# E-procurement in the Brazilian healthcare system: the impact of joint drug purchases by a hospital network

*Fernando Sigulem*[1] *and Paola Zucchi*[2]

**Suggested citation** Sigulem F, Zucchi P. E-procurement in the Brazilian healthcare system: the impact of joint drug purchases by a hospital network. Rev Panam Salud Publica. 2009;26(5):429–34.

**ABSTRACT**

**Objective**. *To evaluate the use of e-procurement to obtain supplies for a network of seven university hospitals with a joint purchase system.*

**Methods**. *The study was carried out between October 2003 and October 2005. We analyzed nine joint purchases of 37 pharmaceutical items. All the items were purchased in at least two-thirds of the nine occasions and/or were among the 10 items with the highest expenditure. The following aspects were recorded: price, number of suppliers providing quotes, type of supplier (distributor or manufacturer), reference value (lowest price paid per item by each hospital prior to the establishment of the joint purchase system), unit price for first purchase, and unit price for last purchase. The percent variation in price was compared in relation to the reference value, first and last purchases, and average unit price for the nine purchases.*

**Results**. *A decrease in price > 10% was observed in 47% of the medications analyzed. A decrease > 20% was recorded in 32% of the 37 items. Five items (midazolam 5 mg 3 mL, tramadol 100 mg 2 mL, vancocin 500 mg vial, ceftazidime 1 g vial and cefepime 1 g vial) had a decrease ≥ 50% in unit cost in the first purchase compared to the last purchase value. The unit price for 26 items (70%) had an average reduction of 23%.*

**Conclusions**. *E-procurement was successful in achieving real savings. The results show that the incorporation of new management technologies such as e-procurement in the healthcare setting may help overcome the management gap in the healthcare sector.*

**Key words** Group purchasing; hospital administration; pharmaceutical trade; Brazil.

Healthcare is a major sector in any economy (1). In Brazil, the opening of new markets in a number of segments enabled the entry of new technologies and exposed the healthcare sector in general and the hospital sector in particular to a high degree of competitiveness in terms of management development (2).

The Brazilian hospital network encompasses public, private, and mixed institutions, and is quite heterogeneous from the standpoint of technology incorporation and complexity of services (3). The Brazilian public healthcare system—*Sistema Único de Saúde*, SUS—includes 5 864 hospitals, of which 3 497 are private, 2 117 are public, and 150 are university hospitals (4). The system presents some idiosyncratic features with regard to other sectors of the economy (5): for example, despite being extremely productive and developed in scientific and technological aspects, it lags well behind other areas with respect to management issues (6).

On average, 65% of expenditures in a hospital unit revolve around payroll, followed by medical and hospital material and medications (MatMed). In the chain of MatMed costs, medication comes in first (7). Therefore, the close monitoring of medication costs is crucial for the allocation of resources, as is the search for tools to ensure control over these costs.

In that sense, the telecommunications revolution changed the global business model, placing emphasis on the Internet as a fast, efficient and cost-effective tool for commerce (8). The advantages of business-to-business (B2B)—the practice of electronic commerce between dif-

[1] Universidade Federal de São Paulo, Centro Paulista em Economia da Saúde (CPES–UNIFESP), Programa de Mestrado Profissional em Economia da Saúde. Correspondence: Rua Dr. Fausto Ferraz 227, CEP 01333-030, São Paulo, SP, Brazil. Tel.: +55-11-8115.1999; e-mail: fsigulem@gmail.com

[2] Universidade Federal de São Paulo, Centro Paulista em Economia da Saúde (CPES–UNIFESP), São Paulo, Brazil.

ferent parties sharing a corporate focus (9)—include integration of the supply chain, an increase in the number of sales channels, increased competitiveness, access to new suppliers, acquisition of company productivity, reduced purchase cycle times, 24-hour-a-day, 7-day-a-week operational availability, faster process-completion time, reduced costs in all Internet-assisted processes, lower cost of information exchange among partners, reduced number of process errors, reduction in the physical circulation of documents, reduction in the cost of purchase processing, and enhanced geographic scope (suppliers and clients can have random geographic distribution) (10, 11). Along the same lines, the process of electronic procurement (e-procurement) refers to the use of electronic systems to identify supplies and suppliers, for acquisition planning, purchasing, inventory control, receipt inspection and other related operations (12). It also covers aspects such as logistics, receiving, purchasing, and cost analysis (13). The commercial relationship established between the hospital sector and the hospital supply network is adequate and appropriate for the use of e-procurement (14)—including business intelligence tools and systems that increase both the response and analytical capacity of organizations (12).

The purpose of this study was to evaluate the use of e-procurement in healthcare institutions to obtain supplies for a public hospital network using a joint purchase system (group purchasing).

**TABLE 1. Items in the joint medication purchase list used by a network of university hospitals, São Paulo, Brazil, 2003–2005**

| Code | Description | ATC[a] |
|---|---|---|
| 1 | Distilled water 10 mL—injectable | V07AB01 |
| 2 | Ethyl alcohol 70%—liter | V07AV05 |
| 3 | Ceftriaxone IV 1 g vial—injectable | J01DA13 |
| 4 | Glucose 5% 500 mL—flask | B05BA03 |
| 5 | Imipenem + cilastatine 500 mg vial—injectable | J01DH51 |
| 6 | Isoflurane 100 mL—flask | N01AB06 |
| 7 | Midazolam 5 mg 3 mL—injectable | N05CD08 |
| 8 | Propofol 10 mg/mL 20 mL—injectable | N01AX10 |
| 9 | Saline 0.9% 100 or 125 mL—flask | B05XA03 |
| 10 | Lactated Ringer's solution 500 mL—flask | B05BB01 |
| 11 | Tramadol 100 mg 2 mL—injectable | N02AX02 |
| 12 | Vancocin 500 mg vial—injectable | J01XA01 |
| 13 | Ceftazidime 1 g vial—injectable | J01DA11 |
| 14 | Tenoxicam 20 mg vial—injectable | M01AC02 |
| 15 | Distilled water 1000 mL—flask | V07AB01 |
| 16 | Distilled water 500 mL—flask | V07AB01 |
| 17 | Distilled water 250 mL—flask[b] | V07AB01 |
| 18 | Glucose 5% 1000 mL—flask | B05BA03 |
| 19 | Glucose 5% 250 mL—flask | B05BA03 |
| 20 | Glucose 5% 125 mL—flask | B05BA03 |
| 21 | Glucose 10% 1000 mL—flask | B05BA03 |
| 22 | Glucose 10% 500 mL—flask | B05BA03 |
| 23 | Glucose 10% 250 mL—flask[b] | B05BA03 |
| 24 | Colloidal solution (polypeptide) 3% 500 mL—flask | B05AA06 |
| 25 | Distilled water 125 100 mL—flask | V07AB01 |
| 26 | Saline 0.9% 250 mL—flask | B05XA03 |
| 27 | Saline 0.9% 500 mL – flask | B05XA03 |
| 28 | Saline 0.9% 1000 mL—flask | B05XA03 |
| 29 | Saline 0.9% 2000 mL—flask | B05XA03 |
| 30 | Simple Ringer's solution 500 ml—flask | B05BB01 |
| 31 | Glucose 25% 10 mL—injectable | B05BA03 |
| 32 | Glucose 50% 10 mL—injectable | B05BA03 |
| 33 | Physiological solution 0.9% 10 mL—flask | B05XA03 |
| 34 | Potassium chloride 19.1% 10 mL—injectable | B05XA01 |
| 35 | Potassium chloride 20% 10 mL—injectable | B05XA03 |
| 36 | Human albumin 20% 50 mL vial—injectable[b] | B05AA01 |
| 37 | Cefepime 1 g vial—injectable | J01DA24 |
| 38 | Enoxaparin sodium 20 mg 0.2 mL—syringe | B01AB05 |
| 39 | Enoxaparin sodium 60 mg 0.6 mL—syringe[b] | B01AB05 |
| 40 | Hemostatic gelatin sponge size 100—piece[b] | B05AA06 |
| 41 | Anti RHO immunoglobulin (D) 300 mg vial—injectable[b] | J06BB01 |
| 42 | Methylprednisolone 500 mg—injectable | H02AB04 |
| 43 | Cephalothin sodium 1 g vial—injectable | J01DA03 |

[a] ATC = anatomical therapeutic chemical classification (15).
[b] Items not included in the drug consumer basket analyzed in this study.

## MATERIALS AND METHODS

The study was carried out between October 2003 and October 2005, following approval by the Research Ethics Committee at the Federal University of São Paulo (UNIFESP).

We analyzed the joint purchase medication list (15) (Table 1) used by a network including seven public teaching hospitals with a total of 2 167 beds, managed by the São Paulo Association for the Development of Medicine (*Associação Paulista para o Desenvolvimento da Medicina*, SPDM). A database tracks the acquisition of medications in thrice-yearly joint purchases by the hospital network. During the study period, there were nine quotes and medication purchases.

The purchasing process employed by SPDM is based on an online e-commerce platform. The platform is integrated into the hospital inventory, pharmacy or nursing management systems, which place orders through the platform. Purchasing then selects the items to be quoted, issuing a quote request. Vendors receive an electronic notification regarding the new quote request and connect to the platform to enter data. The platform categorizes all the responses per item and provides relevant information. The items to be purchased are selected following criteria established by SPDM and purchase orders are issued. The approved purchase orders are then forwarded to the hospital management system for completion of the purchasing process.

For the present study, a drug consumer basket (DCB) was created, including 37 items from the joint purchase medication list based on the following criteria: being quoted and purchased in at least two-thirds of the nine quotes and/or being among the 10 items with the highest expenditure. Six items did not meet these criteria and were therefore not included in the DCB (Table 1). The behavior of the following variables was evaluated for the DCB: price, average number of suppliers providing quotes, type of supplier (distributor or manufacturer), reference value (lowest price paid per item by each hospital prior to the establishment of the joint purchase sys-

tem), unit price for first purchase, and unit price for last purchase of DCB items.

The prices (in Brazilian currency, R$) of DCB items were restated using the Brazilian General Market Price Index (IGP-M) to adjust for inflation for the period between October 2003 and October 2005. Data were imported from an Oracle® database (version 9i) into a Microsoft® Excel® spreadsheet (version 2007) for comparison of prices in terms of their percent variation at different time points.

## RESULTS

Table 2 shows the disbursement ranking of DCB items in the nine quotes. In the first quote, the total amount spent (R$ 790 871,42) is the lowest in the period. In the second quote, the total expenditure is twice the amount spent in the first purchase. Code 5 represents the largest single-item expenditure in the entire study period, accounting for just over one-fourth of the total amount spent on all quotes.

The results show that the expenditure for the top ten items in the list was close to 72% of the total amount purchased in the study period, regardless of the items making the top ten list. Expenditure for the 11th to the 20th position was on average 18% during the entire period. For items placed between the 21st and 37th positions average expenditure was 10%. Twenty-one items among the 37 items in the DCB made it to the top ten expenditure list in the nine quotes.

Concerning vendors, the mean number of manufacturers quoting prices in the period was 12 vs. 18 distributors. Nevertheless, most purchases were made from manufacturers (six vs. two from distributors). Table 3 shows performance indicators and results for the university hospital e-procurement/joint purchase model, expressed as percent variation (Δ%) of unit prices at time of first purchase in relation to the reference value, percent variation of unit prices in the last purchase in relation to the first purchase, and percent variation of unit prices at the first and last purchases in comparison to the average price of the item during the study period.

For the comparison between price at first purchase and reference values, the largest decrease is observed for code 12 (65.6%). A reduction of more than 40% was observed for codes 1, 3, 12, 33, and 37. Only four items—8, 24, 29, and 42—did not vary; for all others, a reduction in price was observed.

Table 3 also shows that during the study period, an increase in price (ranging from 0.9 to 8.7%) was observed for only 11 items—4, 6, 10, 15, 16, 19, 26, 27, 29, 28, 30, as shown by the comparison between price at last purchase and price at first purchase. The largest decrease in price (68%) was observed for code 7. Comparing the prices at first vs. last purchase also revealed a price decline greater than 10% in more than 47% of the items. A price reduction > 20% was observed in 32% of the items. Five items (items 7, 11, 12, 13, 37) had their unit price reduced by more than 50%.

The percent variation (Δ%) of unit price at first or last purchase in relation to average unit prices during the study period (Table 3) ranged widely, from an increase > 7% for code 14 at first purchase to a reduction of nearly 37% for code 7 at the last purchase. A stabilization *vis à vis* the average price was observed, with unit prices at the last purchase presenting less variability than unit prices at first purchases.

## DISCUSSION

Identifying and understanding the behavior of drug acquisition costs is essential for the management of any hospital. For the purposes of hospital management, a cost center ought to include: an autonomous negotiation unit, a cost-generating source, objective identity, a specific measuring unit and functional homogeneity (16).

E-commerce of drugs is increasing on a global scale (17). E-procurement—which is already well established, disseminated and developed in other sectors of the economy, such as civil construction—is still in its early stages in hospital environments. Nevertheless, the trade relationship established between the hospital sector and the network of suppliers is adequate and appropriate for e-procurement (6). The introduction of e-procurement is not a technological revolution, but rather a change in the way of doing business facilitated by technology, as well as a new alternative to control cost and rationalize expenditures with medication (18).

Concerning the public hospital network in this study, it should be noted that a committee of professional pharmacists was created to standardize the type and brand of medications used in all the participating facilities and to distribute these medications. In addition, an e-procurement platform was adopted to ensure transparency for the mediation of commercial transactions—benefiting purchasing hospitals on the one hand with the possibility of expenditure rationalization, and suppliers on the other hand with sales on a larger scale. According to Kruetten et al. (19), the independence of such e-procurement platforms is critical for success. That means that they must not be connected to suppliers or subject to control by consumers (19). Adopting this principle, an Internet-based solution (Bionexo do Brasil™, www.bionexo.com.br) was adopted as the e-procurement platform used for joint medication purchases by this hospital network.

In the ranking of cost disbursement for DCB items, three levels of expenditure emerged that helped interpret the quotes. Those were divided according to the ranking of items in increasing order of consumption value (7). In the first quotation, it is observed that the first to tenth positions correspond to 73% of expenditure; a second level, from the 11th to the 20th position, corresponds to around 21%, while a third level, from the 21st to the 32nd item corresponds to 6% of the R$ 790 871.42 (100%) spent. This indicates that expenditure is concentrated in a few DCB items, a behavior that has been previously described for other sectors. Considering all quotes, a similar distribution is observed, with items in the three levels corresponding to 72, 18, and 10%, respectively of expenditures. The importance of this observation lies in the outfitting of procurement practices and hospital management to make decisions on allocation of medication resources (20).

In the period of the nine quotes, a high rate of supplier participation was observed in response to each quote with self-contained proposals. In fact, the average number of participants was 30, indicating a high level of competition resulting from the use of the e-procurement/joint purchase system we describe. This supports the notion that free competition is an ideal scenario for more efficient negotiation among companies (21). Carabello underscores that e-procurement in the supply of medications contributes to improved

**TABLE 2. Ranking of items according to their percent participation in the total amount purchased in nine joint electronic purchases by a hospital network, São Paulo, Brazil, 2003–2005[a]**

| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 1 to 9 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rank | Code | % | Code | % | Code | % | Code | % | Code | % | Code | % | Code | % | Code | % | Code | % | Code | % |
| 1st | 12 | 13.0 | 5 | 45.3 | 5 | 40.9 | 5 | 35.7 | 5 | 37.5 | 5 | 32.5 | 37 | 21.5 | 37 | 16.2 | 37 | 14.7 | 5 | 26.1 |
| 2nd | 6 | 11.1 | 12 | 14.7 | 12 | 15.4 | 37 | 13.1 | 12 | 11.2 | 37 | 14.2 | 14 | 8.8 | 12 | 11.1 | 12 | 11.9 | 12 | 11.2 |
| 3rd | 3 | 10.0 | 3 | 4.0 | 43 | 4.7 | 12 | 7.0 | 37 | 5.6 | 12 | 10.2 | 12 | 6.6 | 14 | 8.0 | 14 | 7.9 | 37 | 9.2 |
| 4th | 9 | 6.6 | 27 | 3.9 | 27 | 3.5 | 43 | 4.6 | 43 | 4.3 | 14 | 5.3 | 27 | 6.5 | 6 | 6.6 | 43 | 6.7 | 14 | 4.5 |
| 5th | 7 | 5.7 | 9 | 2.4 | 9 | 3.1 | 42 | 3.4 | 6 | 3.9 | 43 | 4.1 | 28 | 4.2 | 43 | 5.1 | 27 | 6.7 | 27 | 4.0 |
| 6th | 8 | 5.7 | 4 | 2.3 | 6 | 3.0 | 14 | 3.3 | 14 | 3.4 | 6 | 3.0 | 43 | 4.1 | 27 | 4.8 | 6 | 6.1 | 43 | 3.8 |
| 7th | 4 | 5.7 | 26 | 2.1 | 3 | 2.8 | 27 | 3.0 | 9 | 3.3 | 3 | 2.8 | 4 | 4.0 | 2 | 4.3 | 3 | 4.6 | 3 | 3.6 |
| 8th | 13 | 5.6 | 7 | 2.0 | 14 | 2.3 | 6 | 2.9 | 3 | 3.2 | 27 | 2.4 | 11 | 3.8 | 28 | 3.9 | 28 | 3.9 | 6 | 3.3 |
| 9th | 11 | 5.2 | 10 | 2.0 | 8 | 2.3 | 3 | 2.7 | 27 | 3.2 | 38 | 2.1 | 9 | 3.8 | 9 | 3.6 | 9 | 3.8 | 9 | 3.1 |
| 10th | 27 | 4.4 | 28 | 1.9 | 11 | 2.2 | 9 | 2.4 | 4 | 2.2 | 42 | 2.1 | 26 | 3.3 | 3 | 3.5 | 26 | 3.1 | 2 | 2.4 |
| 11th | 1 | 4.1 | 11 | 1.8 | 28 | 1.9 | 38 | 1.8 | 28 | 1.9 | 11 | 1.9 | 38 | 3.3 | 42 | 3.0 | 33 | 3.0 | 4 | 2.2 |
| 12th | 14 | 3.7 | 13 | 1.7 | 26 | 1.9 | 26 | 1.7 | 11 | 1.8 | 28 | 1.8 | 8 | 2.8 | 26 | 2.9 | 42 | 2.9 | 11 | 2.2 |
| 13th | 10 | 2.4 | 1 | 1.6 | 10 | 1.7 | 28 | 1.6 | 8 | 1.8 | 8 | 1.6 | 33 | 2.4 | 33 | 2.7 | 10 | 2.8 | 26 | 2.1 |
| 14th | 26 | 2.1 | 33 | 1.5 | 2 | 1.5 | 4 | 1.5 | 26 | 1.6 | 33 | 1.5 | 1 | 2.4 | 1 | 2.3 | 4 | 2.7 | 8 | 2.1 |
| 15th | 2 | 1.8 | 14 | 1.4 | 4 | 1.5 | 33 | 1.5 | 10 | 1.6 | 26 | 1.4 | 6 | 2.3 | 38 | 2.3 | 8 | 2.5 | 10 | 1.8 |
| 16th | 33 | 1.8 | 8 | 1.3 | 1 | 1.3 | 1 | 1.4 | 33 | 1.5 | 9 | 1.4 | 10 | 2.3 | 8 | 2.1 | 1 | 2.5 | 1 | 1.8 |
| 17th | 28 | 1.8 | 25 | 1.3 | 13 | 1.3 | 10 | 1.3 | 1 | 1.4 | 10 | 1.4 | 24 | 2.1 | 10 | 2.1 | 11 | 2.2 | 34 | 1.7 |
| 18th | 24 | 1.5 | 2 | 1.2 | 7 | 1.3 | 11 | 1.3 | 42 | 1.1 | 2 | 1.2 | 2 | 2.0 | 13 | 2.0 | 24 | 1.8 | 42 | 1.6 |
| 19th | 18 | 1.4 | 15 | 1.1 | 25 | 1.1 | 8 | 1.3 | 7 | 1.1 | 4 | 1.1 | 3 | 1.7 | 4 | 1.9 | 2 | 1.6 | 2 | 1.5 |
| 20th | 16 | 0.9 | 6 | 0.9 | 33 | 1.0 | 7 | 1.0 | 15 | 1.0 | 1 | 0.9 | 25 | 1.7 | 11 | 1.7 | 25 | 1.3 | 33 | 1.5 |
| 21st | 19 | 0.9 | 24 | 0.9 | 15 | 0.8 | 13 | 0.9 | 2 | 0.9 | 24 | 0.8 | 16 | 1.4 | 24 | 1.7 | 13 | 1.1 | 7 | 1.4 |
| 22nd | 35 | 0.8 | 18 | 0.7 | 24 | 0.8 | 25 | 0.8 | 25 | 0.9 | 7 | 0.7 | 18 | 1.4 | 25 | 1.1 | 15 | 1.0 | 13 | 1.4 |
| 23rd | 25 | 0.7 | 22 | 0.7 | 18 | 0.7 | 15 | 0.7 | 13 | 0.7 | 18 | 0.7 | 7 | 1.3 | 15 | 1.0 | 16 | 1.0 | 38 | 1.1 |
| 24th | 34 | 0.7 | 19 | 0.6 | 22 | 0.7 | 24 | 0.7 | 24 | 0.7 | 22 | 0.6 | 15 | 1.2 | 16 | 1.0 | 35 | 0.8 | 24 | 1.1 |
| 25th | 32 | 0.6 | 35 | 0.6 | 19 | 0.5 | 2 | 0.7 | 22 | 0.6 | 25 | 0.5 | 19 | 0.9 | 22 | 0.7 | 7 | 0.7 | 25 | 1.0 |
| 26th | 22 | 0.6 | 16 | 0.5 | 16 | 0.4 | 22 | 0.6 | 38 | 0.6 | 15 | 0.5 | 42 | 0.9 | 35 | 0.6 | 18 | 0.7 | 15 | 0.9 |
| 27th | 15 | 0.5 | 32 | 0.5 | 35 | 0.3 | 18 | 0.5 | 18 | 0.5 | 13 | 0.5 | 22 | 0.9 | 19 | 0.5 | 19 | 0.7 | 18 | 0.7 |
| 28th | 30 | 0.2 | 34 | 0.5 | 21 | 0.2 | 19 | 0.4 | 19 | 0.5 | 35 | 0.4 | 13 | 0.8 | 34 | 0.5 | 34 | 0.5 | 16 | 0.6 |
| 29th | 29 | 0.2 | 20 | 0.2 | 20 | 0.2 | 35 | 0.4 | 35 | 0.4 | 16 | 0.4 | 35 | 0.5 | 18 | 0.5 | 22 | 0.3 | 22 | 0.6 |
| 30th | 20 | 0.2 | 29 | 0.1 | 34 | 0.2 | 16 | 0.3 | 16 | 0.4 | 19 | 0.4 | 29 | 0.4 | 7 | 0.5 | 32 | 0.2 | 19 | 0.6 |
| 31st | 21 | 0.2 | 21 | 0.1 | 29 | 0.2 | 34 | 0.3 | 32 | 0.3 | 32 | 0.3 | 32 | 0.3 | 32 | 0.4 | 20 | 0.2 | 35 | 0.5 |
| 32nd | 31 | 0.1 | 30 | 0.1 | 32 | 0.1 | 32 | 0.3 | 34 | 0.3 | 34 | 0.3 | 34 | 0.3 | 29 | 0.4 | 30 | 0.1 | 32 | 0.3 |
| 33rd | – | – | 31 | 0.1 | 30 | 0.1 | 20 | 0.2 | 29 | 37.5 | 29 | 0.2 | 30 | 0.2 | 21 | 0.7 | 21 | 0.1 | 20 | 0.3 |
| 34th | – | – | – | – | 31 | 0.0 | 21 | 0.2 | 20 | 11.2 | 21 | 0.2 | 20 | 0.1 | 20 | 0.8 | 31 | 0.1 | 21 | 0.3 |
| 35th | – | – | – | – | – | – | 29 | 0.2 | 21 | 5.6 | 20 | 0.2 | 21 | 0.1 | 30 | 0.1 | – | – | 29 | 0.2 |
| 36th | – | – | – | – | – | – | 30 | 0.1 | 30 | 4.3 | 30 | 0.1 | 31 | 0.1 | 31 | 0.0 | – | – | 30 | 0.2 |
| 37th | – | – | – | – | – | – | 31 | 0.0 | 31 | 3.9 | 31 | 0.0 | – | – | – | – | – | – | 31 | 0.1 |
| Total | 790 871.42 | | 1 767 389.86 | | 1 717 025.24 | | 2 047 863.75 | | 1 883 169.52 | | 1 849 713.72 | | 1 056 199.09 | | 1 217 050.76 | | 1 229 107.14 | | 13 558 390.50 | |

***Source:*** Fundação Getúlio Vargas (FGV).

[a] Values were restated based on the IGP-M index to adjust for inflation from October 2003 and 2005.

**TABLE 3. Variation in pricing of items in nine joint purchases by a hospital network, São Paulo, Brazil, 2003–2005[a]**

| Code | Reference value[b] | A[c] | B[d] | $\bar{X}$[e] | Δ% RV–A[f] | Δ% A–B[f] | Δ% A–$\bar{X}$[f] | Δ% B–$\bar{X}$[f] |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.22 | 0.09 | 0.08 | 0.08 | –58.4 | –11.4 | –8.7 | 0.0 |
| 2 | 3.77 | 2.63 | 1.99 | 2.13 | –30.3 | –24.3 | –18.9 | 0.1 |
| 3 | 5.17 | 2.73 | 1.68 | 2.25 | –47.1 | –38.5 | –17.6 | 0.3 |
| 4 | 1.10 | 0.80 | 0.83 | 0.77 | –27.1 | 3.7 | –4.1 | –0.1 |
| 5 | 72.08 | 62.94 | 56.34 | 59.88 | –12.7 | –10.5 | –4.9 | 0.1 |
| 6 | 85.75 | 65.17 | 66.00 | 65.35 | –24.0 | 1.3 | 0.3 | 0.0 |
| 7 | 4.14 | 3.41 | 1.09 | 2.15 | –17.7 | –68.0 | –37.0 | 1.0 |
| 8 | 6.86 | 6.86 | 3.97 | 5.39 | 0.0 | –42.1 | –21.4 | 0.4 |
| 9 | 0.73 | 0.48 | 0.48 | 0.45 | –34.4 | –0.1 | –5.8 | –0.1 |
| 10 | 1.10 | 0.75 | 0.82 | 0.75 | –31.3 | 8.7 | –1.0 | –0.1 |
| 11 | 2.84 | 2.38 | 1.00 | 1.83 | –16.1 | –58.0 | –23.1 | 0.8 |
| 12 | 33.16 | 11.41 | 5.65 | 8.95 | –65.6 | –50.5 | –21.6 | 0.6 |
| 13 | 9.42 | 7.08 | 3.50 | 5.09 | –24.9 | –50.6 | –28.2 | 0.5 |
| 14 | 3.13 | 2.63 | 2.48 | 2.82 | –16.0 | –5.7 | 7.1 | 0.1 |
| 15 | 1.53 | 1.19 | 1.20 | 1.13 | –22.4 | 0.9 | –4.9 | –0.1 |
| 16 | 0.98 | 0.75 | 0.77 | 0.71 | –23.3 | 2.0 | –5.6 | –0.1 |
| 18 | 1.75 | 1.35 | 1.30 | 1.26 | –22.9 | –3.7 | –6.8 | 0.0 |
| 19 | 0.86 | 0.63 | 0.65 | 0.61 | –26.7 | 3.4 | –3.6 | –0.1 |
| 20 | 0.74 | 0.50 | 0.50 | 0.48 | –32.3 | –0.6 | –3.9 | 0.0 |
| 21 | 1.72 | 1.62 | 1.58 | 1.56 | –5.3 | –2.7 | –3.7 | 0.0 |
| 22 | 1.31 | 0.98 | 0.95 | 0.93 | –25.2 | –3.4 | –5.5 | 0.0 |
| 24 | 12.35 | 12.35 | 12.00 | 12.85 | 0.0 | –2.8 | 4.1 | 0.1 |
| 25 | 0.63 | 0.62 | 0.58 | 0.51 | –1.8 | –6.1 | –16.7 | –0.1 |
| 26 | 0.82 | 0.58 | 0.60 | 0.56 | –29.2 | 2.9 | –3.8 | –0.1 |
| 27 | 0.98 | 0.75 | 0.77 | 0.72 | –23.3 | 2.0 | –5.1 | –0.1 |
| 28 | 1.54 | 1.14 | 1.22 | 1.15 | –25.9 | 6.7 | 0.5 | –0.1 |
| 29 | 2.85 | 2.85 | 2.95 | 2.86 | 0.0 | 3.8 | 0.3 | 0.0 |
| 30 | 0.99 | 0.74 | 0.80 | 0.72 | –25.3 | 7.6 | –3.2 | –0.1 |
| 31 | 0.23 | 0.15 | 0.13 | 0.13 | –35.0 | –14.1 | –12.8 | 0.0 |
| 32 | 0.24 | 0.16 | 0.14 | 0.14 | –33.3 | –11.3 | –10.9 | 0.0 |
| 33 | 0.23 | 0.13 | 0.11 | 0.11 | –45.0 | –16.2 | –12.8 | 0.0 |
| 34 | 0.23 | 0.15 | 0.13 | 0.13 | –35.0 | –14.1 | –12.0 | 0.0 |
| 35 | 0.23 | 0.15 | 0.12 | 0.13 | –35.0 | –20.6 | –15.6 | 0.1 |
| 37 | 33.84 | 19.62 | 8.50 | 14.19 | –42.0 | –56.7 | –27.7 | 0.7 |
| 38 | 13.61 | 8.46 | 5.04 | 6.62 | –37.8 | –40.4 | –8.7 | 0.3 |
| 42 | 17.93 | 17.93 | 17.60 | 17.48 | 0.0 | –1.9 | –18.9 | 0.0 |
| 43 | 2.52 | 2.19 | 1.56 | 1.81 | –13.0 | –28.9 | –17.6 | 0.2 |

***Source:*** Fundação Getúlio Vargas (FGV).
[a] Values were restated based on the IGP-M index to adjust for inflation.
[b] Price prior to joint purchase.
[c] Unit price at time of first purchase in Brazilian currency (R$).
[d] Unit price at time of last purchase in Brazilian currency (R$).
[e] Average price ($\bar{X}$) for all quotes in Brazilian currency reals (R$).
[f] Δ%: percent variation.

expenditure management by introducing efficiency and reducing costs (12).

In a community-based malaria-control project using a joint purchase strategy, the Andean Regional Health Organization (ORAS) has obtained a reduction between 36 and 90% in all five items purchased in relation to the average price in the sub-region (22). Our data also reflect the efficiency of joint electronic medication purchases. In 87% of the items purchased in the first quote, the average percent reduction was 28.6%, with a 65.6% reduction in the unit price for code 12. It was also demonstrated that the three items with the highest expenditure in the ranking of all quotations—code 5, 12, and 37—presented a percent decrease in unit price of 12.7%, 65.6%, and 42%, respectively, in the first purchase with regard to reference values. The medications with largest expenditures had a similar behavior as that described in the ORAS results (22). Still better results were recorded when the variation in unit price between the first and last purchases was analyzed. It was verified that 26 items, or 70%, had an average reduction of 23%. Code 7 stands out with the biggest reduction, 68%.

In 2006, Mosil and Jitaru asserted that among the various changes implemented, e-procurement was an essential element to face the health care system crisis in Romania (23). In Brazil, with the intent of establishing a medication cost policy, the Brazilian Health Department has developed a Price Bank (http://bpreco.saude.gov.br/bprefd/owa/consulta.inicio) which makes available the prices used by various institutions in their acquisition of medication, medical and hospital supplies, and medicinal gases. Through the Bank, it is possible to calculate the maximum and minimum price in different currencies, and to verify price variability for the same active ingredient in medications purchased by public or private institutions, as well as by primary, secondary, and tertiary hospitals (3). One limitation is that although data are entered by registered institutions only, there is no methodology regarding display, classification, stratification, and regionalization of registered institutions and for the analysis of average values, standard deviation, and re-

statement of amounts to adjust for inflation. The opportunity to provide crucial information is thus lost because of planning and implementation failures.

In New Zealand, Tordoff et al. noted that 11 public hospitals using joint purchases obtained an average reduction of 5.3% (ranging from 3.1 to 16.0%) for tertiary hospitals, and 7.4% (ranging from 4.7 to 12.8%) for secondary hospitals (24).

In sum, our data show that from October 2003 to October 2005, an e-procurement/joint medication purchase system used by a network of public hospitals translated into average savings of 23% in the purchase of 37 items. An average increase of 3.9% was recorded in only 11 DCB items. Marston and Baisch have stated that in order to plan the business architecture for e-procurement, one must understand the interaction between connectivity, consolidation, and collaboration (25). Our results indicate that the system we examined includes these three components.

## REFERENCES


1. Moisil I, Barbat BE. Beyond wishful thinking: medical community presence on the web and challenges of pervasive healthcare. In: Duplaga M, Zielinski K, Ingram D, eds. Transformation of healthcare with information technologies. Amsterdam: IOS Press; 2003. Pp. 319–24.
2. Delfim Netto A. O mercado e a urna. Rio de Janeiro: Topbooks; 2002.
3. López E, Chioro A. A rede hospitalar brasileira no SUS: situação atual e seus componentes. 2003. Available from: www.pqualidade.hucff.ufrj.br/artigos/redehospbrasilsus2003.pdf. Accessed 11 December 2006.
4. DATASUS: Sistema de Informações Hospitalares do Sistema Único de Saúde — SIH/SUS. Available from: www.datasus.gov.br. Accessed 1 September 2006.
5. Gunnarsson A, Persson G. Risk management in a buying group setting [monograph on the internet]. Gothenburg: Göteborg University; 2006. Available from: www.handels.gu.se/epc/archive/00004961/01/05-06-132.pdf. Accessed 26 February 2007.
6. Puschmann T, Alt R. Successful use of e-procurement in supply chains. Supply Chain Manag. 2005;10(2):122–3.
7. Raimundini SL. Aplicabilidade do sistema ABC e análise de custos [dissertation]. Maringá: Universidade Estadual de Maringá; 2003.
8. Vaidya K, Yu P, Soar J. Measuring e-procurement performance in the Australian public sectors: a preliminary approach. Proceedings of the 7th Collaborative e-Commerce Technology and Research (CollECTeR). Melbourne: University of Wollongong; 2002. Available from: www.collecter.org/archives/2002_December/05.pdf . Accessed September 2009.
9. Kalakota R, Robinson M. E-business: estratégias para alcançar o sucesso no mundo digital. 2nd ed. São Paulo: Bookman; 2002.
10. Albertin AL. Comércio eletrônico: modelo, aspectos e contribuições de sua aplicação. 5th ed. São Paulo: Atlas; 2004.
11. Yoshizaki H. Logística B2B no Brasil e no mundo: mitos e realidades. São Paulo: II Congresso Internacional ABML; 2000. Available from: www.multistrata.com.br/site-brasilian/biblioteca/logisticab2b.htm. Accessed September 2009.
12. Carabello L. E-procurement can reduce expenses. Hlthc Financ Manage. 2001;55(12):82–3.
13. Ward S. E-procurement. Technology to fit the bill. Health Serv J. 2000;110(5728):15–6.
14. Thelwall M. Who is using the .co.uk domain? Intern J Inform Manage. 2000;20(6):441–53.
15. WHO Collaborating Centre for Drug Statistics Methodology. ATC Index 2004. Available from: www.whocc.no/atcddd/. Accessed 19 June 2007.
16. Ferreira JHG. Alianças estratégicas em hospitais privados: estudo de caso com oito hospitais [doctoral dissertation]. São Paulo: Universidade de São Paulo, Faculdade de Saúde Pública; 2000.
17. Zehnder S, Bruppacher R, Ruppanner H, Hersberger KE. Swiss community pharmacies' on the Web and pharmacists' experiences with e-commerce: longitudinal study and Internet-based questionnaire survey. J Med Int Res. 2004;6(1):e9. Available from: www.jmir. org/2004/1/e9/. Accessed 14 July 2007.
18. Kampas PJ. Road map to the e-revolution: the e-commerce revolution. Inf Syst Manage. 2000;17(2):8–22.
19. Kruetten JM, Rautenberg F, Liefner M. Future relevance and consequences of hospital purchasing cooperatives for medical technology suppliers in Germany. Germany: BV Med; 2005.
20. Camy AR. Application of the UCON ABC model in B2B electronic commerce systems [dissertation]. Florianópolis: Universidade Federal de Santa Catarina; 2005.
21. Smith A. A riqueza das nações: investigação sobre sua natureza e suas causas. 2nd ed. São Paulo: Nova Cultural; 1985.
22. Organismo Andino de Salud. Convenio Hipólito Unanue. Compra conjunta de medicamentos: un aporte para la integración. Mejorando el acceso a medicamentos antimaláricos en la Subregión Andina. Lima: ORAS-CONHU; 2007.
23. Moisil I, Jitaru E. E-health progresses in Romania. Int J Med Inform. 2006;75(3-4):315–21.
24. Tordoff JM, Norris PT, Reith DM. Managing prices for hospital pharmaceuticals: a successful strategy for New Zealand? Value Health. 2005;8(3):201–8.
25. Marston L, Baisch L. The overdue promise of e-procurement. Health Manage Technol. 2001;22(11):32–6.


Manuscript received on 13 April 2008. Revised manuscript accepted for publication on 2 March 2009.

## RESUMEN

# Proceso de compras en línea en el sistema de salud brasileño: impacto de la adquisición conjunta de medicamentos por una red hospitalaria


***Objetivo.*** Evaluar la utilización de un proceso de compras en línea para obtener suministros para una red de siete hospitales universitarios con un sistema conjunto de adquisición.

***Métodos.*** Este estudio se realizó entre octubre de 2003 y octubre de 2005. Se analizaron nueve adquisiciones conjuntas de 37 productos farmacéuticos. Todos los productos se adquirieron al menos en seis de las nueve ocasiones o estaban entre los 10 productos de mayor desembolso. Se recogieron los siguientes datos: precio, número de proveedores que cotizaron productos, tipo de proveedor (distribuidor o productor), valor de referencia (menor precio pagado por producto por cada hospital antes de establecer el sistema conjunto de adquisición) y precio unitario en la primera adquisición y en la última. Se calculó la variación porcentual del precio con respecto al valor de referencia y los precios unitarios, tanto de la primera adquisición y la última como del promedio de las nueve adquisiciones.

***Resultados.*** El precio decreció más de 10% en 47% de los medicamentos analizados. En 32% de los 37 productos, el precio se redujo en más de 20%. En cinco productos (midazolam 5 mg, 3 mL; tramadol 100 mg, 2 mL; vancocina 500 mg, vial; ceftazidime 1 g, vial; y cefepime 1 g, vial), el costo unitario de la primera adquisición se redujo en 50% o más en comparación con el de la última adquisición. El precio unitario de 26 (70%) de los productos se redujo 23% en promedio.

***Conclusiones.*** Con el sistema de aprovisionamiento en línea se lograron ahorros concretos. Estos resultados demuestran que la incorporación de nuevas tecnologías de administración en instalaciones de salud, como los sistemas de aprovisionamiento en línea, puede contribuir a reducir las deficiencias administrativas en el sector salud.


**Palabras clave** Adquisición en grupo; administración hospitalaria; comercialización de medicamentos; Brasil.