THE COST EFFECTIVENESS OF SPECIALIZED LABORATORY DIAGNOSTIC METHODS IN HEALTHCARE

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Abstract
Laboratory investigative methods in the health sector currently have sophisticated methods and reliable procedures. However, individual labs must take into account their real financial possibilities so that they do not reach negative economic figures. In our paper we evaluate the adequacy of the numbers of IgG, IGA, IgM, immunofixation and total protein examinations realized in patients with hematooncological diseases. The obtained data are confronted with current economic possibilities of medical laboratories.

Key words: Laboratory examinations. Variability of methods. Cost effectiveness. Incomes.

1 Introduction

At present, we are witnessing a significant expansion of laboratory methods in biomedicine. This development involves both research biomedical area and also routine application of methods in diseases diagnostics. But there is one significant difference in financing. In the case of research, the funding of examinations is covered by grant projects and funds. Projects are designed for a predicted number of individuals and can also use sophisticated methods that are often very expensive. In case of routine diagnosis, it is always necessary to examine samples of a larger number of patients within the available time and to a limited financial extent. Therefore, routine diagnostic laboratories often cannot afford to work with such a sophisticated technique as top research sites. Another typical feature of routine biomedical labs is the large palette of examinations. The laboratories are required to provide the required range of examinations. If they fail to do so, it may jeopardize their existence in the longer horizon [1].

2 What is a specialized examination?

The answer to this question depends on different circumstances. For local catchment workplace can be also *demanding* such tests that are considered to be r*outine* at specialized centers. Therefore, there is no universal answer to this question without taking into account other circumstances. These circumstances are: the size of the catchment area of the workplace, population density, ethnical and racial population homogeneity, economic health of the state and health sector.

The most serious diseases such as hematooncological diseases, for example, are treated and managed in specialized centers. This approach enhances the financial and time efficiency of therapy. An important factor is the greater experience of staff with the diseases due to the centralization of therapy in one specialized institution. Because of centralization, higher cost-effectiveness can also be achieved. On the one hand, there are financial requirements for examinations, on the other hand, the budgets of health insurance companies are limited.

Another negative factor is the large methodological variability of the examination methods [2]. Very often, it causes the incompatibility of subsequent laboratory examinations that have been carried out at medical labs with different instrumentation and methods. In our conditions, there is no unification in this regard. There is no authority that, for example, could to order the use of enzyme-immunological or electrochemical luminescent methods with national validity. From a free market point of view, such a regulation would probably be illegal and even unconstitutional [3]. That is why we frequently pay for this freedom in the form of repeated examinations, which are often carried out by individual laboratories of medical centers independently on the existing previous patient´s examinations.

3 Aim

The goal of our work was to quantify the amount of financial income earned for the given examinations in a given time period.

4 Material and Methods

We processed 157 patients who were examined during the period of 9 months at our department's partner labs. Primary data were de-identified in the sense of the Helsinki Declaration of Patient Rights in the addition of subsequent conventions. Data were retrospectively processed, with no additional investigations beyond the physician-ordered palette required. All laboratory tests of these parameters were performed in accordance with the

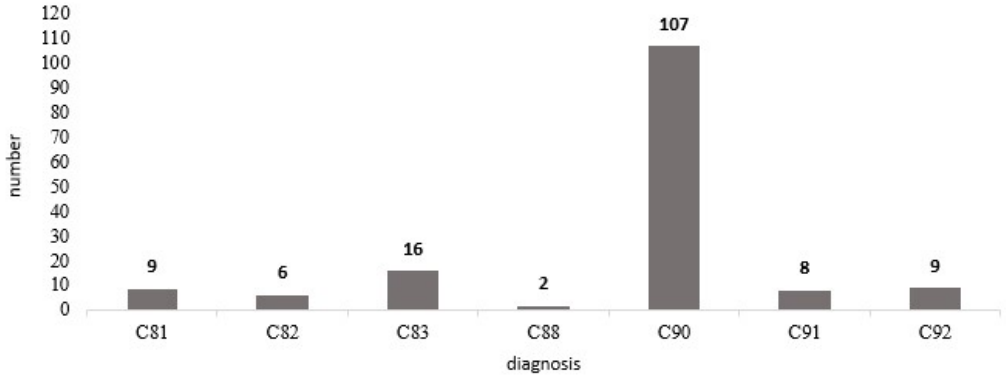
applicable standard operational procedures. For more information about the parameters of the primary data as well as standard operating procedures in partner labs they are available on requested by the authors of the work. In our study we focused only on selected hematooncological diseases such as Hodgkin's disease (C81), follicular disease non-Hodgkin's lymphoma (C82), diffuse non-Hodgkin's lymphoma (C83), malignant immunoproliferative diseases (C88), multiple myeloma (C90), lymphatic leukemia (C91), and myeloid leukemia (C92).

We focused on the examination of protein electrophoresis followed by immunofixation and examination of IgG, IgA, IgM immunoglobulin concentrations as well as total protein.

Data on the value of examinations were drawn from available Internet sources and published contracts of health insurance companies and healthcare facilities [4, 5].

5 Results and Discussion

There were 88 men and 69 women in our file for the time period. The frequency of individual diagnoses varied in a broad range (Graph 1). The results show that the most numerous diagnosis was multiple myeloma C90 (n = 107) followed far less abundant diffuse non-Hodgkin's lymphoma C83 (n = 16). Obviously, the occurrence of individual monitored quantitative parameters is not statistically significantly associated with any of the above-mentioned diagnoses (table 1). An overview of the observed gammapathies is given in Table 2.



Graph 1 *Frequency of particular diagnoses*

Table 1 *Testing of differences in concentration of monitored parameters in particular diagnoses*

Parameter	Diagnosis	*n*	$\bar{x}$	*sd*	x_m	*min.*	*max.*	*p*
Total protein	**C81**	9	76.93	6.87	78.9	65.8	86	0.85
	C82	6	71.03	15.4	74.1	50.7	86.5	
	C83	16	74.54	9.59	77.25	56	87.7	
	C90	106	76.14	10.71	74.45	56.1	145.4	
	C91	8	76.77	6.7	78.15	63.9	86.5	
	C92	9	72.6	10.18	72.4	60.8	90.5	
IgG	**C81**	9	13.8	8.45	11.24	3.36	30.94	0.92
	C82	6	15.27	12.58	11.5	3.86	32.65	
	C83	16	12.92	6.55	13.55	3.74	28.9	
	C90	107	14.4	9.37	12.37	2.5	75.6	
	C91	8	14.21	6.34	11.81	7.55	23.96	
	C92	9	12.25	8.87	9.26	5.65	34.95	
IgA	**C81**	9	2.28	1.33	2.71	0.34	4.31	0.2
	C82	6	1.25	1.1	0.99	0.32	2.67	
	C83	16	1.51	0.92	1.15	0.38	3.74	
	C90	106	1.75	2.59	0.99	0.06	22	
	C91	8	1.62	1.61	0.99	0.27	4.86	
	C92	9	1.87	0.87	1.52	1.11	3.33	
IgM	**C81**	9	0.88	0.96	0.66	0.15	3.29	0.08
	C82	6	0.57	0.29	0.65	0.1	0.91	
	C83	15	1.2	0.52	1.14	0.06	1.93	
	C90	107	0.64	0.52	0.51	0.03	2.65	
	C91	8	0.98	1.23	0.65	0.26	3.95	
	C92	9	0.78	0.34	0.93	0.22	1.1	

Legend: *n* – number of patients, $\bar{x}$ – arithmetical mean, *sd* – standard deviation, x_m – median, *min.* – minimal value, *max.* – maximálna value, p – probability level of Kruskal-Wallis test

Table 2 *Frequency of gammapathies*

Diagnosis	Gammapaty		Total
	Present	Not present	
C81	5	4	9
C82	4	2	6
C83	10	6	16
C90	89	18	107
C91	3	5	8
C92	3	6	9
total	114	41	155

Based on the identified frequencies, we performed an analysis of revenue, which is determined by laboratory analysis of grading points and the price of one point (Table 3). From these data we can see that the net income that is paid by the health insurers is approximately 2860 € within the time period of 9 months. Thus, total monthly income was 317.76 €. In this case, the data are incomplete since tens of parameters are investigated in such cases. If only electrophoresis and immunofixation were considered, the total revenue would be 230.26 € per mount.

Table 3 *Expected profits*

Parameter	Number of scores	Number of patients	Price of one score (€)	Total (€)
Elecrtophoresis	500	157	0,0066	518,1
Immunofixation	1500	157	0,0066	1554,3
Total protein	40	157	0,0066	41,44
IgG	240	157	0,0066	248,69
IgA	240	157	0,0066	248,69
IgM	240	157	0,0066	248,69
Total (€)				2859,91

The aforementioned means must be sufficient for the laboratory to purchase new reagents and maintain the established methodology. However, this reasoning is only theoretical and limited. In practice, we often encounter situations where a health insurance company does not pay the legitimate outputs of a laboratory. This may be due to incomplete ID data of patients or, much more often due to the repeated determination of parameters. Indeed, the laboratory must always carry out the analysis ordered by the doctor, regardless whether it is a redundant examination or not. The laboratory must never refuse a patient's examination or question a doctor's decision. The only way to increase income is self-payers, but they are not very numerous in the current economic situation.

6 Conclusion

Routine laboratory examination methods in the healthcare sector are currently subject to considerable economic pressure. Laboratories therefore often get negative economic numbers in part without their own fault. Given the current budgets of the health sector and the constantly decreasing payments of the state for its policyholders, the situation will probably not improve in the foreseeable future.

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