

Cost – Benefit Analysis: Patient Care at Neurological Intensive Care Unit

Analiza kosztów i korzyści: Opieka nad pacjentem w Oddziale Intensywnej Opieki Neurologicznej

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Abstract

Background. Modern quality definition relies on patient centeredness and on patient needs for particular services, continuous control of the service provided, complete service quality management, and setting quality indicators as the health service endpoints. The health service provided to the patient has certain costs. Thus, one can ask the following: *To what extent does the increasing cost of patient care with changes in elimination improve the quality of health care and what costs are justifiable?*

Aim. The aim of the study was cost determination for patient care with the use of a quality aid relative to classic care without a quality aid, with special reference to changes in elimination.

Material and methods. The study included a sample of 224 patients admitted to the Neurological Intensive Care Unit (NICU), University Department of Neurology, “Sestre Milosrdnice” University Hospital Centre. A list of data designed exclusively for research purposes and modified according to neurologic patient needs was used to follow patient needs during NICU stay with special reference to elimination. Besides data from the list, other data necessary for the study were obtained by direct questions and personnel performance observation.

Results. Study results are presented in three logical units, as follows: laundry, nurses and expendable supplies (urinary catheters, diapers etc.). In both cases (classic management, quality aid), hospital linen maintenance accounted for the largest portion of related costs; however, with classic management it was fourfold that recorded with the use of quality aid. This cost increase was additionally generated by longer time required for patient care provided by nurses. The only saving recorded with classic management relative to quality aid management referred to the cost of expendable care supplies; however, due to the low share of these supplies in the overall cost this finding was not in favour of quality aid non-utilization.

Conclusions. Data presented in this study indicate the cost of managing elimination problems to be lowered more than twice with the use of quality aid as compared with classic management. (PNN 2012;1(2):58-64)

Key words: neurological patient, intensive care unit, cost-benefit analysis

Streszczenie

Wprowadzenie. Współczesna definicja jakości zorientowana jest na pacjenta i na jego wymaganiach dotyczących poszczególnych usług, na ciągłej kontroli świadczonych usług, zarządzania jakością oraz ustanowieniu wskaźników jakości jako wyznaczników działania służby zdrowia. Usługi zdrowotne świadczone dla pacjenta mają pewne określone koszty. Można zatem zadać następujące pytanie: *W jakim stopniu rosnące koszty opieki nad pacjentem powodują poprawę jakości opieki zdrowotnej i jakie koszty są uzasadnione?*

Cel. Celem pracy było określenie i porównanie kosztów opieki nad pacjentem z wykorzystaniem uwarunkowań jakości w klasycznym modelu zarządzania oraz modelu zarządzania przez jakość.

Materiał i metody. Badaniem objęto grupę 224 pacjentów przyjętych na Oddział Intensywnej Opieki Neurologicznej, Kliniki Neurologii, Szpitala Uniwersyteckiego „Sestre Milosrdnice”. Do określenia potrzeb pacjenta w trakcie pobytu w Oddziale Intensywnej Opieki Neurologicznej przygotowano listę danych służących wyłącznie do celów badawczych. Pozostałe dane niezbędne do przeprowadzenia badania uzupełniono o bezpośredni wywiad oraz obserwacje personelu.

Wyniki. Wyniki badań zostały przedstawione w trzech logicznych obszarach dotyczących zagadnień: pralnia, praca pielęgniarki oraz akcesoria (cewniki moczowe, pieluchy itp.). W obu przypadkach (zarządzania klasycznego i przez jakość) utrzymanie w czystości bielizny szpitalnej stanowiło największą część kosztów i było czterokrotnie wyższe w zarządzaniu klasycznym w porównaniu do zarządzania przez jakość. Ten wzrost kosztów został dodatkowo spowodowany dłuższym czasem opieki pielęgniarskiej nad pacjentem. Jedyną oszczędność w klasycznym modelu zarządzania w stosunku do zarządzania przez jakość, to koszt jednorazowych materiałów, jednak ze względu na niski udział tych materiałów w całkowitym koszcie, to stwierdzenie nie uzasadnia zastosowania tej metody.

Wnioski. Dane zaprezentowane w niniejszym opracowaniu wskazują, że eliminację kosztów można uzyskać obniżając je więcej niż dwukrotnie, stosując metodę zarządzania przez jakość w porównaniu z metodą zarządzania klasyczną. (PNN 2012;1(2):58-64)

Słowa kluczowe: pacjent neurologiczny, oddział intensywnej opieki medycznej, analiza kosztów i korzyści

Introduction

The pattern of demographic changes in society indicates a steady increase in the elderly population, resulting in ever greater proportion of individuals requiring health care service at primary and secondary levels. This in turn implies increasing efforts of those involved to provide quality health care to our patients. As stroke is the third leading cause of morbidity and mortality in Europe and worldwide, attention has been increasingly focused on stroke prevention and providing quality care for stroke patients. One of the most common medical/nursing problems in these patients is change in elimination, which additionally affects their mental health. As ensuring quality health care is currently in the focus of interest, all health care professionals tend to provide it, which is even more emphasized in health care for neurologic patients. Obviously, great advances have been made in the field, in line with changes we face daily in our practice. In addition, modern quality definition relies on patient centeredness and on patient needs for particular services, continuous control of the service provided, complete service quality management, and setting quality indicators as the health service endpoints [1].

The health service provided to the patient has certain costs. Thus, one can ask the following: "To what extent does the increasing cost of patient care with changes in elimination improve the quality of health care and what costs are justifiable?" The present study was based on the financial structure of neurologic patient health care with changes in elimination by use of a quality aid as compared with classic care. Personnel cost was analyzed along with material cost [2].

The Intensive Care Unit of the Department of Neurology, as part of intensive and interventional neurology, provides care to a group of neurological patients who required intensive care measures (due to the nature of neurological disease or the general condition of patients), or some form of neurological or neuroradiological intervention treatment.

The largest number of urgently admitted or moved patients are patients with cerebrovascular diseases, especially patients with acute and/or subacute

stroke or bleeding in the brain. Of course, other patients who require intensive treatment are also treated in the Unit, including patients who need continuous monitoring, mechanical ventilation and/or intensive care, and these are most frequently patients in epileptic status, patients with myasthenic crisis, acute polyradiculitis, or patients with rare diseases manifested in neurological symptoms and requiring intensive medical care.

The aim of the study was cost determination for patient care with the use of a quality aid relative to classic care without a quality aid, with special reference to changes in elimination.

Material and methods

The study included a sample of 224 patients admitted to the Neurological Intensive Care Unit (NICU), University Department of Neurology, Sestre Milosrdnice University Hospital Centre, during a 4-month period (February through May 2011). A list of data designed exclusively for research purposes and modified according to neurologic patient needs was used to follow patient needs during NICU stay with special reference to elimination. Besides data from the list, other data necessary for the study were obtained by direct questions and personnel performance observation. Statistical analysis included a follow-up of absolute and relative frequency of the events observed and arithmetic means expressing the needs. Data were collected, analysed and validated. Direct health care indicators were calculated from data obtained on personnel (nurse) time required for solving elimination problems, and cost of this time. Expendable supplies used on elimination (urinary catheters, urinary bags, diapers and rubber clothes) as required by each individual patient during NICU stay, as well as the time invested by laundry personnel, water and electricity consumption for washing, drying and ironing exclusively for NICU were included in the analysis. Figure 1 shows patient data observed during NICU stay and data obtained by direct questions posed to the Hospital technical personnel. All necessary information on the methods of work, time and tariff for washing, drying, ironing

and distribution of hospital lining was obtained by posing questions, making rounds and observing the procedures, talking to technical personnel and laundry workers. In order to get the real cost structure, indirect indicators such as monthly salary of laundry workers, and hourly wage of laundry workers and NICU staff were also taken into consideration.

Comparison of cases managed with the use of a quality aid and classic patient care required setting of certain prerequisites, in this case supported by the rich experience of staff members with long-standing work at NICU. The prerequisites implied assessment of the time required for classic patient management *versus* patient management with the use of a quality aid.

Results

Laundry

As shown below, this item accounted for the largest portion of the elimination related cost. We had to know the amount of linen used *per* 24 h at NICU and the overall amount of linen at the Hospital. Total laundry cost was obtained from data on electricity consumption (washing machines, drying machines and ironing machines), water and detergent, and personnel work.

Regarding the needs of the Intensive Neurological Treatment Unit, 5 washing machines per day are used

is used daily for linen, which is 16 HRK for washing the linen of patients whose elimination problem has been treated with a quality aid (table 2), that is, 80 HRK for washing the linen of patients whose elimination problem has been treated with a poor quality aid (table 2a).

The staff of the linen maintenance service is the most expensive item in the cost benefit analysis of linen maintenance. As indirect support systems, they are classified in two working shifts, a total of 16 hours during 24 hours. The total number of workers is 35 persons for the previously presented linen maintenance system. When using a quality aid to treat the elimination problem, daily work consumption per worker is 875 HRK (table 2), that is, 218.75 HRK when a poor quality aid is used (table 2a).

Assuming that 80 kg of linen per day are necessary to treat the elimination problem with a quality aid, that is, 130 kg to treat the elimination problem with a poor quality aid, daily costs total 41.69 HRK and 166.75 HRK respectively (table 2a). Regardless of the type of aids used, daily consumption is 23 m³.

Ironing costs are calculated per m³ of linen, for the same weight of linen in the calculation of water costs, the cost price is 14.50 HRK with the use of a quality aid (table 2), that is, 58 HRK with the use of a poor quality aid (table 2a).

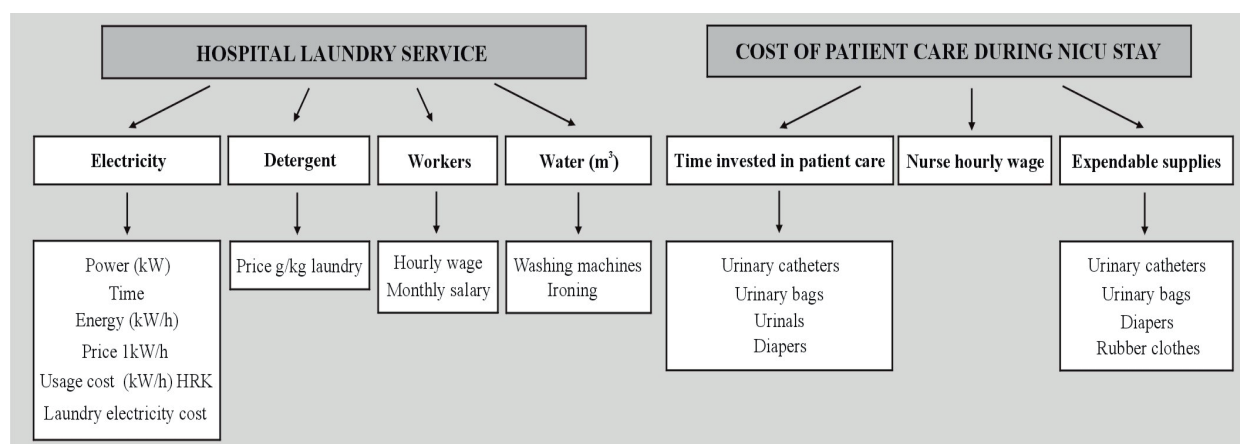


Figure 1. Patient data observed

for laundry services. 120 kW of electricity is consumed for laundry. The cost for a poor quality aid and the cost for a quality aid amount to 37.80 HRK and 9.45 HRK respectively per day. During the drying cycle electricity consumption totals 6 kW, which totals 15.12 HRK for a poor quality aid and 3.02 HRK for a quality aid in the consumption price. During the ironing process electricity consumption is 15 kW per electricity unit, which totals 9.45 HRK for a quality aid (table 2) and 37.80 HRK for a poor quality aid (table 2a).

Detergent consumption is presented as required grams of detergent per kg of linen. 20 grams of detergent is used per one kg of linen. 1600 g of detergent

Nurses

The cost of managing elimination problems by NICU nurses was obtained by monitoring the frequency of particular procedures (placement of urinary catheters, changing urinary bags, urinal placement, placement of diapers, and patient personal hygiene) and recording the time invested for each procedure *per* time unit. The assumption is that a patient has his diapers changed 4 times in 24 hours. If a patient wets the bed the same number of times, the time of service of a nurse, the number of procedures of a nurse and the cost of linen maintenance increase (table 3 and 3a).

Table 2. Total laundry cost cases managed with the use of a quality aid

HOSPITAL LAUNDRY SERVICE						
Electricity						
	power kW	time h	energy kWh	price 1 kWh	price HRK/kWh	price (neurology)
washing machines	120	2	240	0.63 HRK	151.20 HRK	9.45 HRK
drying machines	6	0.8	4.8	0.63 HRK	3.02 HRK	3.02 HRK
ironing	15	16	240	0.63 HRK	151.20 HRK	9.45 HRK
Detergent						
washing machines	20 g/kg	–	1600			16 HRK
Workers						
35			100 HRK/day		3,500 HRK	218.75 HRK
Water						
	capacity m ³	time h	wother total	price 1 m ³	price total	price (neurology)
washing machines	23	1	23	29	667.00 HRK	41.69 HRK
ironing	0.5	16	8	29	232.00 HRK	14.50 HRK
					1 day	312.86 HRK
					1 month	9,385.85 HRK
					4 months	37,543.38 HRK

Table 2a. Total laundry cost cases managed with classic patient care

HOSPITAL LAUNDRY SERVICE						
Electricity						
	power kW	time h	energy kWh	price 1 kWh	price HRK/kWh	price (neurology)
washing machines	120	2	240	0.63 HRK	151.20 HRK	37.80 HRK
drying machines	6	4	24	0.63 HRK	15.12 HRK	15.12 HRK
ironing	15	16	240	0.63 HRK	151.20 HRK	37.80 HRK
Detergent						
washing machines	20 g/kg	–	8000			80 HRK
Workers						
35			100 HRK/day		3,500 HRK	875.00 HRK
Water						
	capacity m ³	time h	wother total	price 1 m ³	price total	price (neurology)
washing machines	23	1	23	29	667.00 HRK	166.75 HRK
ironing	0.5	16	8	29	232.00 HRK	58.00 HRK
					1 day	1,270.47 HRK
					1 month	38,114.10 HRK
					4 months	152,456.40 HRK

Expendable supplies

The cost of expendable supplies required for the management of elimination problems was obtained by monitoring consumption of these materials and recording the price of each material. The analysis showed that during 4 months of managing elimination problems more expendable supplies are used in treating a patient with a quality aid than if the same patient is treated with a poor quality aid (table 4 and 4a).

The data presented were collected at NICU, where patient management is carried out by use of quality aids. Data on the classic management of elimination problems were deduced by increasing the presumed utilization of hospital linen and time of patient management by nurses. Study results are shown in table 5.

Results obtained by the analysis of costs for the management of patient elimination problems by use of

a quality aid are presented in the left panel, while the right panel shows the respective results for the classic management of elimination problems.

In calculating the final cost of treating elimination problems with a poor quality aid a total of 190,091.31 HRK is spent, whereas a total of 72,167.96 HRK is spent for managing the elimination problem. The cost benefit analysis has shown that the saving amounts to 117,923.35.

ing quality care with the use of quality aid can result in cost savings at long term while reducing consumption for parallel services. The costs and the quality of care should be properly balanced. Providing quality care requires good practice, which is closely related to education; this will then result in quality health care at a rational cost. Work standards, control of nursing time utilization and performance quality control make the basis upon which nursing practice should rely.

Table 3. Total nurses cost

CARE COSTS DURING TREATMENT					
	Min	Pieces	Total minutes in 4 months	Total minutes in 1 month	Total minutes in 1 day
Urinary catheters	10.00	73.00	730.00	182.50	6.08
Urinary bags	3.00	576.00	1,728.00	432.00	14.40
Bed urinals	3.00	72.00	216.00	54.00	1.80
Diapers	9.00	2,506.00	22,554.00	5,638.50	187.95
	0.00		0.00	0.00	0.00
Hourly wage of a nurse (gross) 52.52 HRK					
Total hours			420.47	105.12	3.50
Hours per nurse			70.08	17.52	0.58
Cost per nurse			3,680.48 HRK	920.12 HRK	30.67 HRK
Cost per staff			22,082.91 HRK	5,520.73 HRK	184.02 HRK

Discussion

The results of this study answer the question posed at the beginning affirmatively: "Is a quality aid at the same time an economical aid?" Economical aid enables quality performance, but it is not the only solution for quality care free from complications during patient hospital stay. Data from quality control monitoring on the absence of urinary infections, diaper rash, fungal inflammation and decubitus ulcers during the study support the quality of work, suggesting that provid-

Continuous, systematic standardized collection, analysis and interpretation of data related to plans for permanent training and comparison with health statistics can be useful in the educational system when creating programs that will result in competent and competitive workers. Determination of priorities, ongoing program evaluation and research encouragement can be of utmost importance when support individuals and groups in career management and professional development [3].

Table 3a. Total nurses cost

CARE COSTS DURING TREATMENT					
	Min	Pieces	Total minutes in 4 months	Total minutes in 1 month	Total minutes in 1 day
Urinary catheters	10.00	73.00	730.00	182.50	6.08
Urinary bags	3.00	576.00	1,728.00	432.00	14.40
Bed urinals	3.00	72.00	216.00	54.00	1.80
Washing without diapers	13.50	2,506.00	33,831.00	8,457.75	281.93
	0.00		0.00	0.00	0.00
Hourly wage of a nurse (gross) 52.52 HRK					
Total hours			608.42	105.10	5.07
Hours per nurse			101.40	25.35	0.85
Cost per nurse			5,325.67 HRK	1,331.42 HRK	44.38 HRK
Cost per staff			31,954.04 HRK	7,988.51 HRK	266.28 HRK

Table 4. Total cost of expendable supplies

EXPENDABLE SUPPLIES					
	Pieces/24h	Unit price	Price per day	Price per 1 month	Price in 4 months
Urinary bags	4.8	1.79	8.59 HRK	257.76 HRK	1,031.04 HRK
Urinary catheters	0.608	2.84	1.73 HRK	51.80 HRK	207.21 HRK
Diapers	20.88	3.29	68.70 HRK	2,060.86 HRK	8,243.42 HRK
Rubber clothes	25	1.02	25.50 HRK	765.00 HRK	3,060.00 HRK
Total			104.51 HRK	3,135.42 HRK	12,541.67 HRK
FINAL COST					
	1 day		1 month		4 months
Laundry service	312.86 HRK		9,385 HRK		37,543.38 HRK
Nurses	184.02 HRK		5,520.73 HRK		22,082.91 HRK
Expendable supplies	104.51 HRK		3,155.42 HRK		12,541.67 HRK
Total	601.40 HRK		18,041.99 HRK		72,167.96 HRK

Table 4a. Total cost of expendable supplies

EXPENDABLE SUPPLIES					
	Pieces/24h	Unit price	Price per day	Price per 1 month	Price in 4 months
Urinary bags	4.8	1.79	8.59 HRK	257.76 HRK	1,031.04 HRK
Urinary catheters	0.608	0.82	0.50 HRK	14.96 HRK	59.83 HRK
Diapers	0	3.29	0.00 HRK	0.00 HRK	0.00 HRK
Rubber clothes	37.5	1.02	38.25 HRK	1,147.50 HRK	4,590.00 HRK
Total			47.34 HRK	1,420.22 HRK	5,680.87 HRK
FINAL COST					
	1 day		1 month		4 months
Laundry service	1,270.47 HRK		38,114.10 HRK		152,456.40 HRK
Nurses	266.28 HRK		7,988.51 HRK		31,954.04 HRK
Expendable supplies	47.34 HRK		1,420.22 HRK		5,680.87 HRK
Total	1,584.09 HRK		47,522.83 HRK		190,091.31 HRK

Conclusion

Data presented in this study indicate the cost of managing elimination problems to be lowered more than twice with the use of quality aid as compared with classic management. In both cases, hospital linen maintenance accounted for the largest portion of related costs; however, with classic management it was fourfold that recorded with the use of quality aid. This cost increase was additionally generated by longer time required for patient care provided by nurses. The only saving recorded with classic management relative to quality aid management referred to the cost of expendable care supplies; however, due to the low share of these supplies in the overall cost this finding was not in favour of quality aid non-utilization.

Implications for Nursing Practice

Good organization of the implementation of health care in hospitals, which is always based on well-

educated and competent nurses, can significantly affect the overall success of treatment that has the expert and financial effects. Since nurses in a hospital care carry out more than 80% of all the procedures in 24 hours, their impact on the total care is proportional to their share in the health care. It should be noted that nurses' expertise is most important but so are other elements: a sufficient number of nurses, good distribution, based on changing needs, good equipment and accessories for the implementation of health care and space conditions [4].

Limitations to Study

Costs and losses resulting from an investment in a venture are onetime and certain, while revenues and benefits are long-term and uncertain. This complicates the cost-benefit analysis process, especially when we are confronted only with benefits that are indirect and that contribute to the effects of beneficiaries, in this

Table 5. Total cost analysis

COST ANALYSIS							
QUALITY AID				CLASSIC MANAGEMENT			
	24 h	1 month	4 months		24 h	1 month	4 months
Laundry	312.86 HRK	9,385.85 HRK	37,543.38 HRK	Laundry	1,270.47 HRK	38,114.10 HRK	152,456.40 HRK
Nurses	184.02 HRK	5,520.73 HRK	22,082.91 HRK	Nurses	266.28 HRK	7,988.51 HRK	31,954.04 HRK
Expendable supplies	104.51 HRK	3,135.42 HRK	12,541.67 HRK	Expendable supplies	47.34 HRK	1,420.22 HRK	5,680.87 HRK
Total	601.40 HRK	18,041.99 HRK	72,167.96 HRK	Total	1,584.09 HRK	47,522.83 HRK	190,091.31 HRK

case patients. For example, it is easy to determine the costs and losses of applying useful aids in faeces and urine elimination, but it is not at all easy to determine the economic benefits for many beneficiaries of these aids resulting from improved health care. And it is even impossible and unnecessary to quantify the costs and losses arising from degrading the environment through inadequate diapers and waste water after washing linen, or revenues and benefits arising from faster and easier elimination management. In any case, if investments are higher, the cost-benefit analysis is also more complicated because the "game" includes more "variables", economic life and uncertainty are long, and the risk is higher.

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