health programme with the Health Insurance Institute and thus does not provide resources for actually performed laboratory tests. The financing of laboratory activities in a particular public healthcare institution is determined by the annual financial plan of the parent public healthcare institution. Financing is thus indirectly linked to the primary source of funding of the parent healthcare institution.

The cost of an individual laboratory test depends on the variables associated with the workstation and other indirect variables. Thus, the costs of the test are impacted by the total number of tests carried out, the cost of laboratory reagents and materials, technology, and depreciation of appliances. “In response to the financial trend of decreasing laboratory revenues per test to competition and increasing costs per test, it has become mandatory to improve productivity to survive” (Ash, 1996, p. 825). In Slovenia, the calculation of the price of laboratory services is linked to the so-called Green Paper in Healthcare. For self-pay patients, prices are therefore set by market forces and are independent of the ZZZS. Thus, the average registered laboratory point in 2017 at the primary level of healthcare was 1.66 €. The record point determined by the ZZZS on the one hand, gives service providers an incentive to unify the technology and the consumption of materials, but on the other hand does not reflect the actual costs of an individual public healthcare institution. The General Agreement allows the public healthcare institution to calculate laboratory services for other contractors at prices agreed with them. Thus, only self-paying prices that reflect the technology, personnel, reagent costs and the market situation more closely can be used as the factor of comparison between the primary and secondary level in terms of service prices. In the full picture, it is important how each public healthcare institution adjusts the price of services according to the number of tests carried out and the consumed laboratory materials and reagents. Cost per unit of test is therefore an important indicator of whether prices are based on costs, as mentioned by Ash (1996, p 823): "*... If cost per test can be calculated. This value is important for a number of reasons. It can be used to compare analysers being considered for use in the laboratory, to compare costs in central versus satellite laboratories, to evaluate the benefits of changing a batch size, or to decide whether to continue to perform the test in house or refer it out for testing*”.Thus, laboratories in larger healthcare institutions can benefit from the economy of scale and reduce costs, so the "Cost-minimisation analysis to determine the least expensive laboratory tests and diagnostic technologies that will produce the same effect" (Zunic et al. 2011, p.93) is important.

So to summarise the comparison of the financing of laboratory services at primary and secondary level, the most important differences are the financing of the basic activity of healthcare institutions and the range of services provided by laboratories in these institutions. At both levels of healthcare, laboratory services are included in the overall treatment of patients, but at primary level as part of the capitation, and at secondary level as part of the acute treatment of patients. Laboratories on the secondary level of healthcare due to the speciality of the work, also perform a greater share of special tests, which are paid as a fee for service. By exploiting economies of scale, laboratories at the secondary level also reduce the actual costs of the performed laboratory services.

3 LITERATURE REVIEW

There are very few studies around the world about research of the financing of public biomedical laboratories. The majority of research refers primarily to the comparison of financing of public healthcare institutions as a whole. Thus Stepan et al. (1999) evaluates healthcare systems with an international comparison, while Albreht et al. (2003) offers us an overview of the healthcare system in Slovenia as an example of a system in transition. In the field of laboratory medicine in Slovenia, Ocepek (2012) assessed the adequacy of the model of financing laboratory services in primary healthcare. Her conclusion is that the current way of financing healthcare is inadequate, and changes are urgently needed. Falcone (2010) defined the basic financial management of laboratories by defining the calculation of the costs of each of the tests performed. By calculating indirect costs, Gjural (2010) tries to determine the total cost of individual tests in a haematological laboratory. He is detecting a drop in total cost per test with an increase in the total number of tests performed. The total cost of specialised tests is higher, due to the use of more specialised equipment and more qualified laboratory staff. Udpa (1996) compares the use of cost estimates with respect to hospital activities using traditional payment model systems such as, for example, SPP. He notes that the ABC system offers a structural approach to analysing activities, cost/cost reduction and improvement in quality. Likewise, Habibi (2010) identifies the benefits of estimating costs by activity compared to the traditional cost system. Langlois et al. emphasises the need to integrate cost-effectiveness with the quality of work in laboratories at the secondary level of healthcare, which could be achieved through proactive work and laboratory consolidation.

A common finding of most of the research, in conjunction with ours, is that in order to ensure financially sustainable public healthcare, a reform of the healthcare system is needed, which would include the actual definition of laboratory costs arising from the treatment of patients. Because of the incorrect definition of the actual cost of the tests carried out, biomedical laboratories now represent a financial burden to public healthcare institutions. Reducing costs for laboratory reagents and materials could be achieved by consolidating laboratory activities and, consequently, by exploiting economies of scale.

4 PRESENTATION OF THE RESEARCH AND RESULTS

We obtained data for the research with a survey questionnaire, which was transmitted to all 81 public healthcare institutions in Slovenia, of which 57 are on the primary level and 24 are on the secondary and tertiary levels of healthcare. We wished to obtain information on the costs of laboratory materials and reagents and the total number of laboratory tests carried out. We needed this information to determine the correlation between the costs and the prices of the laboratory tests carried out.
In total, we obtained data for nine institutions at the primary level and nine on the secondary/tertiary levels of healthcare. The analysed institutions at the primary level of healthcare include 32% of all Slovenian citizens who have an appointed physician at primary level. On the secondary/tertiary levels of healthcare, we analysed the public healthcare institutions that carried out 55% of all acute hospital treatments in 2017.

It was easier to obtain data to determine the differences between the prices of individual tests, since data on self-payment prices of laboratory services could be obtained on the websites of individual public healthcare institutions. To test this hypothesis, we used data from 12 public institutions on both levels of healthcare. We compared the data of the 9 most common laboratory tests carried out by institutions at both levels of healthcare.

Data on the average price of each test on the primary (group 2) and the secondary (group 1) level are shown in Table 1. The Table shows that, on average, the prices of all tests are higher on the primary level. It is also evident from the data that the prices differ greatly within each group, with some standard deviation values being relatively large compared to the average. If we compare the nominal values of prices within a single level between different laboratories, we find that the prices of certain tests are in the ratio of more than 1:5 (for example, on the primary level the test: trigliceridi, hemogram, and on the secondary level, the ratio of the hemogram is even 1:7). On average, larger laboratories have lower prices, which indicates the exploitation of economies of scale.

1**: Average prices for laboratory tests on the primary and secondary level**

		Tests								
groups		HEMOGRAM	K-SR	S-GLUKOZA	S-SEČNINA	S-KCRP	S-ALT	S-AST	S-KALIJ	S-TRIGLICERIDI
1	Mean	2.9667	1.2867	1.2200	1.4408	2.7875	1.6418	1.6527	1.1383	2.2717
	N	12	12	12	12	12	11	11	12	12
	Std. Deviation	1.31734	0.33011	0.45768	0.50257	1.39193	0.57414	0.58181	0.40409	1.04581
2	Mean	3.5625	1.9558	2.0183	2.0450	3.9492	2.4908	2.4908	1.4767	3.5433
	N	12	12	12	12	12	12	12	12	12
	Std. Deviation	2.11063	1.09774	0.89465	0.77473	1.98804	0.79458	0.79458	0.63818	1.35054
Total	Mean	3.2646	1.6213	1.6192	1.7429	3.3683	2.0848	2.0900	1.3075	2.9075
	N	24	24	24	24	24	23	23	24	24
	Std. Deviation	1.74732	0.86328	0.80576	0.70928	1.78014	0.80843	0.80795	0.55022	1.34807

Source: Price lists on public healthcare institution websites, 2018

In order to verify the hypothesis 'The prices of laboratory services vary between primary and secondary level', we used the Mann-Whitney U test, mainly due to the small sample of observed units. We also carried out the t-test of independent samples of both groups and the results were the same with a confidence level of 0.05% in both tests. In the t-test, differences in this level of confidence are further shown in the 'Sečnina' test. Mann-Whitney U test results are shown in Table 2 and conclude that prices are statistically different in four of the nine tests. This means that at a risk level of 0.05, the prices for laboratory services 'S-GLUKOZA', 'S-ALT', 'S-AST' and 'S-TRIGLICERIDI' can be statistically significantly higher at primary level, where the method of financing the institution is different, and in addition, they achieve smaller effects of economies of scale.

2**: Mann-Whitney U test of the comparison of the prices of selected tests between laboratories on the primary and secondary level**

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of HEMOGRAM is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,478[1]	Retain the null hypothesis.
2	The distribution of K-SR is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,128[1]	Retain the null hypothesis.
3	The distribution of S-GLUKOZA is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,010[1]	Reject the null hypothesis.
4	The distribution of S-SEČNINA is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,078[1]	Retain the null hypothesis.
5	The distribution of S,KCRP is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,128[1]	Retain the null hypothesis.
6	The distribution of S-ALT is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,013[1]	Reject the null hypothesis.
7	The distribution of S-AST is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,013[1]	Reject the null hypothesis.
8	The distribution of S-KALIJ is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,291[1]	Retain the null hypothesis.
9	The distribution of S-TRIGLICERIDI is the same across categories of groups.	Independent-Samples Mann-Whitney U Test	,039[1]	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,05.

[1]Exact significance is displayed for this test.

Source: Price lists on public healthcare institution websites, 2018

The average prices of individual tests at the primary and secondary level were also compared with the value of the test, which is determined by the ZZZS through the value of the point. The Institute determines the lower value of the test for all the tests shown at the primary and secondary level.

To verify the first hypothesis, 'The costs of reagents (which are bound by the selected technology) correlate with the prices', we used the Pearson coefficient of connectivity. Results are shown in Table 3. The correlation between the costs of reagents and prices was determined because we wanted to check whether the cost of providing a service is taken into account when determining the prices of laboratory services. Data on the number of test and reagent costs were obtained through a questionnaire filled out by public institutions using the data from annual reports.

3**: Coefficient of correlation between reagent costs and prices of selected laboratory services at the primary and secondary level**

	Primary level		Secondary level	
	Pearson coefficient	*Sig.*	Pearson coefficient	*Sig.*
HEMOGRAM	0.46	*0.21*	-0.22	*0.84*
K-SR	0.63	*0.07*	-0.42	*0.95*
S-GLUKOZA	0.57	*0.11*	-0.40	*0.92*
S-SEČNINA	0.61	*0.08*	-0.18	*0.94*
S-KCRP	0.84	*0.00*	0.07	*1.00*
S-ALT	0.63	*0.07*	0.03	*0.95*
S-AST	0.64	*0.07*	-0.09	*0.95*
S-KALIJ	0.59	*0.09*	-0.39	*0.93*
S-TRIGLICERIDI	0.55	*0.12*	-0.01	*0.91*

Source: Questionnaire replies and price lists of the institutes involved in the research

The results show that at the primary level, the price and cost connection is relatively high and statistically significant at a risk level of 0.1%. In this case as well, the results differ for the secondary level, since at this level the connection does not appear. The reason is in the use of more expensive laboratory reagents for carrying out special secondary level tests that are not performed at the primary level. However, the number of special tests carried out is also lower. We can conclude that additional financing through fee for service and the implementation of more expensive special diagnostic tests at the secondary level, allows lower prices of services, although the reagent costs for tests are higher than at the primary level.

5 CONCLUSION

Healthcare financing in Slovenia is complex and regulated in different ways. Laboratory services that are part of the patient treatment are thus included at all levels with their share in the capitation and the SPP. Between the different levels, however, there are differences in the determination of some prices of laboratory services and, consequently, also in the mutual charging of these services. From the analysis of the data of public institutions included in the research, it can be concluded that, due to carrying out a narrow set of basic tests, prices are higher at the primary level (that is, in health centres), where the scope of tests is lower and where the costs of tests are lower, but related to price fixing. Secondary level laboratories use more expensive laboratory reagents to carry out special tests, which are fewer in number. Consequently, at the secondary level, costs per unit are higher, but revenues from payments for more expensive tests are also higher. This may partly indicate that laboratories want to exploit economies of scale and compete with one another, while this is not present at the primary level, as this level of service is more connected to the local environment. Of course, the research has some limitations in order to be able to generalise the possible measures to improve the efficiency of the operation of public laboratories and, consequently, the effective use of public money for healthcare. Not all public institutions, and not all laboratory tests have been included, while costs have been stated for all tests carried out by the laboratory. Nevertheless, it can be concluded that larger laboratories spend less money per test, and consequently they can offer lower prices, which additionally increases the demand for their services and thus additionally increases the benefits of economies of scale. One step towards greater efficiency would therefore be the pooling of laboratories within individual public institutes, especially at the secondary level. At the local level, pooling is more difficult, as they are tied to the local environment, but it would be possible to pass non-urgent tests to a common laboratory centre, and health centres would only perform tests that are necessary for diagnostics at the primary level.

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