



Lessons from one year experience of pooled procurement of pharmaceuticals: exploration of indicators and assessing pharmacies` performance

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Abstract

Background Joint procurement of medicines is a way to improve access and justice in developing countries. The aim of this study is to determine local indicators for assessing the performance of joint procurement agencies and compare the indicators in those pharmacies which use centralized purchasing before and after this change.

Methods This was a mixed method study. In the first qualitative phase, 3 expert panels were held including 20 national experts who were selected through purposeful sampling. Data was analyzed applying a five-stage framework analysis using MAXQDA. In the second quantitative phase, financial, supply and procurement, physical and functional indicators of two hospitals affiliated with joint procurement were assessed and the satisfactions of patients from the pharmacy performance were compared applying a valid questionnaire. Data was analyzed using SPSS through independent test, Paired t-test and ANOVA.

Results Results show that after settlement of joint procurement, the cost of transportation has increased by 54%, a part of the cost of overhead has increased by 30%, the cost of manpower has increased by 88.9% and cost of insurance of warehouses has increased by 71.85% in 2016 compared to 2015. In addition, the total costs of holding were 89.8% of selling revenue. In other words, the profit was about 10% of revenue in total. Moreover the average score of pharmacies under the Holding has been higher than similar ones in all aspects of satisfaction from the patients` points of view.

Conclusion The one-year experience of deploying centralized purchasing to supply medicine has led to increased income and patient satisfaction. However, increase in staffing costs, longevity, overhead and warehouse costs have been significant that need appropriate monitoring and interventions.

Keywords Pharmaceutical holding · Pooled procurement · Joint procurement · Centralized purchasing · Indicators

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Introduction

Medicine as the last communication bridge between patient and the health system plays a vital role in the proper functioning of health services and lack of access to medicines has negative effects on public health [1]. Hence, medication management in the public sector is a crucial issue especially in developing countries and its optimization can help maintain the capital of these countries and increase people`s access [2].

On the other hand, changing patterns of diseases in developing countries and the need of these countries to use medical and hospital services has led to an increase in use of medicine [3] to an extent that one of the most important factors in determining the quality and quantity of “therapeutic” services

provided in hospitals has been considered to be manner and quality of the provision of the services of “pharmaceutical and related supplies” [4]. To this end, most of these governments have been pursuing macro policies to increase access to medicines and reforming policies related to medicine is considered as one of the most important areas for reform in the health sector in developing countries [5].

In this regard, health policy institutions such as the World Health Organization (WHO) have adopted policies such as strategic and centralized purchasing as strategies for reforming the medicine system in access and justice dimensions for developing countries and have considered pooled procurement as the cause of sustainable provision improvement and financial access, safety and efficacy of essential medicines in these countries [6].

Other evidences also show that centralized purchases can be along with various benefits such as creation of expert teams in the purchase and development of market-oriented purchasing officers, receiving discounts and price reductions due to the focus of the purchase, precise inventory control and the purchase of the required amount, saving on recruiting manpower in the purchasing department, ordering goods at the right time due to regular and predetermined schedules and better planning for financing and optimal allocation of financial resources [7].

In this regard the results of Alebadi et al. in Jordan indicated that procurement of medicine through the centralized and joint procurement process has led to saving 2.4% in 2007 compared to last year [8].

Iran was no exception to this rule as a developing country and recent evidence suggests that creation of amendments to the pharmaceutical system is one of the priority issues. For example, national statistics show that medicine costs (including pharmaceuticals, syringes, technical tariffs, etc.) accounts for about 30% of total health care costs and close to 50% of outpatient health care costs [9]. In addition, other evidences suggest that implementation of market-based policies has led to a significant increase medicine costs in the country in a way that these costs have increased by about 107 times since the beginning of 2000 [10].

To this end, the Ministry of Health and Medical Education in this country have implemented a reformation as Health Transition plan with the objective of reducing payments by patients and increasing equity and access to outpatient health services which was executed in the form of eight packages. One of these packages was the provision of medicines and medical supplies for patients admitted to the hospital [11]. Accordingly, all state hospitals in the country were required to prepare all pharmacies and medical supplies prescribed for hospitalized patients by the hospital pharmacy and do not refer patient to the community pharmacies for medicine [12]. So it was necessary to use joint procurement to prepare medicines including

rare pharmaceuticals including chemotherapy medicines, Interferon, and recombinant medicines for all hospitals at the provincial level. And accordingly, centralized purchase of medicine was carried out through a unit called Pharmaceutical Holding in the four major universities in the country during which instead of decentralized ordering and preparing of medicine through the pharmacy of each hospital, Holding focused on the provision of medicines for hospitals under the auspices of the Department of Food and Medicine Administration.

Shiraz University of Medical Sciences was one of these four universities as one of the country’s largest Southern Medical Universities which acted on establishment of a Holding to prepare the necessary medicine of three referral hospitals since the beginning of March 2016 and there was the need for evaluation of performance of hospital pharmacies after the implementation of centralized purchasing through Holding. Hence, this study extracts the most important indicators of evaluation of pharmacies covered by holding and compares the financial and operational status of pharmacies before and after this change.

Methods

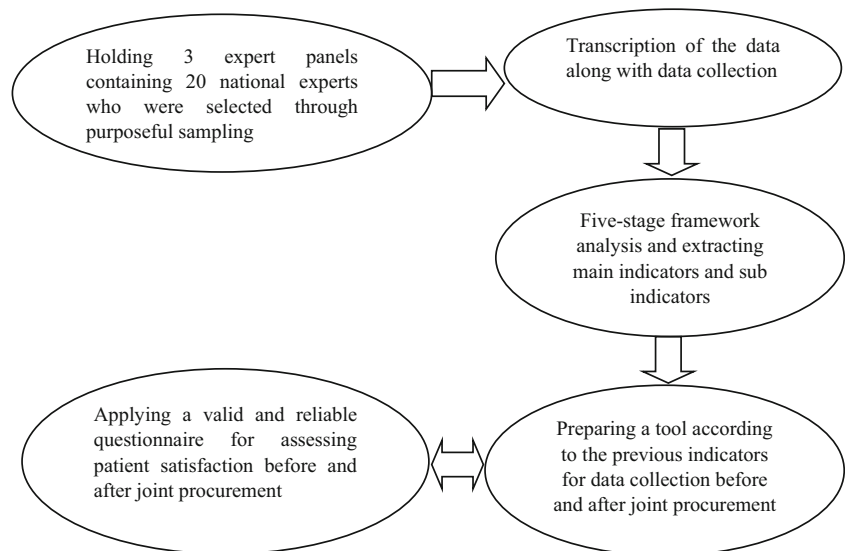
It was a mix method study which was carried out in two consecutive qualitative and quantitative phases in 2016–2017 at Shiraz University of Medical Sciences as the largest university and referral therapeutic center of the south of the country. The study design is presented in Fig. 1.

The first phase – qualitative

The first phase of this research was carried out qualitatively and with the objective of determining indicators for evaluation of performance of hospitals pharmacies before and after the establishment of pharmaceutical holding. The studied population in this phase consisted of experts and specialists of medicine system and those who are somehow familiar with the pharmaceutical holding plan and have contributed to the development of the plan in the hospitals. The experts’ inclusion criteria were having at least Master’s or Pharmacy Degree, being Technical Officer of the Hospital under the supervision of Shiraz University of Medical Sciences, having at least 5 years of work experience, having at least two years of experience in management, having records or executive activities in the field of pharmacy, willingness to participate in the interviews.

Above experts were included in the study using a purposeful sampling approach. In this method which is one of the most common sampling methods in qualitative studies, the researcher selects individuals based on his/her objectives and greater usefulness of samples so that they can be a great source

Fig. 1 the diagram of the study design



of information, can talk well, can reflect the issues correctly and have willingness to share information [13]. Accordingly, 20 experts were included in the study and the data were saturated with this number. The saturation criteria was lack of generating new themes and repetition of the statements of the participants.

The interview topic guide contained five main questions as well as several sub-questions using a review of previous studies and two open interviews with two experts who were not a part of the main sample and significance of questions and their credibility were confirmed during two other pilot interviews. A group interview was used in form of a panel of experts. Three panels were held for this purpose. The necessary coordination with the selected participants was done in writing and reminders were sent to them a few days before holding each panel. The research objectives were also explained to the interviewees in each group interview and the ethical issues were taken into consideration in a way that informed consent was taken from individuals to participate in the panel and for recoding their voices. Furthermore it was emphasized that they can stop the interview whenever they do not want to continue and interact the panel. The location for holding of panels was the Food and medicine Administration Conference Hall (for two panels) and the Holding Conference Hall for the pharmaceutical panel in the final panel. All three sessions were held in the final hours of the work (from 14:30 to 16:30) in terms of timing. At the beginning of each meeting, a member of the research team (H.D) provided explanations on the topics discussed and the summed up previous meetings as the head of the meeting. Then, another member of the research team (P.B) would present the interview questions in form of semi-structured questions and would let individuals to express their point of view in this regard. Researchers would provide supplementary or enlightening explanations wherever it was necessary. In addition to this, the contents of the

sessions were completely recorded using two electronic devices in order to use the full statement of the individuals and prevent information from being lost. The content of each session was executed on the paper immediately after the end of that session and were sent to participants in order to increase the credibility and appropriateness so that they can confirm their statements.

A five-stage framework analysis method was used in order to analyze the data using MAX QDA software. In this regard at the first step, the audio files obtained from the meetings were heard by the researcher several times and a word-for-word transcript came with each tape in order to identify the content and became familiarized with the data. In the second step, ideas repeated in identification process were turned into groups made of similar ideas or intrinsic forms in order to identify a thematic framework, in another words, we tried to develop a framework assisting the pre-determined key words and expressions and during this step all the texts were reviewed again in order to highlight the meaningful units of the text, at the same time in this step we tried to agree on the meaning and definition of “indicators” in the pharmacy performance. In the third step which was indexing units or parts of the data that are linked to a specific index were identified. So, the authors were started to initial indexing and creating codes in a way that after finding each of the above phrases or words based on the researchers critical assessment and their previous knowledge as an expert in this area. So we highlighted them in the body and then devoted an appropriate code for each determined phrases. These codes were reviewed for many times to develop new codes and be assured of merging the repeated ones, MAXQDA₁₀ was applied in this stage. In the fourth step, the data were summarized in the intramural table based on the thematic framework after indexing we tried to merge the related codes to generate sub themes or sub criteria and then achieved to main themes that are our

indicators here. In this step the relation between the main and subthemes were identified too and at the last step, data is finally combined and mapping and interpretation were used to define concepts, show the relation between concepts, specify the nature of the phenomenon and provide explanations and suggestions and the most important indicators of evaluation of hospital pharmacies were explained for this purpose. So at the end of the fifth step, all the themes and subthemes were interpreted and approved by the research team that did not have any conflict of interest [14].

The second phase – quantitative

The objective of this step was to measure and compare the status of pharmacies indicators in hospitals affiliated to Shiraz University of Medical Sciences before and after the establishment of a holding. For this purpose, we used indicators determined in the previous phase and data collection form was designed in four financial, supply and procurement, physical and functional dimensions and the related data was collected using HIS system, of pharmacies of the three hospitals which were a part of holding as well as HIX Holding system for one year before the establishment of pharmacy holding and one year afterwards. The collected data entered SPSS software version 18 and were analyzed using descriptive statistics and paired t-test.

In addition, considering that one of the indicators in the first phase of the study was to assess patients' satisfaction by measuring the status of pharmacies, we used a researcher-made questionnaire in this phase based on the objective of research to compare the satisfaction of patients referring to Holding pharmacies with patients referring to similar pharmacies of hospitals which were not a part of Holding in 2017. The questionnaire contained 21 questions in 5 dimensions. Questions 1 to 5 were in dimensions of visible and palpable cases, questions 6 to 8 were in dimension of Security and mental Peace, questions 9 to 11 were in dimension of feeling empathy, questions 12 to 15 were in dimension of being reliable and finally, questions 16 to 18 were in dimension of being responsible. The formal and content validity of this questionnaire were approved by three professors in the field of pharmacology and pharmacology and two experts in epidemiology and medical education. Reliability of this tool was calculated using Cronbach's alpha coefficient and $\alpha > 0.7$ was obtained for each one of the five dimensions. The researcher provided 250 questionnaires for patients referring to the pharmacy during one week by referring to each one of the six selected pharmacies using a random sampling method and acted on obtaining their informed and voluntary consent and completed the questionnaires. SPSS software and descriptive statistics, independent test, Paired t-test and ANOVA were used at a significant level of 0.05 were used for data analysis.

Results

The findings obtained from analysis of qualitative phase led to identification of 9 general indicators and 38 sub-indicators as described in Table 1 in which general indicators were financial indicators, supply and procurement, patient-based indicators, service provider indicators, inter-sectorial indicators, physical, informational, functional and regulatory indicators.

The results of the quantitative phase in the field of four important financial, functional, procurement and physical indicators for two Holding hospitals are presented in Tables 2 and 3.

As shown in Table 2, the average amount of medicine cost in Hospital A is less than the previous year, and it has been on the contrary in the case of medical consumables. In addition to this, the average purchase and sales of medicine has increased in the year after the Holding implementation compared to the previous year. Meanwhile, the results of paired t-test in this hospital showed that there is a statistically significant relation only in total amount of equipment ($P < 0.001$) and purchase ($P = 0.006$) and price of medicine in the first 4 months of the year ($P = 0.004$). Other findings from Table 2 show that the average number of medicines in 2016 after the implementation of the holding plan has been less than 2015. While the average total number of equipment in 2016, the average of supplementary medications, average medicine turnover and stock inventory have been higher in 2016 compared to 2015. Meanwhile, the results of paired t-test showed a significant relation between stock inventory before and after implementation of holding ($p < 0.05$).

On the other hand, Table 2 shows that average quantity of goods or goods exported from the warehouse in 2016 in hospital A has been less than 2015 after implementation of the holding while average Importing of equipment to the warehouse and average quantity of equipment exported from the warehouse have been higher in 2016 compared to 2015 but no significant difference was observed between indicators in these two years. Finally, Table 2 shows that the average discount for medication and equipment consumed and the average gifts were higher in 2016 after the implementation of the centralized medicine purchase plan compared to 2015 and before implementation of holding plan. However, the results of paired t-test show no statistically significant relation with any of these indicators.

Similarly, in the case of Hospital B, Table 3 shows that the average number and amount of the first inventory, the average number and amount of medicine and equipment input, the average number and amount of medicine and equipment remaining at the end of course were higher in 2016 compared to 2015. While the average number of articles and prescriptions in the year 95 was lower than the previous year. In addition, according to the results of the t-test there was a significant

Table 1 Indicators and sub indicators for assessing the performance of pharmaceutical Holding

Financial	Total Purchase Amount of medicines and medical equipment
	Total sales amount of medicines and medical equipment
	Net and gross profit
	Costs (Human resources, management, overhead costs, storage and maintenance, transportation and distribution)
	Fixed and current asset of Holding
	Debt ratio
	Cash Flow
Supply and procurement	Refund Duration
	Duration of order
	Number of custom items (medicines and medical equipment)
	Economic order rate
	Inventory amount
Patient-based indicators	Discount rate (cash, serial,...)
	Patient Satisfaction
	Patient access to medicines and medical equipment
	Patient access to Brand medicines
Service provider indicators	Rate of refers to private pharmacies
	loyalty to prescribe brand medicines
	Satisfaction of health care providers (physician, nurse, pharmacist)
Inter-sectorial indicators	Development and improvement of human resources based on Personnel Development Plan
	The amount of insurance deductions
Physical	Managing pharmaceutical accounts from the place of insurance repayment and health subsidy
	Improvement of storage space and equipment
	Amount of goods and pharmaceuticals from the warehouse
Informational	Amount of the goods and the drug in the warehouse
	Possibility to receive online output from HIS and HIX systems
Functional	Possibility of defining the regulatory and financial dashboard and centralized storage
	Savings from supplies of alternative medicine and supplies
	Savings due to discounts on medicines, Medical equipment and offers
	Scale savings
	The extent of improving the procurement and distribution processes of the medicines
Regulatory	Pharmaceutical safety and quality improvement
	Supervising Pharmacopoeia of medicines and medical equipment
	Monitoring the consumption of medical equipment in inpatient, para clinics and operation rooms
	Rate of returned pharmaceuticals and medical equipment
	Reduction in the order of items from troubled companies
	monitoring the rate of corruption, lobbying and smuggling
	Monitor the expiration date of drugs and equipment and reduce the amount of resources being thrown

difference in the number of medicines, the number of pharmaceutical copies, unit price of medicine and the total price of medicine in 2015 and 2016 (p value <0.05).

Table 4 shows the statistical comparison of medicine information and equipment in two A and B hospitals. As it can be observed in the table, the discount rate for medicine purchase has been higher in 2016 compared to 2015 in A while this has been lower after establishment of holding in hospital B. In addition, the discount rate for equipment in 2016 has been lower in hospital A compared to 2015 and the discount rate for the entire

medicines and equipment has been higher in 2016. The amount of equipment discounts in 2016 in hospital B has also been higher than 2015 but the discount rate for purchasing medicine and equipment in 2016 has been lower than 2015.

Table 5 compares the financial (cost and debt) indicators of the medicine aggregation center (for the hospitals A and B as the largest ultrasound medical centers in the south of the country and the C hospital as a comprehensive cancer center in the south of the country) over 2015 and 2016. As it can be observed, the cost of transportation

Table 2 Comparing Hospital A indicators one year before and after implementing pharmaceutical Holding

Indicators	Sub indicators	Period	Average	Standard deviation	<i>P</i> value
Financial	Total number of medicine items	2015	1'384'576	196'490.45	0.703
		2016	1'423'014	206'457.89	
	Total number of medical equipment items	2015	1'249'821	159'178.34	0.000
		2016	917'871	118'476.03	
	Total amount of medicines and medical equipment	2015	15,903,133	6495	0.709
		2016	18,308,399	14,116	
Purchase rate	2015	925,941	207	0.006	
	2016	627,670	155		
Sales rate	2015	86,871	35	0.989	
	2016	86,514	52		
Supply and procurement	Total number of medicines	2015	1'325'437'040	5191.71	0.338
		2016	1'420'873'068	5207.40	
	Total number of medical equipment	2015	1'226'070'302	4158.96	0.0001
		2016	917'871'603	4118.47	
	Total number of Supplements	2015	75'000'396	326.36	0.323
		2016	30'000'843	322.82	
Flow of medicine	2015	1'696'958'209	880,067.53	0.285	
	2016	1'193'713'936	744,658.34		
Inventory	2015	18'266'443'494	9137.30	0.000	
	2016	4'598'893'071	2205.13		
Physical	Issued or out of stock	2015	3'579'635'130	12,819.47	0.634
		2016	4'018'309'153	18,377.42	
	Inbound equipment consumed in the warehouse	2015	1'006'895'314	3336.60	0.450
		2016	7'714'786'916	59,359.36	
	Output equipment out of stock	2015	5'404'684'664	44,305.19	0.767
		2016	7'354'297'058	59,329.29	
Functional	Discount drug	2015	214'502'627	985.90	0.351
		2016	170'554'833	911.19	
	Discount medical equipment	2015	99'673'214	168.89	0.0001
		2016	26'300'880	160.46	
	gifts	2015	225'000'559	130.40	0.500
		2016	350'000'711	120.70	

has increased by 54% in 2016 compared to 2015, a part of the cost of overhead (utilities, telephone and gas) has increased by 30% in 2016 compared to 2015, the cost of manpower has increased by 88.9% in 2016 compared to 2015 and cost of insurance of warehouses has increased by 71.85% in 2016 compared to 2015.

Other findings about holding costs indicated that total revenue from the sale of medicines and medical consumables in hospitals covered by holding at the end of 2016 was 54,871,073 dollars and other donations and gifts were equal to 1,974,501 dollars in which pharmaceutical companies have reduced their cash and non-cash revenues to hospitals. In addition to this, the Holding Profit and Loss Facility shows that the main costs of holding which were cost of employee redress which is paid by the university is 8% of the total sales. Fee for doctors and staff accounts for 2% of total sales. In addition, the total costs of holding were 89.8% of selling revenue. In other words, the profit was about 10% of revenue in total.

Table 6 shows that all of the five dimensions measured in case of Hospital C (Holding member) had the highest satisfactory score. This is while Hospital E had the lowest level of satisfaction in case of mental health and safety and Hospital F the lowest level of satisfaction in case of other dimensions and as it can be observed in Table 6, difference in satisfaction with hospital pharmacy has been significant unlike empathy ($P < 0.05$).

In the end, the results obtained from comparison of the average satisfaction of patients referring to hospital pharmacies covered by holding with other similar hospitals which are performing decentralized purchases showed that the average score of pharmacies under the Holding has been higher than similar ones in all aspects of the visible and perceptible cases of psychological security and well-being, unanimity, reliability and accountability but this difference was not statistically significant in any of the dimensions (Table 7).

Table 3 Comparing Hospital B indicators one year before and after implementing pharmaceutical Holding

Sub indicators	Period	Average	Standard deviation	P value
Items of the first course	2015	1'899'514	4065.22	0.396
	2016	1'060'057	1909.10	
Amount of inventory of the first period	2015	4,572,335	9694	0.147
	2016	1,211,613	940	
Number of entries during the course	2015	87'098'892	191'449.47	0.273
	2016	34'534'229	63'307.07	
Input amount during the course	2015	101,638,434	214,145	0.271
	2016	45,504,240	12,567	
Number of outputs during the course	2015	7'715'0187	169'415.67	0.330
	2016	34'860'984	67'451.05	
Exit amount during period	2015	106,210,769	223,748	0.264
	2016	46,715,853	12,774	
Number of end of period	2015	19'286'015	41'434.17	0.128
	2016	4'226'088	3'237.88	
Number of medications	2015	10'004'605	4'428.83	0.000
	2016	31'655'731	12'959.40	
Number of pharmaceutical transcriptions	2015	5'117'116	1'639.85	0.000
	2016	13'924'643	5981.05	
Pharmaceutical Unit Price	2015	1,359,355	662	0.000
	2016	156,795	70	
Total amount of Pharmaceutical	2015	37,150,559	16,534	0.003
	2016	16,117,198	5840	
Number of admission transcriptions	2015	587'8120	42.67	0.526
	2016	860'599	41.71	

Discussion

An appropriate purchase is a purchase which is competitive and buyer will act on preparing the good with enough information about the supply and demand situation and the price and how to access to it. In addition, purchasing

units in all organizations are in search of a permanent source of supply of valuable goods and on this basis, the method to supply and procure goods is wise and competitive in which goods can be provided with desired quality, the right amount, the right price at the right time [15]. Hospitals are no exception to this.

Table 4 The comparison of pharmaceuticals and medical equipment in Hospitals A and B in 2016–2017

Hospital	Year	Indicator	Purchase amount (USD ¹)	Discount amount (USD)	Percent of discount
A	2015	Pharmaceuticals	5,329,666	189,703	3.56
		Medical Equipment	5,742,032	97,325	1.69
		Total	11,071,698	287,028	2.59
	2016	Pharmaceuticals	1,152,881	15,836	1.37
		Medical Equipment	1,079,965	19,038	1.76
		Total	2,232,846	34,873	1.56
	Total in a hospital during 2015 and 2016			Donation to equip the warehouse and pharmacy	95,611 (USD)
			13,304,545	417,513	3.14
B	2015	Pharmaceuticals	13,573,518	423,122	3.12
		Medical Equipment	8,517,245	250,599	2.94
		Total	22,090,763	673,721	3.05
	2016	Pharmaceuticals	8,240,811	594,314	7.21
		Medical Equipment	4,992,648	95,908	1.92
		Total	13,233,458	690,222	5.22
	Total in B hospital during 2015 and 2016			Donation to equip the warehouse and pharmacy	20,716 (USD)

¹ USD: the United States dollar

Table 5 Financial indicators of pharmaceutical Holding (Hospitals A, B, C) during 2015 and 2016 (USD)

Financial criteria	2015	2016
Transportation and distribution cost for medical equipment	7912	26,826
Overhead costs	803	1506
Human resources costs	43,468	739,233
Management costs	–	9561
Warehouse Insurance costs	12,748	16,573
Total Amount of debt	3,356,190	
Current assets (Cash Flow)	11,768,724	
Debt ratio	111,756	

Meanwhile, centralized purchasing is one of the methods which can standardize the entire purchasing process from exchange and receipt of goods to rewards and gifts and the payment system to the supplier [16]. Historically, the history of centralized medicine provision dates back to 1976 during

which 6 Gulf Cooperation Council countries began to purchase centralized medicine and were able to save 30% of their annual costs in this way. Saving on medicine purchase after a central purchasing program in Western Caribbean was 44% and this has been reported to be 15 to 20% in Arab countries [17].

Table 6 The comparison of satisfaction dimensions in hospitals affiliated with pharmaceutical holding (A, B, C) with those without holding (D, E, F)

Satisfaction dimensions	Hospitals	Average	Standard deviation	Test result
Visible and perceptible cases	A	16.40	4.16	F- 4.890 P < 0/001
	B	18.11	3.70	
	C	19.91	5.16	
	D	18.20	6.58	
	E	15.32	4.17	
	F	14.61	5.41	
Psychological security and well-being	A	8.86	2.75	F- 4.043 P = 0.002
	B	9.76	2.92	
	C	11.41	3.93	
	D	9.56	2.89	
	E	8.26	2.43	
	F	8.46	3.10	
Empathy	A	9.44	3.59	F- 2.117 P = 0.064
	B	10.88	2.88	
	C	11.73	3.93	
	D	9.80	2.96	
	E	9.93	6.42	
	F	9.11	3.04	
Reliability	A	12.16	4.06	F- 2.799 P = 0.018
	B	14.61	6.18	
	C	17.23	9.05	
	D	13.64	7.24	
	E	14.45	10.99	
	F	10.81	4.18	
Accountability	A	16.80	10.03	F- 4.332 P = 0.001
	B	17.51	5.86	
	C	22.27	15.08	
	D	15.32	4.04	
	E	20.13	12.78	
	F	12.11	6.44	

Table 7 The comparison of satisfaction dimensions' average in hospitals with Holdings and those without Holdings

Satisfaction dimensions	Categories	Average	Standard deviation	Test result
Visible and perceptible cases	With Holding	17.77	4.27	$t = 1.974$
	Without Holding	16.49	5.87	$p = 0.293$
Psychological security and well-being	With Holding	9.69	3.14	$t = 2.003$
	Without Holding	8.91	2.86	$p = 0.251$
Empathy	With Holding	10.49	3.41	$t = 1.676$
	Without Holding	9.67	4.24	$p = 0.599$
Reliability	With Holding	14.14	6.29	$t = 1.039$
	Without Holding	13.19	8.03	$p = 0.440$
Accountability	With Holding	18.01	9.53	$t = 1.775$
	Without Holding	15.93	8.51	$p = 0.532$

The findings of the present study indicate the fact that the level of profit from medicine and equipment sale has increased since the implementation of the centralized procurement plan in the university compared to the past and the level of this profit has been roughly equal to one-tenth of annual sales. Similarly, the study of al-Abbadi and colleagues in Jordan shows that savings caused by centralized medicine purchase in this country for 2007 have been equal to 2.4% which has reached to 8.9% in case of centralized of purchase for only one medicine which is cephalixin (500 mg capsules). Also, a study done by Chamont et al. (2015) in Mexico showed that the cost of saving about US \$ 121.8–8.81 million has been done with the formation of the Pharmaceutical medicine Committee in the first four years after the implementation [18]. On the other hand, the World Health Organization has identified four methods of procurement for the procurement of medicines and the degree of cooperation in the procurement process increases in this spectrum from the first method to the fourth method. In the first method which is informed buying buyers share price information and suppliers with each other but purchase is done individually and decentralized. In the first method which is coordinated informed buying, buyers form a market or subscriber network and share price information and suppliers in it but the purchase is still solitary. In the third method which is Group contracting, buyers will negotiate with suppliers in terms of the price and the best suppliers will be selected on the basis of these negotiations but purchasing is still done individually from selected suppliers and in the end, in the final method which is central contracting and procurement, a centralized purchasing unit is formed which acts on buying, contracting, bargaining, and procurement for all parties [19]. Evidences of the present study show that holding in Shiraz University of Medical Sciences has negotiated with companies in this sector, has contracted and ordered medicine on behalf of several hospitals as an

independent unit under the supervision of the university's legal collections and it is expected that the continuation of this plan will be able to benefit from some economic benefits and receive cash discounts and gifts.

However, establishment of holding can on the other hand lead to the imposition of some costs for storage, maintenance, fixed costs and overhead. Results of the present study show that the cost of transportation has increased by 54% in 2016 compared to 2015, a part of the cost of overhead (utilities, telephone and gas) has increased by 30% in 2016 compared to 2015, the cost of manpower has increased by 88.9% in 2016 compared to 2015 and cost of insurance of warehouses has increased by 71.85% in 2016 compared to 2015. In the meantime, what is certain is that the university should be able to cover the benefits of creating these costs by estimating the amount of savings resulting from centralized purchasing. In addition to this, adopting solutions for new warehousing and upgrading of logistics solutions can help constantly reduce these costs in the coming years. In this regard, the study of waning [20] shows that a lot of human resource costs will be saved by creating pharmacy network and establishing central medicine warehouse for those. In addition to what was discussed, the findings of the present study show that Patients' satisfaction with medicine provision in pharmacies of hospitals covered by Holding has been higher than other similar pharmacies. In this regard, the results of the study of Midlave show that integration of products ordered by the centralized medicine purchase unit in the public sector can have positive effects on the continuation of medicine use by the patient, reducing medicine mistakes and improving their quality and satisfaction [21].

In a general summary of what was said about the importance of centralized medicine purchase and its potential benefits and disadvantages, determination of appropriate indicators for assessing the performance of the centralized purchasing unit (Holding) is of utmost

importance. The findings revealed that from the perspective of participating experts, nine categories of financial indicators, supply and procurement, patient-based indicators, service provider indicators, inter-sectorial indicators, physical, informational, operational and regulatory indicators are necessary for assessing the performance of pharmaceutical holding. This method is recommended to be used by policy makers in the coming years if this method continues. Other studies have also pointed to similar indicators for assessing the financial and economic performance of pharmacies in general. For example, Imani et al. [22] have had a systematic review for the current ratio, immediate ratio, net worth, debt ratio, payables ratio, asset turnover, and return on investment, net profit and similar indicators which can be used in terms of similarity with public sector operations in the assessment of government holding performance.

In a general summary of what has been said, since centralized purchasing will face challenges in increasing the likelihood of collusion and corruption if there is no proper monitoring mechanism despite all the benefits for which it is enumerated [23] which could be more significant for a country with legal structure of Iran because under the Financial Trading Rules of Medical Universities, any item that has the approved price is outside the scope of the price inquiry and tender [14]. Therefore, in this context, it is recommended to implement the best centralized purchases and reduce the above risks. Firstly, the bills of treatment and the patient's medicine will be sent separately to the purchasing organizations for the purpose of extradition to have the possibility of full and correct allocation of funds to the medicine sector in addition to the fact that Holding should be able to use an integrated software system to order a medicine which makes it possible to strengthen internal monitoring and have control.

Conclusion

The one-year experience of deploying a centralized purchasing unit to supply medicine and equipment needed by pharmacies of the Shiraz University of Medical Sciences has led to increased income and increased patient satisfaction. However, increase in staffing costs, longevity, overhead and warehouse costs have been significant along with it. Hence, it is recommended for the University to act on establishing a comprehensive integrated information system for pharmacies of holding and collecting relevant data based on current specific indicators so that there will be better power to explain and predict the continuation of centralized purchasing or change its direction to other types of medicine procurement in the coming years.

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Data availability Datasets analyzed during the current study available from the corresponding author on reasonable request.

Compliance with ethical standards

Conflicts of interest The authors declare that they have no competing interests.

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