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Do we know the costs of what we prescribe?

A study on awareness of the cost of drugs and devices among ICU staff

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Abstract *Objective:* To evaluate the level of cost awareness of drugs and devices among intensive care unit (ICU) doctors with variable levels of experience (senior intensivists, junior intensivists, residents).
Design: Interview-questionnaire.
Setting: ICU of the University of Rome "La Sapienza".
Participants: 60 ICU doctors (40 specialists in anaesthesia and intensive care, 20 residents).
Measurements and results: The estimated prices of drugs and devices were compared with the correct prices; responses within a range ± 20 % of the true price were arbitrarily considered correct; all the subgroups of doctors made inaccurate estimates of the prices, showing an absence of any impact of professional experience of cost awareness.
Conclusion: The doctors in the study showed a high level of inacurrate cost awareness of drugs and devices.

Key words Cost analysis · ICU · Equipment · Drugs

Introduction

The profound changes in the last 10 years in the socioeconomic situation in Europe has also greatly affected public health systems: in this situation, the policy of cost containment of hospital care certainly plays a central role.

As clinicians, we are now not only involved in taking care of patients and their diseases, but also in controlling expenditure and meeting budget plans. This is particularly important in intensive care medicine, particularly considering the elevated costs of intensive care units (ICUs) [1–3].

Few details are known about the European situation, but ICUs currently represent the major cost centres in the United States and Canada [4–5]. In this context, it becomes essential to be informed and aware of the relevant costs of drugs and devices currently used in the care of critically ill patients [6]. A few European studies [7–9] have analysed this aspect, particularly between the anesthetist and the intensivist, indicating that cost awareness, at least among anaesthetic staff, is limited.

There are no data on cost awareness among staff in southern Europe: the aim of this study was to test the level of present knowledge of costs in a group of 60 anaesthetists-intensivists of various grades. We asked these doctors to estimate, by means of an interview-questionnaire, the costs of 27 items (drugs and devices) currently used in Italian ICUs and/or in the course of emergency anaesthesia. We also evaluated the possible relationship between the amount of professional experience (expressed in terms of years of specific professional activity) and the knowledge of costs of drugs and devices in current use.

Table 1 Real cost of drugs (per vial) and cost estimation from the three groups of doctors in the study (*A* anesthetists)

Items	Price (Lire)	Senior A. intensivists (mean + SD)	Junior A. intensivists (mean + SD)	Residents (mean + SD)
Propofol	14.400	13.950 ± 9.643	18.375 ± 13.876	16.300 ± 10.668
Thiopentone	4.600	2.425 ± 1.290[a]	4.466 ± 2.834	7.475 ± 8.917
Pancuronium	2.700	2.250 ± 1.371	2.165 ± 1.091	2.700 ± 2.239
Atracurium	7.700	4.760 ± 2.911	6.865 ± 8.952	4.425 ± 3.027
Atropine	260	585 ± 564	827 ± 1.088	707 ± 410
Fentanyl	4.200	3.502 ± 3.236[a]	9.955 ± 13.904	14.098 ± 22.776
Isoflurane	184.700	111.250 ± 70.777	116.755 ± 74.770	165.451 ± 106.805
Betamethasone	1.500	1.720 ± 1.523	1.784 ± 1.971	1.682 ± 1.005
Ranitidine	1.300	6.525 ± 10.456	6.780 ± 9.781	4.010 ± 2.646
Dopamine	1.000	3.250 ± 2.899	5.235 ± 5.333	9.850 ± 21.377
Nitroglycerin	7.700	5.700 ± 5.759	4.707 ± 2.842	8.525 ± 11.123
Clonidine	1.400	1.795 ± 1.579[a]	3.602 ± 3.540	3.460 ± 2.797
Penicillin G	3.400	5.500 ± 3.631[a,b]	16.750 ± 15.828	17.750 ± 11.443
Teicoplanin	72.300	39.450 ± 22.251	38.550 ± 14.866	27.350 ± 12.049
Amikacin	16.800	18.200 ± 9.278	24.275 ± 15.712	28.650 ± 13.666

[a] Significant vs residents
[b] Significant vs junior anesthetists

Table 2 Real cost of devices (per unit) and cost estimation from the three groups of doctors in the study (*A* anesthetists)

Items	Price (Lire)	Senior A. intensivists (mean + SD)	Junior A. intensivists (mean + SD)	Residents (mean + SD)
Venflon 18 G.	2.600	6.175 ± 3.904	3.965 + 3.250	4.055 + 2.808
Standard infusion set	350	2.840 ± 6.472[a]	2.435 ± 2.164	3.800 ± 3.400
ETT Ø 8	4.050	11.940 ± 7.577	13.485 ± 11.127	22.250 ± 18.316
Ventilator set	59.800	35.550 ± 25.889	36.250 ± 28.414	42.300 ± 38.404
HME filter	23.500	13.400 ± 12.327	13.600 ± 9.875	11.500 ± 12.894
Nasogastric catheter	700	3.385 ± 2.949	3.020 ± 1.908	4.825 ± 3.134
Trilumen catheter	117.800	95.300 ± 55.301	123.250 ± 94.580	138.000 ± 143.796
Urinary bladder catheter	7.850	9.550 ± 6.793	10.875 ± 8.410	16.750 ± 13.214
3-way stopcock	1.000	4.707 ± 4.715	3.165 ± 2.384	6.285 ± 5.160
ABBOTT pump infusion set	25.000	17.075 ± 18.723	17.885 ± 19.377	21.950 ± 18.653
TPN bag	4.500	14.150 ± 13.267	23.350 ± 18.478	28.350 ± 27.863
Spinal needle 22 G	2.400	6.075 ± 5.289[a]	6.415 ± 4.880	27.300 ± 27.946

[a] Significant vs residents

Materials and methods

A questionnaire listing 15 drugs and 12 devices commonly used for routine ICU treatment and emergency anaesthetic practice was devised. This questionnaire required, for each item, the cost in Italian lire per vial or per unit of product.

When this study was performed (December 1995) from 90 anaesthetic staff, we included 40 doctors from the Anaesthesia and Intensive Care Institute of the University of Rome "La Sapienza" at random. It is important to note that in the Italian public health system general intensive care can be provided only by specialists in anaesthesia and intensive care.

For the purposes of this study, they were divided into two groups of 20: group A = senior doctors and group B = junior doctors, respectively with more or less than 6 years of continuous professional experience in anaesthesia and intensive care. As a control group (C), 20 residents in their last 2 years of specialization in anaesthesia and intensive care at the same university, were asked to complete the same interview-questionnaire.

In the presence of one of the authors, each doctor was asked to complete the questionnaire individually and anonymously, estimating the price of each item, without referring to price lists or conferring with other members of the staff. The correct prices of all items were obtained from our hospital pharmacy department. Responses within a range of ± 20 % of the true price were arbitrarily considered as correct. The mean ± standard deviation and the median were calculated for the estimated values of each item (expressed in absolute numbers), and for each group of doctors in the study.

Statistical analysis was performed comparing the differences among the three groups with a non-parametric test (Kruskall-Wallis). A p value less than 0.05 was considered as significant.

The results of the study were shown to group A doctors ($n = 20$); they were asked to summarize the main reasons behind the observed inaccuracies and these reasons have been detailed in order of frequency of response.

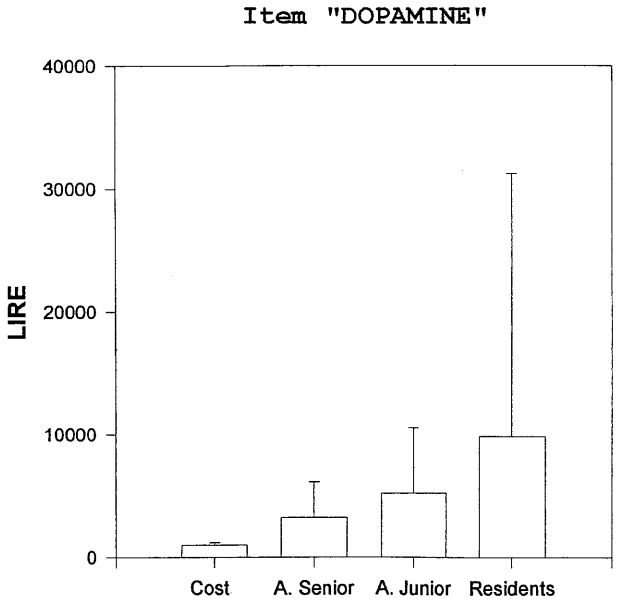

Fig. 1 Cost estimation for dopamine vial (200 mg) (*A* anesthetists)

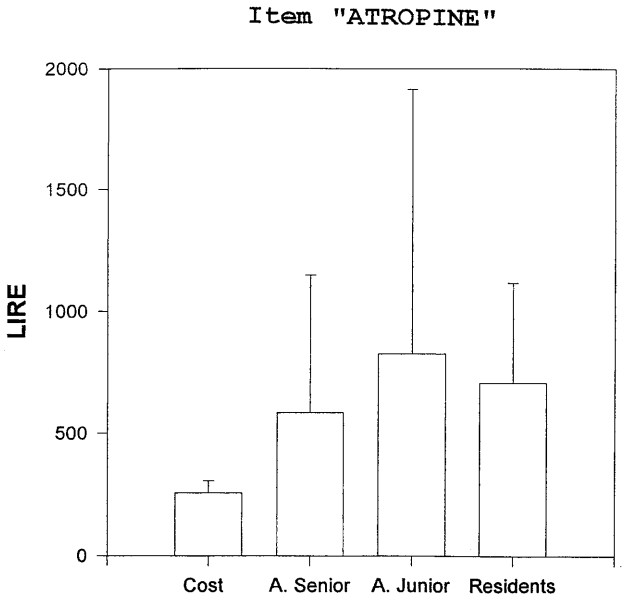

Fig. 3 Cost estimation for atropine vial (0.5 mg) (*A* anesthetists)

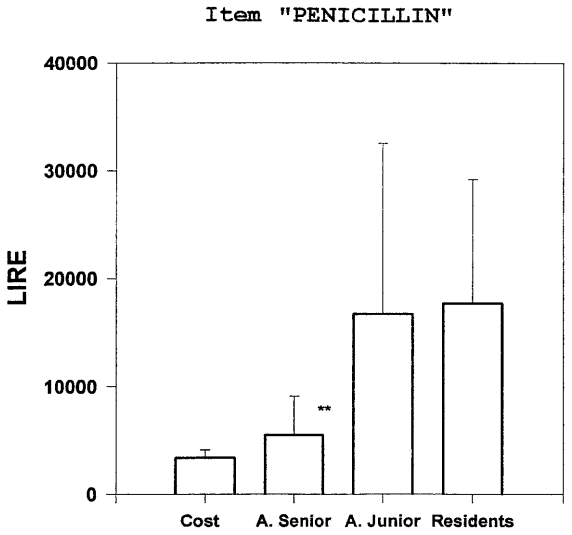

Fig. 2 Cost estimation for penicillin G 1 000 000 U. ** Significantly different versus A. Junior, residents ($p < 0.001$) (*A* anesthetists)

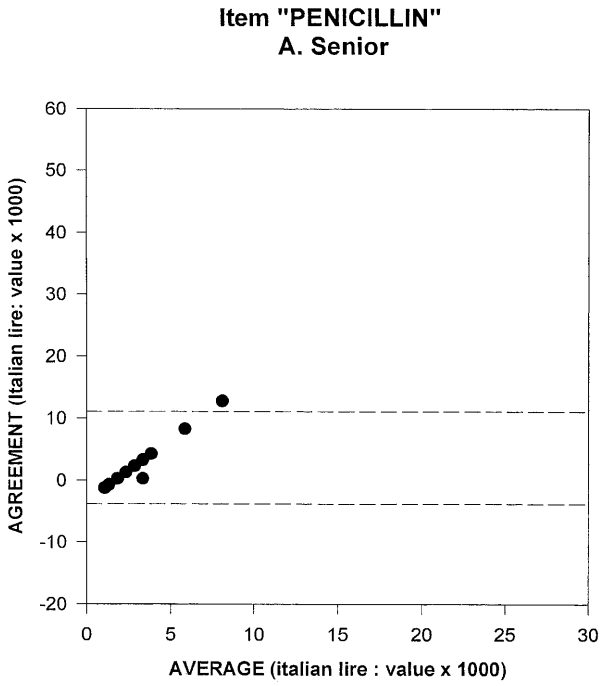

Fig. 4 Bland and Altman plot of item "penicillin" (group A senior doctors) (*A* anesthetists)

Results

Group A and group B doctors were significantly different in terms of years of specialization and professional activity ($p < 0.001$). The estimates of each item, expressed by mean ± SD values for each group of doctors, are shown in Tables 1 and 2. The numbers of correct and incorrect responses were calculated; the differences among the three groups were not significant.

For drugs, the number of correct responses were 2.9 ± 1.4 (group A), 2.4 ± 1.3 (group B) and 2 ± 1.6 (group C), and for devices, 1.8 ± 1.3 (group A), 1.6 ± 1.1 (group B) and 1.3 ± 1 (group C) (NS). The incorrect responses were then divided into two groups: those overestimating ⩾ 20 % and those underestimating ⩽ 20 % the true price; in the first group a significant difference between group C and group A was observed

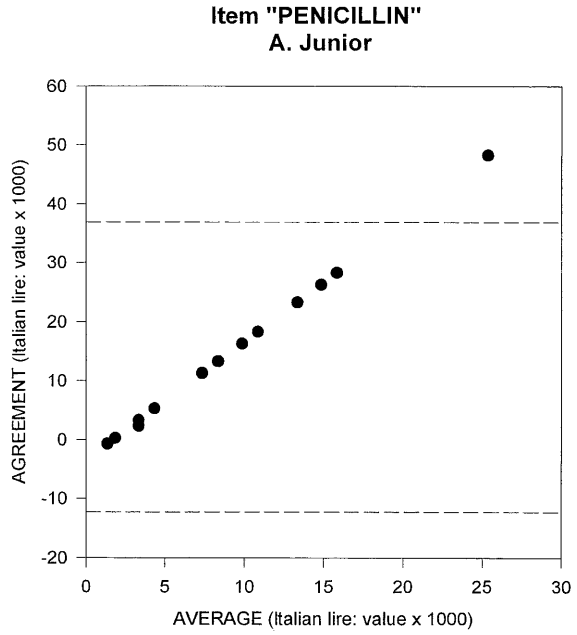

Fig. 5 Bland and Altman plot of item "penicillin" (group B junior doctors) (*A* anesthetists)

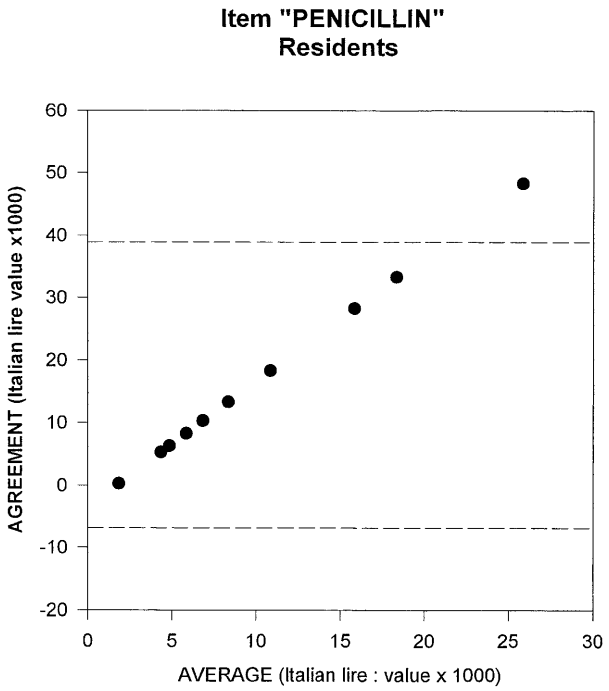

Fig. 6 Bland and Altman plot of item "penicillin" (group C residents doctors) (*A* anesthetists)

($p < 0.01$ for the drug questionnaire, $p < 0.05$ for the devices questionnaire), suggesting a tendency to overestimate in the group of residents (C). Figures 1, 2 and 3 illustrate some of the items which were most inaccurately estimated.

It is odd that the cost of several relatively expensive items was consistently underestimated and, on the contrary, several inexpensive items were consistently overestimated. (For example, see isoflurane and penicillin G in Table 1). The tendency of the younger doctors (group B and group C) to grossly overestimate the costs of some "old" drugs can be observed in the example of the Bland and Altman plot of the item "penicillin" (see Figs. 4, 5, 6).

The main reasons for inaccurate cost estimations (group A doctors) were as follows: (1) lack of preparation on the economic aspects of medicine during the academic course ($n = 12$); (2) lack of contacts (!) between clinicians and administration ($n = 5$); (3) non-acceptance of the economic implications for ethical reasons ($n = 2$); (4) lack of econometric updating after the academic course ($n = 1$).

Discussion

This study reveals that cost awareness among the anaesthetists-intensivists enrolled in the study was lacking, and knowledge of the costs of drugs and devices was highly inaccurate, with less than a 20% correct estimation for both drugs and devices. Moreover, even though the difference in years of professional experience was highly significant, all three groups of doctors made similar inaccurate estimates. One of the goals of medical care is to provide cost-effective management while maintaining a high quality of care: in this context accurate information about the costs of individual items would permit the medical staff to modify their practice in order to reduce waste and, therefore, optimise resources, without compromising patient care. A detailed analysis of the resources individually consumed by ICU patients has recently been published by Noseworthy et al. [10], showing a cost/day per patient of $ 1508 ± 475 (1992 Canadian dollars), where drugs, supplies and medication represented 20.4% of the total cost.

It is important to note that the current economic climate in Europe (and particularly in Southern Europe) dictates that all physicians practising in ICUs know the costs of patient care in order that some economic considerations can be introduced into their decision analysis. In view of the escalating costs of intensive care, this approach, producing direct budget saving, must not be considered as a reduction in the level of patient care but simply as a way to optimise expenditure, avoiding waste [11, 12]. Drugs and single-use devices are in fact a minor, but not marginal, source of expense [9].

The results of this study are, therefore, discouraging, given both the level of inaccuracy and the lack of impact of professional experience on cost awareness. Although we feel that cost awareness is insufficiently widespread among European intensivists [7–9], this inaccuracy

may, at least in part, be due to the peculiar public health system organization adopted until 1994 in Italy, which consisted of a sort of uncontrolled use of drugs, devices and medical facilities for all Italian citizens, with no control (or with minimal controls) from peripheral or central administrations. This system has been replaced, since 1996, by a diagnosis related group (DRG) oriented system, but the results of our study suggest how difficult it can be to make the transition from the absence of economic thinking to an economically oriented use of drugs and devices, in view of the diffuse lack of cost awareness among ICU doctors.

In conclusion, this study has demonstrated a high level of inaccuracy in cost awareness, for both drugs and medical devices in the ICU. This seems to be little influenced by the level of doctors' experience and by their age and tends towards a gross overestimate of cheap items and an underestimate of costly items: it is interesting also that the younger doctors (groups B and C) tend to overestimate the costs of older drugs (see penicillin, as an example), probably because they are more familiar with more recent drugs of the same class with higher prices.

Surprisingly, when the results of the study were shown to group A doctors, none was surprised by the high level of inaccuracy, and 18 out of 20 indicated as possible main causes the lack of interest in the economic implications of therapy during university training or the absence of direct communication between clinicians and hospital administration, thus indirectly indicating where we should probably concentrate efforts to solve the problem of lack of cost awareness.

Our results suggest in fact that, at least in Italy, public health administrations and academic organisations should ensure that there are educational programmes dedicated to cost awareness for doctors. The economically oriented DRG system may contain elements of budget control and cost-containment, and we plan in the future to re-evaluate this aspect with a new study, to assess precisely the effects of the DRG system on doctors' cost awareness.

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