

A Comparative Study of Activity-Based Costing vs. Current Pricing System for Pathology Examinations at Okmeydani Training and Research Hospital, Turkey

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ABSTRACT

Objective: To provide real cost data for pathology examinations by using activity-based costing method, in order to provide means to departments, health administrators and the social security institution to achieve improvements in financial planning, quality and cost control.

Material and Method: The cost of the histopathological examinations, which were accepted by the Department of Pathology at Okmeydani Training and Research Hospital during August 2014, was calculated using the activity-based costing method. The costs were compared with the amounts specified in the Healthcare Implementation Notification Tariff and the conventional volume-based costing.

Results: Most pathology examinations listed within a given band in the Healthcare Implementation Notification Tariff show variations in unit costs. The study found that the costs of 77.4% of the examinations were higher than the prices listed in the Healthcare Implementation Notification Tariff.

Conclusion: The pathology examination tariffs specified in the Healthcare Implementation Notification do not reflect the real costs of the examinations. The costs that are calculated using the activity-based costing system may vary according to the service types and levels of health care institutions. However, the main parameters of the method used in the study reflect the necessity of a more accurate banding of pathology examinations. The banding specified by the Healthcare Implementation Notification Tariff needs to be revised to reflect the real costs in Turkey.

Key Words: Activity-based costing, Cost effectiveness, Pathology

INTRODUCTION

At most of the institutions providing health care service in Turkey, costs of the services provided are not given due consideration. The systems in place are inadequate for providing sufficient, reliable and comparable information necessary for costing (1).

The true costs of health care services must be known in order to reserve sufficient resources for the health care sector, to use the resources effectively and efficiently. Conducting cost and performance analysis in the health care sector helps reduce costs and improves effectiveness, efficiency and performance, subsequently allowing the provision of better quality health care services (2).

Competition between facilities, private entrepreneurs taking a bigger part in the sector, and the large-scale referral chain formed between public and private facilities in recent

years make a more accurate and effective costing necessary for appropriate pricing (3). The costs of health care services provided by the institutions and the tariffs applied in the social security system (SSS) of the state must be compared (4).

The cost can be defined as a sum of direct and indirect expenses of procuring any goods or services in the event or place they are sold or used (5,6). The cost in hospitals can be defined as a monetary expression of the materials and labour involved in providing health care services (7). Cost of production has three basic elements, which are direct raw materials and supplies cost (DMC), direct labour cost (DLC) and production overheads (PO) (5).

Direct raw materials and supplies are the materials that constitute the basic structure of the service and are directly traceable (7). The sum of economic endeavours that are directly used in services and in main production areas of

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institutions is called direct labor (5). Use of values related to production other than DMC and DLC is called production overhead. PO is comprised of various individual, unscheduled expenses that are not related to one another. The precise amounts of some of these expenses can only be known at the end of the year (8). Electricity, water, cleaning, etc. are involved in PO (7).

Activity Based Costing (ABC) system is a costing system that assigns the costs only to the relevant service groups. With this feature, it has the advantage of achieving a more accurate costing by accurately assigning PO to the services in health care institutions. Therefore, the use of ABC is gradually increasing among health care services (7).

There is no such thing as a standard model since each facility has its own specific way of applying the ABC system (9). The basis of the ABC method is comprised of five steps. These are; personnel training, process evaluation analysis, identifying activity centers, transferring costs to activity centers, and choosing cost drivers (10).

This study aims to provide approximately accurate cost data by using the ABC system for pathology examinations at a training and research hospital (TRH) affiliated to the Ministry of Health, and to provide means to Okmeydanı TRH, health administrators and the SSS to achieve improvements in financial planning and quality in pathology clinics.

MATERIALS and METHODS

All histopathological examinations, autopsy materials and special pathological investigations (frozen section examinations, preparations stained with ready-mixed paint and/or paraffin blocks) recorded between August 1-31, 2014, at the Okmeydanı TRH Pathology Laboratory were included in the study. Cytological materials, histochemical examinations and immunohistochemical examinations were excluded from the study.

In the first implementation stage of the study, the production process was analysed and the personnel received training on ABC. Each activity related to production was presented in a workflow diagram. The activities were gathered together in activity centers. The activity centers were established as follows: 1. Delivery of Materials to the Laboratory, 2. Patient Registration and Specimen Acceptance, 3. Material Identification and Macroscopic Examination, 4. Monitoring of Tissue Specimen, 5. Paraffin Blocking of Specimens, 6. Paraffin Sectioning of Specimens, 7. Staining, Cover Slipping, Checking, 8. Microscopic Examination, 9.

Report Writing, 10. Results Reporting, 11. Archiving, and 12. Frozen Section.

In the second stage of the study, the amount of all of the materials used in the laboratory was recorded daily by the laboratory personnel, and “direct raw materials and supplies costs” of all investigations included in the study were calculated. Unit prices of the materials used in the laboratory were identified by data of the Medical Stock Unit of the hospital.

In the third stage of the study, which is calculation of the “Direct Production Costs”, the time period spent for each investigation in the abovementioned activity centers were measured, and an average time period was determined for each examination. Then, wages of personnel working in the respective activity centers were calculated per second and these wages per second were multiplied by the average time spent for each process.

In the fourth stage, which is the calculation of “Production Overhead”, first, the primary cost drivers were identified. Identified primary cost drivers were classified as: indirect personnel expenses, the electricity bill, the water bill, the heating bill, the cleaning bill, amortization of fixed assets, amortization of the building, stationery and consumables costs and food costs. The allocation of indirect personnel expenses was done focusing on the working time that the personnel spent in their respective activity centers. For direct wage calculation, the number of working days of individuals and the value of their daily total working hours in seconds were formulated. Salary and floating capital extra payment information of individuals were accessed through the Personnel Unit. Calculated direct wage was postulated as DLC; and indirect wage and floating capital payments were postulated as PO. Electricity, water and natural gas bills were accessed by data of the Hospitality Services Management. While calculating amortization expense of fixed assets, the revaluation ratio published by the Revenue Administration was used (11). The economic life of fixed assets and devices used in the laboratory was estimated as five years. In order to calculate the amortization expense of the building, “Notification Regarding Approximate Unit Costs to be Used in Calculating Remunerations for Architectural and Engineering Services for Buildings in 2014” published by the Ministry of Environment and Urbanization was used (12). The economic life of the hospital building was estimated as 50 years. The expenses added to the activity centers by means of primary cost drivers were transferred to the models by means of secondary cost drivers, by which PO was obtained. The time spent at relevant activity centers was used as a base for choosing secondary cost drivers.

The calculated DMC, DLC and PO were added together and the cost of each examination was calculated by using the ABC method. Also, the conventional volume-based costing results were obtained by allocating PO at a fixed rate to specimens accepted to the laboratory during the relevant month. In order to allow for comparison with future studies, the figures were converted into US Dollar and Euro using the exchange rates by the Central Bank of the Republic of Turkey dated August 1, 2014 (13). The results were discussed using the Healthcare Implementation Notification (HIN) tariff and current knowledge in the literature (14).

RESULTS

The study found the total number of materials received by Okmeydanı TRH Pathology Laboratory to be 3137 in August 2014. During the same period of time, a total of 1852 histopathological examinations of 93 types that were included in the study were performed.

In the study, the material cost of preparing a block was found to be 0.62 TL, and the unit cost of staining of a slide was found to be 0.81 TL (cutting: 0.61 TL, HE staining: 0.06 TL, cover slipping: 0.14 TL).

DMCs were calculated by multiplying calculated costs of blocks and slides by the average numbers of blocks and slides specified for each histopathological examination and adding other costs (Table I).

In the study, DLC was obtained by calculating wages of personnel working in their respective activity centers per second and multiplying the wages per second by the average time spent for each process (Table II). The

employee wages per second were found to be 0.005 TL for Associate Professors; 0.004 TL for Teaching Staff, Chief Assistants and Attending Physicians; 0.003 TL for Assistant Physicians; 0.002 TL for Laborants, Transfer Personnel and Archivists; 0.001 TL for Specimen Acceptance Personnel and Report Personnel.

The transfer of primary cost drivers was identified in the scope of PO to the activity centers. Calculated values were transferred to the specimens by means of secondary cost drivers and PO of specimens was found (Table III).

The cost of each examination was calculated by adding DLC, DMC and PO results together using ABC method. Also, conventional volume-based costing results were obtained for the relevant month. The costs calculated using ABC method were converted into US Dollar and Euro using the exchange rates by the Central Bank dated August 1, 2014.

DISCUSSION

Pathology examinations differ from other laboratory examinations for having various procedure steps. Macroscopic examination and sampling of materials, microscopic examination of specimen slides, and preparation of a pathology report are the procedure steps all completed by pathologists. The responsibility and workload of the pathologist in completing pathology investigations are the factors that prove the necessity of valuing the physician's labor and explain why pathology is a clinical branch.

Amounts of labor and workload required by pathology investigations might be different from interventional procedures performed to obtain tissues or surgeries. The

Table I: Direct raw materials and supplies average costs

Histopathological Examination Band	Number of Blocks	Blocking Cost (TL)	Number of Slides	Staining Cost (TL)	Other Costs (TL)	Total Material Cost (TL)
First Band	1.50	1.64	2.33	2.40	0.24	4.28
Second Band	2.49	1.91	2.74	2.66	0.25	4.82
Third Band	7.09	4.90	8.92	7.17	0.91	12.98
Fourth Band	19.37	14.08	20.18	19.28	2.64	36.00

Table II: Direct labor average costs

Histopathological Examination Band	Average DLC (TL)
First Band	7.93
Second Band	10.19
Third Band	16.27
Fourth Band	39.67

DLC: Direct labour cost

Table III: Production overheads average costs

Histopathological Examination Band	PO (TL)
First Band	28.50
Second Band	40.62
Third Band	72.29
Fourth Band	193.91

PO: Production overheads

most important factor evaluated here is the time spent on the process. In the study, the time spent while costs were transferred to the activity centers was used as a cost driver. In this way, it was aimed to reflect employees' labor to the costs accurately.

When DLC is examined, it is seen that the investigations do not present a homogeneous distribution in terms of their bands. DLC averages determined for each band are shown in Table II. Some of histopathological examinations that are among the first, second and third band examinations have higher costs than the average of their band examinations. Some of the third band examinations raise the average with a DLC more than 20 TL and prevent homogeneous distribution. It is seen that the major driver of the increased cost is microscopy in all examinations. The examinations that take longer to be reported in comparison to the other examinations in their own bands increase the DLC. Therefore, bands of examinations that require more labor need to be reevaluated.

In the study, the material cost of a block was found to be 0.62 TL and staining cost of a slide was found to be 0.81 TL. Ergün et al. (7) and colleagues found the material cost of a block to be 2.79 TL and the staining cost of a slide to be 0.38 TL in their study. The differences in given prices might have arisen from different unit prices of materials used for blocking and staining or from different procedures included in blocking and staining stage in their laboratory.

Among Pathology investigations, there are minor biopsies that can be examined in a paraffin block by routine staining at one end and there are major resection materials for which a number of specimens must be taken for tumour stage identification at the other end in terms of cost. Costs of raw materials and supplies increase as the number of blocks and sections increases in order to examine materials sufficiently. The average DMCs of the examinations according to the HIN bands are listed in Table I. It shows that while the first and second band examinations have similar DMCs, the cost increases significantly as the band number goes up. When DMC is viewed, it is seen that the first band examinations "femoral head, excluding fracture" and "colon, colostomy stoma" have higher costs than the average of the third band examinations; the second band examination "finger/toe, amputation, excluding trauma" has a cost almost equal to the average of the third band; the third band examination "breast partial/simple resection" has a cost nine times more than "bladder, TUR" examination, which is in the same band as itself. Similarly, some of the third band examinations (bladder, TUR; bone

fragments) have lower costs than the average of the first band. In terms of DMC, a homogeneous and balanced distribution is not seen between the HIN bands.

In cost analysis, PO is the major driver of product cost, because PO is far higher than DLC and DMC. Thus, the allocation keys to be chosen to allocate DMC to products are critical in identifying real costs of products. Since the main criterion in choosing allocation keys is the amount of labor performed, the allocation was done in proportion to the time spent on processes in all activity centers. As the time spent on processing in the activity and result-reporting is the same for every product, calculated average time was fixedly allocated to the products. The activity centers that the work done is in proportion to the average number of the blocks and/or slides, the calculated average time was allocated proportionally with the numbers of blocks and slides of the products. In this way, it was ensured that every product has a share of PO pro rata with the amount of labor performed.

When Table III is reviewed, it is seen that the highest expense participating in PO is the "Indirect Personnel Costs". It indicates that production is based on workforce. Therefore, it will make a healthy allocation to focus on workforce in allocating costs to products. In the same table, it can also be seen that microscopic examination has the highest PO among the activity centers. Because a significant number of employees spend most of their time working with microscopes.

The main factor in designating product costs is PO in the ABC method. The effect of DLC and DMC on total product cost is considerably less compared to PO. The ratios of DLC, DMC and PO to the total cost according to their bands are as shown in Figure 1. As it is seen, PO was allocated to the fourth band examinations, which require more labor and workforce with a higher ratio than the first band examinations, which require less labor and workforce. DMC ratio increases as the number of examinations, which require more blocking and sectioning increase, yet its effect on the total cost is not significant. DLC cannot impose a significant load on the cost; hence the reason employee wages per second are low.

Table IV shows that the average costs of examinations in all bands are considerably higher than the HIN tariff. As for the fourth band histopathological examinations, where the cost significantly increases, the ratio goes up 4.5 times higher. It is clear that this causes significant losses in major hospitals where advanced surgeries and procedures are

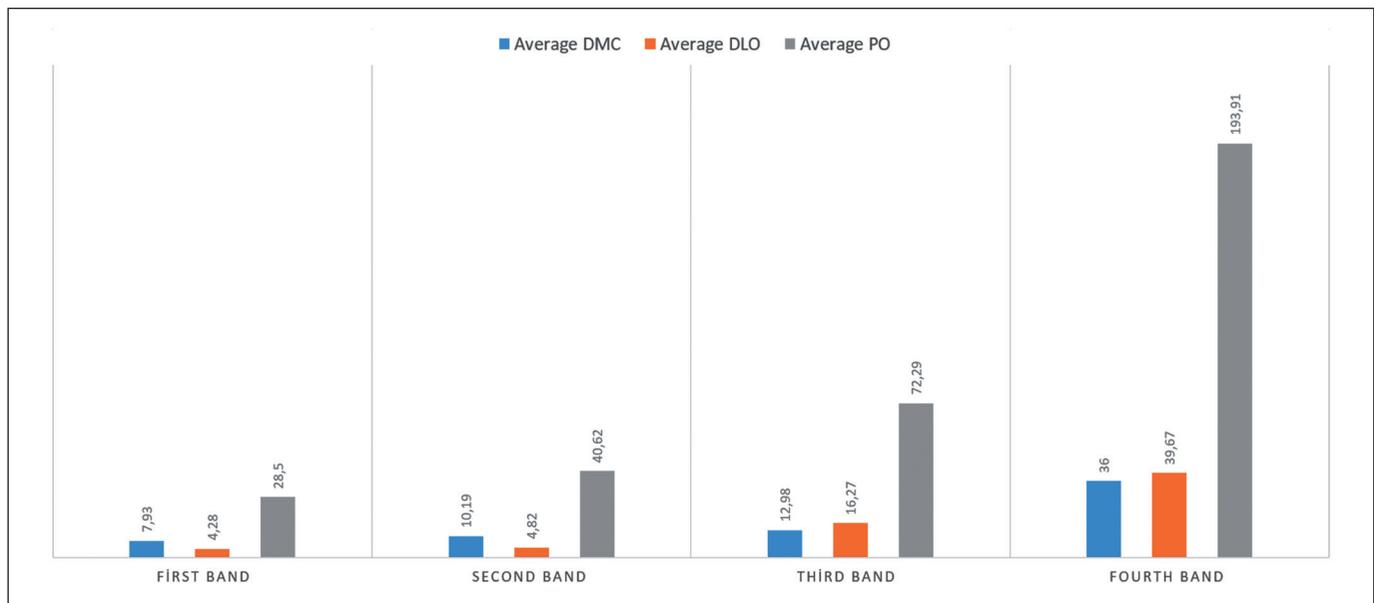


Figure 1: Allocation of DLC, DMC and PO according to histopathological examination bands.

performed. According to the conventional volume-based costing analysis conducted during the study in order to make a comparison, average costs in all the bands are significantly higher than HIN prices.

In conventional costing systems, volume-based allocation keys are used to allocate PO, however, this allocation is far from reflecting the reality since it fixedly allocates PO to all products. In the study, conventional volume-based costing was done and prices were listed for comparison (Table IV). In volume-based costing, PO allocation is done by focusing on number of products; therefore, the time spent and the amount of labor performed on examinations are disregarded. Conventional costing results for each band examination were also higher than HIN prices as in ABC analysis (Table IV).

When all examinations were considered together, it was seen that the costs of 72 of 93 examinations (77.4%) were higher than HIN prices, whereas 21 of them (22.6%) were lower than HIN prices. In a similar study, the costs of 88.88% of the third band histopathological examinations were higher than HIN prices and 11.12% of them were lower than HIN prices (7). For the fourth band, it was found that the costs of all materials examined were 2 to 6 times higher than HIN prices and prices specified within the fourth band in the HIN tariff do not even cover the costs of direct raw materials and supplies used in the examinations. According to these results, there are significant differences between Pathology investigation prices specified in the HIN and the real costs of relevant examinations. And this shows that

specifying service costs without doing a cost analysis can cause higher or lower pricing compared to actual prices. SSS and professional associations like the Turkish Medical Association established pricing rules without using any data from comprehensive costing studies that demonstrate the real costs (7). A new implementation on stomach, colon and excisional skin biopsies was introduced in the HIN published in July 2014 (15). According to the new regulation, multiple biopsies are invoiced as single biopsies in the third band. Payments, which cannot cover the cost of single biopsies after all, became more problematic with the new regulation. Since the amount of labor performed and time spent on pathology examinations are pro rata with the number of biopsies, the cost will increase as this number increases.

In Turkey, the HIN bands of pathology examinations are specified according to surgical difficulty levels of relevant procedures. However, pathology examinations are not always in line with these difficulty levels. A procedure that is easily performed surgically can be rather difficult for the pathologist while performing the pathology examination. The best example for this is skin punch biopsies, which are on the first band in the HIN pathology examinations tariff. Although this examination, rated in the first band in the HIN, is an easy process in terms of taking specimens for the clinician, it is considered a difficult examination for being labor-intensive in terms of its pathology examination, requiring a lot of time and frequently needing consultation. Meanwhile, transurethral resections of prostate and bladder, which involve similar surgical procedures, were

Table IV: Comparison of the results

Histopathological Examinations	ABC (TL)	HIN Tariff (TL)	Conventional Volume-based Costing (TL)	In US Dollar	In Euro
First Band Histopathological Examinations					
Abortus	45.95	28.9	62.72	21.57	16.09
Skin, punch/incisional/shave biopsy	59.48	28.9	62.56	27.93	20.83
Endometrium, curettage/biopsy	26.02	28.9	56.31	12.22	9.11
Femoral head, excluding fractures	161.06	28.9	101.59	75.61	56.39
Intervertebral disc	21.05	28.9	55.75	9.88	7.37
Bone marrow biopsy, pathology	108.17	28.9	76.29	50.79	37.88
Colon, biopsy single localization	31.57	28.9	58.19	14.82	11.05
Stomach, biopsy single localization	34.73	28.9	58.91	16.3	12.16
Pilonidal cyst /sinus	23.24	28.9	56.14	10.91	8.14
Gallbladder	25.49	28.9	56.27	11.97	8.93
Tonsil and/or adenoids	33.16	28.9	58.89	15.57	11.61
Soft tissue lipoma excision or biopsy	34.51	28.9	59.47	16.2	12.08
Second Band Histopathological Examinations					
Appendix, excluding incidental	30.78	37.3	58.1	14.45	10.78
Skin, excisional biopsy 1-2 lesions	31.12	37.3	58.12	14.61	10.9
Femoral head, fracture	108.36	37.3	73.84	50.87	37.94
Lymph node, biopsy	128.43	37.3	75.85	60.3	44.97
Breast/reduction mammoplasty	71.34	37.3	71.78	33.49	24.98
Myoma(s), myomectomy, excluding uterus	83.61	37.3	72.59	39.25	29.27
Ovary, biopsy/wedge (Kama) resection	43	37.3	61.47	20.19	15.06
Ovary (+ /- Tuba), not neoplastic	46.37	37.3	62.11	21.77	16.23
Pancreas, biopsy	133.46	37.3	75.11	62.66	46.73
Finger / toe, amputation, excluding trauma	99.83	37.3	77.09	46.87	34.96
Prostate, TUR	64.68	37.3	66.71	30.36	22.65
Soft tissue simple exc. excluding lipoma	41.22	37.3	59.95	19.35	14.43
Third Band Histopathological Examinations					
Brain/meninges, tumor resection	72.63	39.9	70.11	34.1	25.43
Kidney, partial /total nephrectomy	163.08	39.9	95.68	76.56	57.1
Skin, excisional biopsy 3 and more lesions	92.34	39.9	74.28	43.35	32.33
Bone-biopsy/curettage material	74.19	39.9	67.77	34.83	25.98
Bone fragments	76.76	39.9	65.86	36.04	26.88
Colon, segmental resection, for reasons other than tumors	88.07	39.9	76.56	41.35	30.84
Colon, biopsy multiple localization	71.34	39.9	69.01	33.49	24.98
Breast, partial/simple resection	171.64	39.9	96.95	80.58	60.1
Bladder, TUR	49.73	39.9	60.46	23.35	17.41
Prostate, needle biopsy	106.58	39.9	83.5	50.04	37.32
Cervix, conization	141.91	39.9	92.27	66.62	49.69
Thyroid, total/lobectomy	125.14	39.9	84.04	58.75	43.82
Salivary gland (including tumors)	201.43	39.9	91.71	94.57	70.53
Uterus (+ /- Adnexa), excluding tumors and prolapses	108.93	39.9	81.46	51.14	38.14

Table IV continue

Histopathological Examinations	ABC (TL)	HIN Tariff (TL)	Conventional Volume-based Costing (TL)	In US Dollar	In Euro
Fourth Band Histopathological Examinations					
Mouth/Tongue/tonsil- resection including tumors	276.1	60	119.52	129.62	96.67
Fetus, examination by dissection	197.27	60	114.47	92.61	69.07
Bone, resection	219.37	60	91.92	102.99	76.81
Colon, total resection	299.08	60	147.05	140.41	104.72
Colon, segmental resection for tumors	224.75	60	118.87	105.52	78.69
Larynx, partial/total + jugulodigastric lymph nodes	370.38	60	159.85	173.89	129.68
Breast, mastectomy + axillary lymph nodes	224.24	60	115.08	105.27	78.51
Stomach, subtotal/total resection for tumors	410.16	60	158.31	192.56	143.61
Pancreas, total/subtotal resection	316.66	60	122.68	148.67	110.88
Prostate, radical resection	337.7	60	155.37	158.55	118.24
Testicle, tumor	245.76	60	105.21	115.38	86.05
Uterus, neoplastic (+ /- Tubes and ovaries)	196.55	60	104.02	92.28	68.82
Vulva, total/subtotal resection	298.55	60	136.45	140.16	104.53
Soft tissue tumors, wide resection	157.59	60	88.83	73.98	55.18
Examination of Autopsy Materials					
Autopsy, fetus	160.77	50.9	95.09	75.48	56.29
Special Pathological Investigations					
Frozen Examination	308.34	50	73.38	144.76	107.96
Preparations with ready-mixed paint and/or paraffin blocks	158.25	14.9	78.47	74.29	55.41

ABC: Activity-based costing, HIN: Healthcare implementation notification

specified in the second band for prostate and in the third band for bladder as pathology examinations similar to their surgical procedure points in the HIN tariff. However, in routine pathology examinations, although pathological interpretations of these two materials are similar, transurethral resections of the prostate have a much higher volume than the transurethral resections of the bladder; increasing the number of blocks and slides used in the transurethral resections of the prostate, thus making the time spent for the microscopic examination longer and the procedure costlier than resections of the bladder.

Interpretation of biopsies, which involve taking specimens from the same organ for different reasons, does not change the band of the pathology examination. For instance, incidental finding of the appendix during surgical procedure is in the first band in the HIN tariff and surgical procedure performed for appendicitis or appendix tumor in pathology examinations is on the second band in the HIN tariff. However, the appendix being taken out incidentally or taken out for appendicitis or appendix tumor does not

make a difference to the pathologist. Tumors can be found in the appendix taken out incidentally, or there might be no findings in the appendix that was taken out in search of tumors; the same procedure steps will be implemented regardless of the reason it was taken out.

Pathology examinations are different from other laboratory tests. Since it is a detailed examination of the tissue specimens, pathology examinations should be considered as a physical examination. The clinician cannot specify the type of pathology investigations needed except for some special tests such as for gene mutation or amyloidosis during the requesting issue. However, in our country, the authorisation of requesting specific type of pathological examination has been given to the clinicians. This situation is creating problems in practice. It is usually not possible to predict for every specimen what will be necessary for proper pathological evaluation before microscopic examination. These problems in practical life should be solved by government authorities. At the approval stage of the pathology report, the pathologist could define

the procedure why the tests were performed. This is an important step and, in fact, could be the solution to these problems in Turkey.

Findings of the study conducted by Ergün et al. (7) were compared to the Medicare Payment System in the United States of America, and it was emphasized that the prices specified for the investigations were high compared to the country the study was conducted and the costs, hence the labor costs and the cost of consumables are high due to mandatory standards for laboratories in that country. It was emphasized that bone marrow biopsies, which are priced within the first band in Turkey, are priced within the third band; amputations caused by benign factors are priced within the third band; kidney and liver biopsies, which are labor-intensive and within the second band in the HIN Tariff, are priced within the fourth band in the Medicare System.

There are significant differences between the pathology investigation prices specified in the HIN tariff and the real costs of these investigations. This shows that specifying service prices without conducting a costing analysis causes higher or lower pricing compared to the actual prices. Examinations that take a longer time to be reported than other examinations in their band increase the cost. Therefore, banding of these examinations that require more labor needs to be reconsidered. Preparing SUT tariffs with the help of guide-books and re-regulating them based on pathological interpretation will minimize current problems and provide a more realistic and appropriate pricing.

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CONFLICT OF INTEREST

Authors have no conflict of interest to declare.

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