COST IDENTIFICATION AND ANALYSIS FOR THE EXTRACTION OF PLASMA IN THE BLOOD BANK OF CIENFUEGOS CUBA

Reyes Hernández, Reynier
Facultad de Ciencias Económicas y Empresariales
Universidad de Cienfuegos Carlos Rafael Rodríguez
Cuatro Caminos, Cienfuegos, Cuba
reyreyes@ucf.edu.cu

Becerra Suárez, Keitel
Facultad de Ciencias Económicas y Empresariales
Universidad de Cienfuegos Carlos Rafael Rodríguez
Cuatro Caminos, Cienfuegos, Cuba
kbecerra@ucf.edu.cu

Gómez Alfonso, Elizabeth
Facultad de Ciencias Económicas y Empresariales
Universidad de Cienfuegos Carlos Rafael Rodríguez
Cuatro Caminos, Cienfuegos, Cuba
egomez@ucf.edu.cu

Pérez Falco, Grisel
Facultad de Ciencias Económicas y Empresariales
Universidad de Cienfuegos Carlos Rafael Rodríguez
Cuatro Caminos, Cienfuegos, Cuba
gpfalco@ucf.edu.cu

Pérez Guevara, David
Facultad de Ciencias Económicas y Empresariales
Universidad de Cienfuegos Carlos Rafael Rodríguez
Cuatro Caminos, Cienfuegos, Cuba
dpguevara@ucf.edu.cu

Reception date:04/23/12 - Approval date:05/15/12

ABSTRACT

The cost information is an indispensable tool for planning, monitoring and timely decisions making in the organizations and is one of the most important elements for the internal management and analysis. The accurately knowledge of production and services allows the asses and analysis of the procedures, activities and productions return. The Blood Bank of Cienfuegos is unable to determinate the costs of their individual productions, which are derived from blood drawn and require different processes to obtain the final product. The objective of this work is to establish a procedure for determining the costs of production arising from the blood in the Blood Bank of Cienfuegos; this is achieved by designing and implementing a process costing accounting techniques linking management function of providing elements necessary for decision making. This shows that the currently costing that the entity applies is inadequate because it generates a single cost for all their products when in fact each involves a different cost.

KEY WORDS: Cost; Blood; Procedure.

INTRODUCTION

Blood is not simply “a red liquid that flows through the veins and arteries” [Alvero, F., 1979, p. 733][(1)] it is also the component of the human body that allows all the organs to work as a result of its circulation through the arteries, veins and capillaries.

The main functions of blood are: transporting hormones, move oxygen and nutrients to the cells and extract from the cells all the waste products.

It intervenes also in the balance of acids, bases, salts and water inside the cells, it is involved in regulating the temperature of the cooling body organs such as the liver and muscles that produce excess heat, and as heat the skin, while components such as white blood cells are a critical means of defense against bacteria and other pathogens, and coagulation methods that prevent the loss of valuable liquid. All of these are enough reasons to value the importance that blood represents in the human body.

"Blood is a liquid tissue that covers the body and cells carrying all the necessary elements to perform vital functions and a set of very complex and important functions for life" [Ballester, J., 2004, p.5][(2)].

The demand of blood and blood products is increasing. The increase of accidents, the creations of intensive care units and the needs of some patients who were previously considered unrecoverable, are some of the elements that have led to this enhancement.

To respond the needs and demand of blood and blood products, health institutions worldwide rely on donations of blood and plasma or platelets.

> “Plasma is the liquid part of the blood and represents the 55% of the total blood volume. Mainly it consists in proteins, like immunoglobulin, clotting factors and minerals which are essential ingredients for proper functioning of the body. The demand of plasma is very high, not only because of the needs of transfusions in hospitals, also because the pharmaceutical industry produces many products from plasma as feedstock, or gamma-globulin, albumin, ant hemophilic factor VIII, among others. Plasma is used in patients with severe burns, coagulation disorders, liver disease, major bleeding, among other cases” [Alfonso, M.E., 2002a, p.2][(3)].

> “Cells Platelets are essentially involved in blood clotting. If these cells are missing or the number of them is low, there will be bleeding. On the other hand, they have the special feature (or disadvantage) of living a few days, so who has a lack of them need transfusions every 2-3 days, which is why some patients, as some cases of hematological patients or transplant may need several hundred units of platelets during their treatment. Platelets are used in patients with leukemia, a plastic anemia, cancer, transplant, and so on” [Alfonso, M.E., 2002b, p.3][(4)].

The process that accompanies a donation is strictly rigorous, comprehensive and complicated, since it starts from the analysis, testing and verification of the suitability of the donor, and then starts the work carried out at the Blood Bank.

Due to the particularities of the components and the blood derivatives, the worldwide procurement of them has high costs. Today thousands of people die every day simply because of not being able to have donated blood, plasma or platelets at the right time.

Cuba, within this global context, in spite of the economic, military and financial situation imposed by the Government of the United States for more than fifty years, is known for having blood banks where they are offered for free, immediate and unlimited quantities of these components that any person requires.

However, the whole production process for a bag of blood, plasma or platelets extraction is completely taken over by the revolutionary government, without receiving any monetary compensation, only the recognition of the people and their health.

The costs in the health sector have always been fundamental for the control of resources that are assigned to improve the quality and standard of living of the population; however, in the Provincial Blood Bank of Cienfuegos, and in any of its kind in the country, which are institutions subordinate to the Ministry of Public Health (MINSAP), it is possible to know the cost of producing a bag of blood or plasma, since the accumulation of extraction and production costs resulting from the blood, plasma or platelets, are made globally without any type of specific production; so all the resources that are sacrificed in the production are accumulated to one expense account without specifying its involvement in the final product, which constitutes an obstacle to the successful development of the planning and control of resources allocated for this purpose and therefore negatively impacts the economy because it does not represent the cost method of production derived from blood donations, plasma or platelets relevant and accurate elements to perform a correct decision.

Because of this problem it is necessary to reach the productions cost arising from the blood in Cienfuegos Provincial Bank.

The hypothesis is described as follows: with the design and implementation of a procedure for determining the costs of production arising from the blood in Cienfuegos Provincial Bank, is possible to know the unit cost of the same. This hypothesis is validated through the design and implementation of a procedure for the determination of plasma extraction costs in the Provincial Blood Bank of Cienfuegos, constituting this production with increased incidence and involvement within this institution. The main objective is to establish

a procedure for determining the costs of production arising from the blood in the Provincial Bank of Cienfuegos.

The specific objectives are:

1. Assess the state of the science on cost accounting and its implementation in Cuban health institutions.
2. Demonstrate the need for costing by production in the Provincial Blood Bank of Cienfuegos.
3. Design a procedure for determining the costs of production arising from the blood in the Provincial Bank of Cienfuegos.
4. Apply the proposed procedure for the extraction of plasma in the Provincial Blood Bank of Cienfuegos.

DEVELOPMENT

The costs in the Blood Banks

It is necessary to execute the derivatives blood productions costing generated in blood banks, especially when those elements are incorporated into patients for certain treatments, operations or medical care; also, these are raw materials for the productions of other medicines or treatments.

> The Cuban Ministry of Public Health, has establish for the Blood Banks only the existence of a general expenses account where are recorded all costs and expenses relating to materials, salaries, drugs, fixed assets, equipment, tools; so, all the expenses of the institution are charged to a single account, and then distributed by cost center. [Reyes y Pérez, 2009, p.22][(5)].

These accounting procedures do not allow the determination of the productions cost of the derivatives blood, because they cannot identify each cost element with the productions results.

Diagnosis of the situation of the costs in the Provincial Blood Bank of Cienfuegos and design procedure for the determination of costs

Economic events that occur in the execution of the activities of this institution are listed chronologically based on accounting registration techniques.

> "These facts are reflected in the primary document, which begins with a process for making accounting journal vouchers that are based on them, which are written down in different classification subsidiary records for accounts. Subsequently, the results are passed to the general ledger and the corresponding sub-ledgers, including the cost. However, this sub-mayor cost is not directly usable for determining the cost of each organizational area of the institution "[Ministry of Public Health of Cuba, 1960, 61] (6).

Hospital Costs Handbook, issued by the Cuban Ministry of Public Health, contain all the currently cost activity of the different health institutions in Cuba, and suggests the need to incorporate the cost of blood, in order to determine the actual expenses for a specific period, trough cost centers related to blood products.

As the Provincial Blood Bank of Cienfuegos has not an adequate system to accumulate costs, it is only able to perform statistical reports that are issued by all cost centers and processed in the accounting department at the end of each month, in which it sets out how much has been spent for different items.

The following list shows the expenses account, with their respective sub-item, which are used for recording and accumulation of costs and expenditure information.

Current Expenditure of the Entity

- Salaries and accrued vacation
- Social Security Contribution
- Taxes for the use of workforce
- Food, clothes and lingerie
- Medicines and medical products
- Other expenses (Fuels, lubricants, electricity, other productions expenses, others)
- Depreciation of tangible fixed assets

Although this institution already has its defined cost centers and accounts where are recorded each of the operations that are performed, they are unable to define the total costs and expenses, which are all recorded in the current cost account of the entity, the amounts that correspond to different types of production.

For that reason, we proceed to design a procedure for determining the costs of production arising from the blood in the Provincial Bank of Cienfuegos.

The method proposed consists of four phases, which take place in stages as shown in Figure 1.

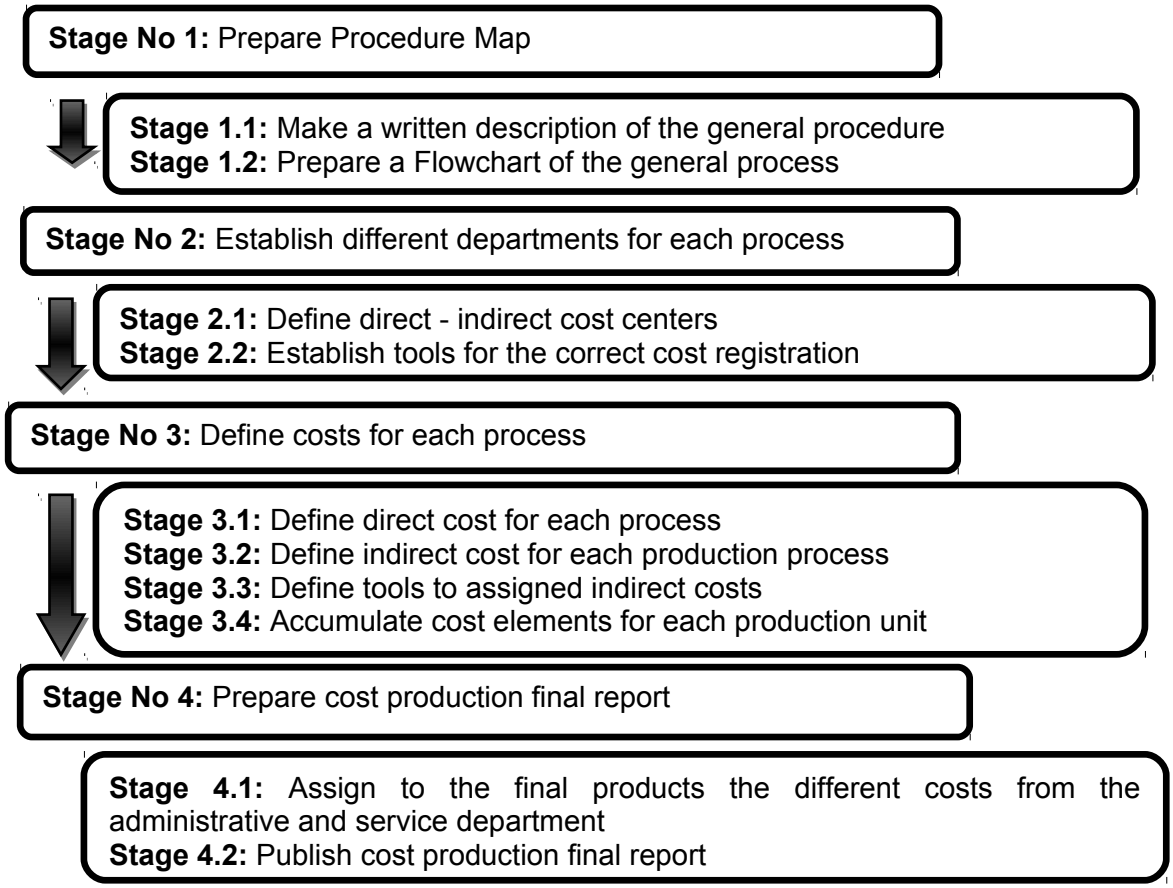


Figure 1. Determination of the costs procedure. Blood Blanks Productions
Source: Own Elaboration

With this procedure it is possible to obtain the cost of productions for each blood product that are held in the Provincial Bank of Cienfuegos.

Following are the main final results of its application for the extraction of plasma in the Provincial Blood Bank of Cienfuegos.

Costing for extraction processes in the plasma

Figure 2 shows the process diagram for the extraction of plasma for Cienfuegos Provincial Bank.

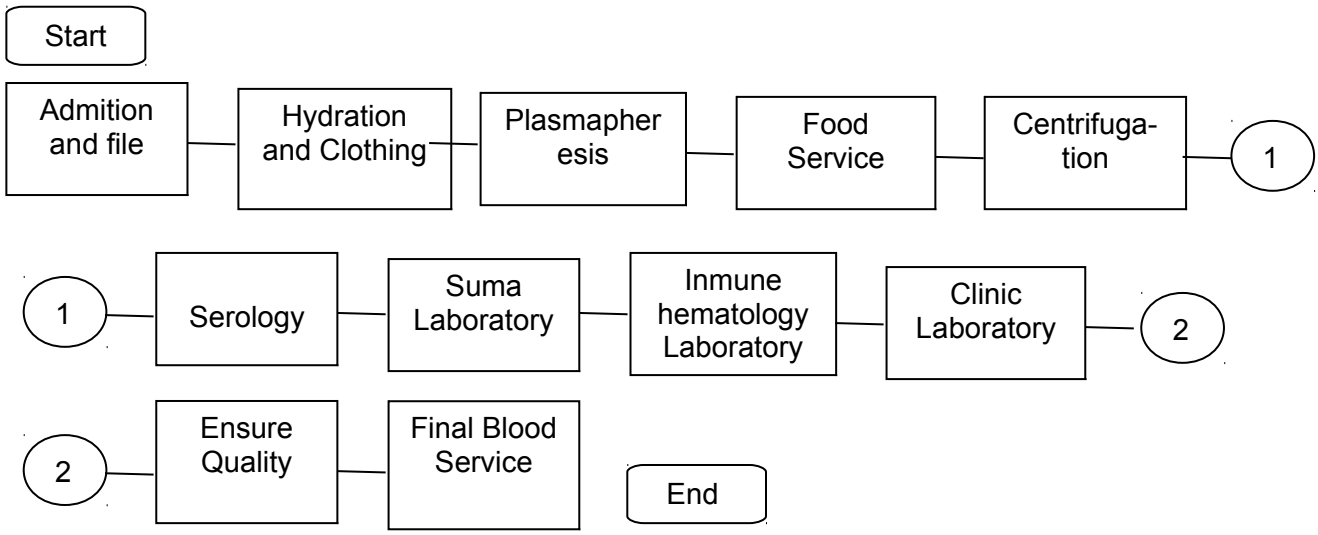


Figure 2. Flowchart. Extractions of plasma. Cienfuegos
Source: Own Elaboration

Costing for direct processes

Plasmapheresis Process:

This process makes the extraction of blood to the donor, obtaining two pilot tubes and a kit (bag plasmapheresis donation), which pass together with the proper and relevant documentation to different areas of laboratories for analysis; the plasmapheresis process requires of the following direct materials; filter and kit, from those who take the required amount multiplied by the cost of acquisition unit, and determine the material cost up to $16.78.

Regarding the use of direct labor, the process requires 1 Medicine specialist, 1 Nurse, 1 Laboratory technician. Of those who have taken the basic salary, the percentage accumulated corresponding to pay leave and their contribution to social security (12.5%) and workforce (25%) to give a monthly salary cost, which is assigned to the product taking in count the time that each of them invests in the process, in this case the cost, is $6.61.

Regarding the indirect cost, in this process the use of different material are considered indirect because they are too difficult to identify in the product, from those who have taken the monthly costs assigned to each cost center as well as for depreciation of tangible fixed assets, electricity and water consumed by the Parenteral cost center (where this process takes place), defined according to studies by the Blood Bank of Cienfuegos Provincial and cargo capacity, also considered indirect wage costs, cleaning and others that affect production. These amounts have been distributed among the number of donors on average

are handled in a month at this institution, giving a cost of indirect donor for this process $3.89, being the number of donors average distribution base for indirect elements in this process.

Accumulating the material cost, direct labor cost and indirect production cost; the cost of plasma per donor for the extraction service that derivate form the Plasmapheresis process in the Blood Bank of Cienfuegos is $27.30.

The same procedure is followed for the rest of the processes that directly affect the extraction of plasma in the blood bank of Cienfuegos Provincial whose results are shown below:

Sample Spinning Process:

In this process the collected sample (one of the pilot tubes) is centrifuged, obtaining as result two pilot tubes and one balita, which have to continue with the process and analysis of the sample. The cost per donor in this centrifugation process is $21.83.

Serology Process:

This process receives one of the tubes obtained from the centrifuge registering each of the operations that are carried out and their results, which are sent to Control and Quality Assurance. The cost per donor in this process for the extraction of plasma is $ 10.42.

Laboratory Addition Process:

This process takes place in the Clinical Laboratory cost center, you get the vial centrifugation of the sample, determine the sero-epidemiological evidence, the results are duly recorded and sent to quality, all of this with a sample are send to a blank blood to end the exams. The cost per donor in this process for the extraction of plasma is $ 13.61.

Immune-hematology Laboratory Process:

In this process, which also takes place within the Clinical Laboratory cost center, you receive one of the tubes and the documentation issued by the centrifugation of the sample and they give you several tests necessary to the same, the results are documented and sent to Quality. The cost per donor in this process for the extraction of plasma is $ 66.23.

Clinical Laboratory Process:

This process receives one of the tubes generated in parenteral and performing various tests, which are documented appropriately and sent to quality. The cost per donor in this process for the extraction of plasma amounts to $ 8.34.

Quality Assurance Process:

This process receives the kit that is the result of the extraction process with all the results and documentations that were made previously in other laboratories (serology, short, and clinical immune-hematology), analyze the quality of the sample and the rest exams and then all the results documentation are sent for blood service. The cost per donor in this process for the extraction of plasma is $ 0.56, since it only requires five minutes per sample by an inspector of tradability, and other indirect costs are not significant.

Blood Service Process:

This process receives the bag, the kit as the rest of the samples properly documented, dispatching the kit obtained in the extraction, registering the entire final process and dispatching to the appropriate sectors. The same is incurred a cost of $ 3.14, constituting the largest amount of direct labor at $ 1.90, because of the incidence of a Specialist and a Blood Service Technician.

After having determined the unit costs for each of the direct processes that are involved in the extraction of plasma in the Provincial Blood Bank of Cienfuegos, you may accumulate all this information and submit the cost report for the extraction of plasma. Here are summarized for all processes materials consumption (amount used for a donor multiplied by the unit cost of items), direct labor (staff time directly working on each direct process for the extraction of plasma multiplied by the hourly rate) and distributed through indirect allocation bases. Results shown in Table 1.

Table 1. Unit cost of direct processes. Extraction of plasma. Cienfuegos

Direct Materials	UM	Quantity	Price	Amount
Filter	U	1	$ 13.86	$ 13.86
Kit	U	1	2.92	2.92
Eppendorf vials	Paq	1	9.87	0.009
Pilot centrifuge tube	U	2	0.01	0.024
Cardiolipin Buffer (reagent)	U	1	0.19	0.19
VDRL antigen (reactive)	U	1	1.26	1.26
HBsAg Confirmatory Kit UMELISA	Pack.	1 unit	52.00	2.60
Recombinant HIV UMELISA Kit	Pack.	1 unit	204.00	0.42
HCV UMELISA Kit (480)	Pack.	1 unit	228.00	0.47
HbsAg UMELISA Kit PLUS	Pack.	1 unit	216.00	0.45
Substrate (Reagent)	jar	0.25 ml	2.99	0.006
Developer (reactive)	jar	0.25 ml	2.99	0.006
Cholesterol (reagent)	jar	2ml	36.35	0.605
Beta test tube (reagent)	jar	2ml	1.48	0.024
HemoTest (reactive)	jar	5ml	8.72	0.363
Heparin (reagent)	jar	5ml	2.63	0.109
Microhematocrit tube	jar	1	11.05	0.110
Sodium Citrate (reagent)	jar	0.5 ml	1.87	0.007
Prints	U	2	0.68	1.36
Special Pilot Tube	U	11	0.01	0.132
Total Direct Material				$ 24.51
Labor Cost assigned to each donor		Weights		$ 21.63
Overhead costs for patients		Weights		$ 112.75
TOTAL COST REMOVAL OF PLASMA		For patient		$ 158.90

Source: Own Elaboration

Finally, for the Final Report of the production costs for the extraction of plasma in the Provincial Blood Bank of Cienfuegos there only remains the distribution of the administrative and service costs to the final products through direct allocation method, that is, monthly costs are taken and recorded on each of them and are apportioned between the amounts of donations of all kinds, because those departments serve all donors of blood, plasma, platelets attending the Provincial Blood Bank of Cienfuegos and that amount will be added to the costs already calculated for the extraction of plasma. All this is shown in Tables 2 and 3.

Table 2. Allocation of costs Administrative and Service Departments to end

Departments	Total Cost	Donors (base distribution)	Cost per donor
Transport	849.00	425	2.00
Administrative areas	4652.50	425	10.95
Store	790.00	425	1.86
Maintenance	653.48	425	1.54
Kitchen	2707.00	425	6.37
Cafeteria	1398.50	425	3.29
Power Plant	505.60	425	1.19
Others	310.25	425	0.73
TOTAL	11866.33	425	27.92

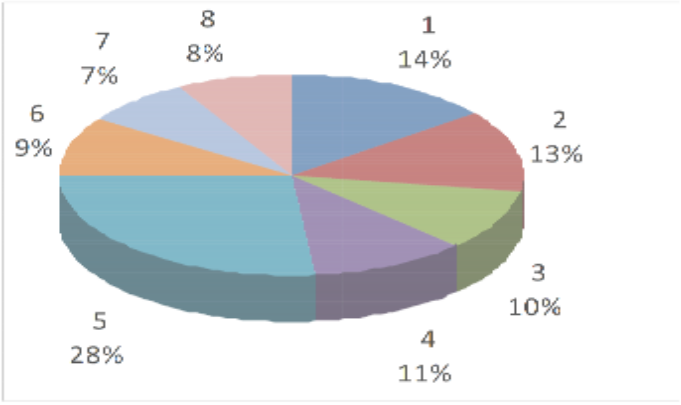
Source: Own Elaboration

Table 3. Incorporation of the costs assigned to the productions processes for the extraction of plasma in the blood bank of Cienfuegos Provincial

Processes	Cost	Earmarked	Total unit
Plasmapheresis	27.30		27.30
Centrifugation	21.83		21.83
Serology	10.42		10.42
Laboratory Addition	13.61		13.61
Immunohematology Lab	73.67		73.67
Clinical Laboratory	8.34		8.34
Quality Asgto	0.56		0.56
Blood Service	3.14		3.14
Support Centers		27.92	27.92
Unit cost plasma extraction	158.90	27.92	$ 186.82

Source: Own Elaboration

Following is graphically shown how each process affects the final cost of the extraction of plasma in the Provincial Blood Bank of Cienfuegos.



Reference:

1. Plasmapheresis
2. Centrifugation samples
3. Serology
4. Laboratory Addition
5. Immunohematology Laboratory
6. Clinical Laboratory
7. Quality Assurance
8. Blood Service

Figure 3. Plot of Plasma Extraction costs. Cienfuegos Blood Bank
Source: Own Elaboration

As shown in the cost of extraction of plasma in the Provincial Blood Bank of Cienfuegos, the process of higher incidence is being carried out in the Clinical Laboratory Cost Center and that has to do with the Immune-hematology.

This procedure allows to determine the costs of extracting plasma Provincial Blood Bank of Cienfuegos, disaggregating total costs recorded as current expenses of the Bank, the amounts corresponding to this blood derivative production. The same applies perfectly to all productions blood derivatives that are held in this institution and those of its kind in the country.

Validity of the proposed procedure

Below is a summary of the results obtained in this research and its comparison with all that, up to now, were being reported by the entity under study. The Provincial Blood Bank of Cienfuegos, delivery its productions of blood, plasma, platelets and other derivatives as predetermined costs that exist from the decade of 1980 - 1990 and are shown in Table 4.

Table 4. Prices of products derived from blood as current procedure

Produce	Price	Produce	Price
Whole blood	$ 56.00	PRBC	$ 30.00
Plasma Antihemophilic	54.00	Lyophilized Plasma	55.20
Fresh frozen plasma	48.00	Frozen Plasma	40.00
PRP	32.00	Platelet Concentrate	60.00
Leukocyte Mass	60.00	Antihemophilic globulin	54.00
PRBC	50.00	Frozen packed cells	60.00

Source: Own Elaboration, based on the cost of MINSAP Manuals

But actual costs playback blood derivatives are not to be predetermined as this research has shown that only the plasma extraction yields a cost of $158.90.

CONCLUSION

- The cost information must respond to the needs of the management of the entities and the country, in a way that supports the processes of planning, control and decision making.
- The Blood Bank of Cienfuegos Provincial cannot determine the cost of production of blood derivatives.
- The proposed procedure allows to determine the cost of extraction of Plasma in Provincial Blood Bank of Cienfuegos.
- The information currently reported on the costs of production arising from the blood does not reflect current costs which are incurred to obtain them.

BIBLIOGRAPHICAL REFERENCES

(1) ALVERO, F. (1979). Cervantes Diccionario Manual de la Lengua Española. Tomo I. Ciudad de la Habana, Editorial Pueblo y Educación, p. 733.

(2) BALLESTER, J. “La sangre en el cuerpo humano”. Revista cubana de Hematología, Inmunología y Hemoterapia, Enero- Marzo de 2004, Volumen 15, Año 2, No 5, p. 5.

(3) ALFONSO, M.E. “La donación de Plasma y plaquetas”. Revista cubana de Hematología, Inmunología y Hemoterapia, Septiembre – Diciembre de 2002a, Volumen 18, Año 3, No 2, p. 2.

(4) ALFONSO, M.E. “La donación de Plasma y plaquetas”. Revista cubana de Hematología, Inmunología y Hemoterapia, Septiembre – Diciembre de 2002b, Volumen 18, Año 3, No 3, p. 3.

(5) REYES, R. (2009). Determinación de los costos por pacientes en instituciones hospitalarias cubanas. Su aplicación en el hospital provincial de Cienfuegos. Tesis de maestría en contabilidad de gestión. Universidad de la Habana – UH, p. 22.

(6) MINISTERIO DE SALUD PÚBLICA. (1990). Manual de costos hospitalarios. La Habana. Cuba, p. 61.

BIBLIOGRAPHY

Please refer to articles Spanish Bibliography.