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# Comparative Study of Medical Equipment Procurement in Selected Countries

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## Abstract

**Background:** Despite the fact that medical equipment is critical for providing good health services and also incurs significant expenditures for the health system, little is known about how to procure it effectively. To date, only a few comparative studies on the procurement framework for medical equipment between nations have been conducted. Thus, the purpose of this study was to examine this issue between the leading countries.

**Methods:** To conduct this comparative study, Canada, the United Kingdom, Australia, Spain, Italy, Turkey, Thailand, and Iran were selected. Medical devices, medical equipment, procurement, purchasing, and acquisition were keywords considered to search PubMed, ProQuest, Web of Science, Scopus, Science Direct, and Google scholar databases. Also, the websites of the related organizations, such as the World Health Organization (WHO), the World Bank, and the Ministry of Health of respective countries were searched for the gray literature. Providing information about the procurement framework and availability of evidence in the English language was considered as the inclusion criteria and the lack of access to full texts, letters, and commentary article designs were the exclusion criteria. The results were summarized and reported using comparative tables.

**Results:** Most of the countries involved in this study are trying to align procurement activities with national health care priorities. In view of this, there is a trend toward centralized procurement, especially in Italy, Spain, England, Italy, Canada, and Iran. While a range of actors participate in the procurement process, a greater role for physicians and patients is necessary to be defined to meet patient needs. Moving from price-based approaches to value-based approaches is in the agenda to consider a broader range of criteria to achieve value for money and support patient access to innovations.

**Conclusion:** Most of the countries have reorganized the mechanism of medical equipment procurement. The price of products is the important factor, and recently the value factor has become more important in procurement. Reinforcing the role of decision-making teams and hospital committees in the procurement of medical equipment is suggested. Further studies are needed on the application of value-based approaches to evaluate their effects in hospitals.

**Keywords:** Medical Equipment, Procurement, Purchasing, Health Systems, Value-Based Procurement, Comparative Study

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## Introduction

Medical equipment is one of the major prerequisites for the optimal functioning of health care provision (1, 2). The World Health Organization (WHO) has stated that access to medical equipment and improving the quality of their use are considered its strategic goals (3). Despite the added value of medical equipment in health care provision

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***↑What is "already known" in this topic:***
There are many approaches to procuring medical equipment, and this is reflected in the degree of centralization and the criteria used.

***→What this article adds:***
The trend in different countries is toward centralization in medical equipment procurement to some extent. The use of value-based approaches in regulation and approaches is increasing.

through effective diagnosis and treatment of patients, the equipment imposes high costs to health systems (4). Procurement of medical equipment can control the cost by managing the purchase and distribution of new technologies using a transparent process of purchasing quality and valuable equipment (5). The procurement initiates with the need identification, followed by planning, the definition of specifications/requirements, financing, evaluation of options, contract award, and monitoring until the very last day of the warranty (6).

Before initiation of the procurement process of any medical equipment, it seems necessary to consider the strategic goals of health care organizations, as this process needed to be rooted in these goals (7). Besides, the baseline data in population, diseases, human and financial resources (8), Health Technology Assessment play increasingly significant role in need identification (6, 9). Medical equipment specifications should include the necessary features to meet the end user's needs and deliver the desired health outcomes over the complete equipment life cycle (10). Various criteria have been used to evaluate the options, some of which include price, quality, after-sales service, brand, and user feedback (11-13). Finally, contract management and monitoring need a systematic view for planning, implementation, monitoring, and evaluation. The aim of this step is to ensure that the supplier and the borrower fulfil their contractual obligations and commitments (14).

While procurement is considered an important component of success in organization, in the health care industry it is immature and often overlooked in the strategic vision of health care organizations (15). Many health care organizations do not use scientifically proven approaches in other industries in their purchasing process to promote efficiency and control costs (7, 16). Proper procurement of medical equipment is the most important factor in the management of medical equipment and prevents many possible problems in providing appropriate hospital services. Paying attention to factors such as quality, after-sales service, and user training will prevent equipment failure and excessive costs. Also, access to appropriate medical equipment affects patient satisfaction and hospital performance (17, 18). Health systems are therefore moving from conventional procurement methods (with mere focus on price) to strategic, efficient, and fair procurement methods that maximize the ultimate value of money (19). The new approach establishes a wider perspective for procurement, including factors in quality, total costs over the product life cycle, and broader value for monetary issues for a given product or service (15).

To date, few comparative studies have been conducted on the procurement framework of medical equipment among different countries. This study aimed to examine the issues among selected countries.

## Methods

To compare the medical equipment procurement framework in the selected countries, a holistic comparative review was conducted in the year 2021. The United Kingdom, Canada, Australia, Spain, and Italy as leading countries (10), and Turkey and Thailand, because of similarity of their health systems to Iran, were selected.

Medical devices, medical equipment, procurement, purchasing, and acquisition are keywords to search PubMed, ProQuest, Web of Science, Scopus, Science Direct, and Google scholar databases. An example of search strategy in the PubMed is presented in Table 1. In addition, the website of the related organizations, such as the WHO, the World Bank, and the Ministry of Health of respective countries were searched for the gray literature. The time span for search was 2000 to 2021.

After the initial screening, articles and documents that generally described the procurement framework in the selected countries were included. Also, availability of evidence in the English language was considered. Lack of access to full texts, letters, and commentary article designs were the exclusion criteria.

The data collection and analysis framework used in this study is comprehensive enough to encompass all aspects of the medical equipment procurement process. The framework was developed based on the literature review, the research question, and opinion of the members of the research team. For data extraction, a form was developed including publication date, authors' name, respective organization, type of document, key stakeholders in the field of medical equipment procurement, level of centralization, key decision criteria, and recent important changes in medical equipment procurement. Using the form, data were collected for each article. Through a qualitative review of the content of articles and documents, the information was extracted according to the mentioned form. To conduct this descriptive-comparative study, the data were classified through comparative tables.

*Table 1.* Example of Search Strategy

| | |
|---|---|
| #1 | "medical device"[Title/Abstract] OR "medical equipment"[Title/Abstract] OR "medical equipment"[Text Word] OR "medical device"[Text Word] |
| #2 | "procurement"[Title/Abstract] OR "procurement"[Text Word] OR "purchas*"[Title/Abstract] OR "purchas*"[Text Word] OR "acquisition"[Title/Abstract] OR "acquisition"[Text Word] |
| #3 | "united kingdom"[MeSH Terms] OR ("united"[All Fields] AND "kingdom"[All Fields]) OR "united kingdom"[All Fields] OR ("canada"[MeSH Terms] OR "canada"[All Fields] OR "canada s"[All Fields] OR "canadas"[All Fields]) OR ("australia"[MeSH Terms] OR "australia"[All Fields] OR "australia s"[All Fields] OR "australias"[All Fields]) OR ("spain"[MeSH Terms] OR "spain"[All Fields] OR "spain s"[All Fields]) OR ("italy"[MeSH Terms] OR "italy"[All Fields] OR "italy s"[All Fields]) OR ("turkey"[MeSH Terms] OR "turkey"[All Fields] OR "turkey s"[All Fields] OR "turkeys"[MeSH Terms] OR "turkeys"[All Fields]) OR ("thailand"[MeSH Terms] OR "thailand"[All Fields] OR "thailand s"[All Fields]) OR ("iran"[MeSH Terms] OR "iran"[All Fields]) |
| #4 | 1 OR 2 OR 3 |





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## Results

A brief history of each country as well as an overview of the procurement framework and recent changes are tabulated in Table 2.

### *Canada*

Procurement Framework. The Canadian health system is largely funded through taxes, and the provinces are independently responsible for managing financial resources and providing health care. The provision of health services is the responsibility of private organizations (independent hospitals and health centers) and all facilities are overseen by the provincial governments (20).

While the provincial health ministries that are responsible for ensuring the availability and quality of medical equipment, health care providers purchase medical equipment individually or through group purchasing organizations (20). Nearly 75% of the medical equipment are imported (21). Hospitals and other health care providers can purchase their required medical equipment through a group purchasing organization or negotiating directly with distributors or wholesalers (22). Procurement management activities (ie, planning, tendering, asset acquisition, and scrapping) are subject to review and audit by various organizations, including the Office of the Inspector General, the Audit and Accountability Office of Canada, and the Procurement Office. Physicians, especially specialist physicians, play a key role in making decisions about purchasing medical equipment, including the selection of specific vendors. Meanwhile, provincial health organizations can play a key role in scheduling and providing expensive medical equipment, especially magnetic resonance imaging and computed tomography equipment (20). Procurement of large capital equipment, supplies, and equipment follows similar approaches. Purchase of more than $100,000 requires an open competitive bidding process in line with the requirements of a national law called the Agreement on Internal Trade, which requires open, fair, and transparent purchase (23). Evaluation criteria often include supplier evaluations, products, and pricing. Products are evaluated based on usefulness, ease of use, patient outcomes, and cost (21, 23).

What Is New? Since 2013, government policies have been shifted toward driving value-based strategic pro-

*Table 2.* Overview of Procurement Framework

| | Canada | UK | Spain | Italy | Australia | Turkey | Thailand | Iran |
|---|---|---|---|---|---|---|---|---|
| Key actors in medical equipment procurement | MOH<br>physicians<br>Regional governments | MOH<br>NHS centralized supply chain<br>Medical service providers<br>Manufacturers<br>Hospital Procurement Committee<br>Distributing organizations<br>Collaborative Procurement Hubs | MOH<br>Autonomous regions hospitals<br>physicians<br>medical equipment staff in hospitals<br>Manufacturers<br>Distributors | MOH<br>Hospitals and providers<br>Manufacturers<br>Regional group purchasing organizations | MOH<br>State governments<br>hospitals<br>physicians | MOH<br>Hospital Medical Equipment Committee<br>Specialized Commission for Medical Equipment | MOH<br>Office of Medical Equipment Control and Supervision<br>Manufacturers<br>Distributors<br>hospitals | MOH<br>Heyat Omana Arzi<br>University of Medical Sciences Hospital Medical Equipment Committee<br>University Tender Commission<br>University Technical Committee |
| Degree of centralization | Decentralized at Hospitals | Increasingly centralized through Collaborative Procurement Hubs | Degree of centralization differs across Autonomous Communities | Increasingly centralized at interprovincial/ regional level, with growing number of purchasing consortia | Primarily decentralized with Increasingly centralized at regional level, | Decentralized at Hospitalls | Decentralized at Hospitals | Centralized at University of Medical sciences and Heyat Omana Arzi |
| Criteria used in procurement | Ease of use<br>Patient outcomes<br>Costs<br>Green Procurement<br>Integrity<br>Ongoing expert advice<br>value for money | Price<br>Volume<br>Quality<br>Sustainable Development<br>Impact on small and medium enterprises innovation<br>Therapeutic benefits<br>Value for money | Price<br>Volume<br>Quality<br>Therapeutic benefit<br>Value for money | Price<br>Quality<br>technical support<br>after sales services<br>Value for money | value for money<br>fit for purpose;<br>history of the supplier<br>flexibility<br>environmental effects<br>Total life cycle costs | Price<br>The most cost-effective method of preparation<br>Quality and value<br>Number of potential patients<br>Availability of staff<br>Maintenance needs<br>Domestic production | Fair Price<br>Quality of the manufacturer<br>Compliance with national standards | Price<br>Product quality after sales services<br>Supplier history |



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curement to encourage efficiency and innovation (19). Competitive dialogue and risk sharing are the novel approaches used in this shift. For example, in a tender due to the time required to prove the suppliers' claims, they were asked to share in service risk. If an instrument needs to be replaced before a specific time, the supplier needs to pay for the replacement surgery. This commitment served as a significant incentive for suppliers to provide reliable information (19).

### United Kingdom

Procurement Framework. The National Health System (NHS) is generally financed through taxes. Health services are controlled by primary care trusts which contract physicians and hospitals for provision of the health services in the specific areas. Specialized services are provided by semi-independent and private hospitals (24).

The Ministry of Health (MOH) is responsible for overseeing medical equipment procurement and donation. The Innovative Technology Procurement Program oversees the procurement process, and medical equipment purchasing is funded through the central government. National Institute for Clinical Excellence (NICE) introduces a list of medical devices to be purchased and used (24). Decisions about purchasing equipment are locally made by health trusts and need to be complied with legal financial frameworks. Medical equipment procurement is handled through NHS regional institutions called collaborative procurement hubs (24). These institutions work with the centralized supply chain the NHS. In purchases by value from 5000 to 19,999 pound the Request for quotation need to be followed and any purchase over 20,000 pound must be made according to the formal bidding process and must comply with the requirements, standards, and rules. Moreover, if possible, the medical device should be compatible with available devices and the organization's strategic plan. A team of senior hospital managers, ward manager, nursing manager, medical equipment manager, and procurement manager is formed as the decision-making committee when purchasing or replacing medical equipment in medical trusts.

What Is New? In line with the new European Union (EU) directive on public procurement in the year 2014 and to deliver sustainable savings in the NHS supply chain, there is an emerging recognition of value-based procurement (VBP). In implementing a VBP approach, reduction in product costs has been changed to partnership with suppliers to think about products or solutions that can improve patient outcomes, increase efficiency, and reduce the total costs within the patient pathway. There is a shift from sourcing products and devices to sourcing more services and solutions. Major drivers of this shift were cost reduction, risk reduction, improved solution offering from the suppliers, stricter quality, and safety requirements (25). Competitive dialogue as an innovative value-based approach was used as well (16, 26).

### Spain

Procurement Framework. The Spanish health system is generally financed through taxes, and private insurance also plays a role. Providing health services has been delegated to regional organizations since 2001, although funding has remained centralized. In this structure, the central government monitors and evaluates the performance of regional organizations. Each district is responsible for developing its own health care plan, including development policies and hospital procurement. Public and private hospitals and principal health care centers are responsible for providing health care (27).

Because of decentralized health care decision-making and provision, local or regional bodies have a great role in the procurement process. Regional autonomous communities determine who can tender devices and at what price, and they also compile a list of justified medical equipment at the regional level (28). Procurement of medical equipment in public hospitals is conducted through call for tenders. These tenders are regulated by EU directives on public procurement, which are also enshrined in the Spanish financial law. Physicians and senior staff of medical equipment in hospitals are the main decision-makers in purchasing medical equipment. A consortium has been set up by the Catalan Regional Health Authority to provide private management services. These services include organizing major purchases of medical supplies to obtain the best price, prepare tender conditions, manage the tender process, and consult on purchasing and equipment planning. There is also a centralized purchasing organization in the Valencia region (27).

What is new? As the criterion of Most Economic Advantageous Tender mandated by the new EU public procurement directive in the year 2014 (15, 29), this has been transposed into the Spanish legislation and the use of parameters such as lifecycle costs, social and environmental impacts, as well as innovation have been promoted (30). As in the United Kingdom, in Spain, procurement of solutions has been increasing. As in the provision of medical equipment separate contracts for the purchase of equipment and related services are used, an attempt has been made to include the 2 in a single contract as a solution. The reasons for this have already been mentioned (25). In addition, in the year 2016, Hospital Sant Pau in Barcelona hired an innovative procurement (competitive dialogue) to procure a service related to implantable cardiovascular defibrillator. Both the total cost of ownership and delivering outcomes beyond the device were core criteria for the tender. This led to a 10% decline in outpatient visits, a 10% reduction in complications, and an increased collaboration along the care pathway (31).

### Italy

Procurement Framework. The Italian National Health System is generally financed through national and regional taxes and organized at 3 levels: national, regional, and local. At the national level, the Ministry of Health determines the main policies and goals of the health system, and allocates the national budget to the regions. The regions are responsible for organizing and providing health care, and at the local level, local health institutions are responsible for providing public health services and primary health care. Secondary and specialized care is pro-





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vided by public hospitals or private providers (32).

The National Medical Equipment Committee is responsible for defining and updating the medical equipment database (27). Medical technologies are generally procured through public bidding procedures. Negotiations are locally conducted between health providers and manufacturers or sellers. Recently, different types of consortia have been created to share technical and administrative activities between health care providers in the time of medical equipment purchasing, which are both optional and mandatory (1). Public procurement in the Italian health system is managed at 3 levels (33) as follows:

1. Purchasing through Consip (a public procurement company);
2. Making centralized purchases at the regional level by regional procurement entities;
3. Purchasing through local health authorities, which are made in 2 forms: individual purchases separately by medical centers, and group purchases made by groups of health centers, with special features.

What is new? Italian public health care structures can buy medical devices only via tenders. Up to 2016, competitive pricing was the main rule for tender winners. Since then, the price/quality criteria can be applied in the rate of 70/30, 50/50, and usually 30/70. Quality is not limited to the functional and esthetic products features and its handling use. The attention is now focused on the commercialization phase, innovative and efficacy features, profitability and usability of instruction for final users, as well as eco-friendly features. Organization procedures of companies and professional training can also be valued in tenders' protocols (34).

### Australia

Procurement framework. Australia's health care system is as a rule funded through a general tax and a mandatory tax. Medicare, the National Health Insurance Plan, provides patients with subsidized access to their preferred physician through outpatient care, free health care in public hospitals, and subsidized drugs. In addition to taxes, there are private sources such as private insurance. Hospitals are an important part of the health care system and provide a wide range of services. Public hospital services are funded through an agreement between the Australian Government and state and territory governments (35, 36).

The Ministry of Health supervises the procurement of medical equipment nationwide. Medical device companies must register their products in a national database to be present in the Australian health market (37). All medical equipment approved for use in Australia are registered in a national database called the Australian Medical Goods Registry (36). All purchases in Australia, including the purchase of medical equipment in hospitals, must comply with the public procurement rules. Procurement rules form the core of the procurement framework. These rules are divided into 2 parts: the first part applies to all purchases, regardless of their financial value, and the second provides additional rules for purchases above the US$80,000. The general rule that applies to all purchases is that the value of money should be taken into account. Public procurement laws explicitly stipulate that in value for money, the price of goods and services is not the only determining factor, and a comparative analysis of the relevant financial and nonfinancial costs and benefits of alternative solutions determine the value of money. Factors need to be considered in procurement include fit for purpose, performance history of a potential supplier, innovation, and life cycle costs (38).

What is new? Achieving value for money is the core of rules recently enacted by the government. Besides, it was stated that procurements should encourage competition and be nondiscriminatory; use public resources in an efficient, effective, economical and ethical manner that is not inconsistent with the policies; facilitate accountable and transparent decision making; encourage appropriate engagement with risk; and be commensurate with the scale and scope of the business requirement. Price is not the mere factor in procurement and other factors such as quality, fitness for purpose, performance history, environmental sustainability, and whole-of-life costs should be considered (38).

### Turkey

Procurement framework. The Turkish health system is funded from a variety of sources, including social health insurance, government resources, out-of-pocket payments, and other private sources. Social security insurance is the predominant form of financing. Each province is governed by a government representative. Every ministry, including the Ministry of Health, has a local entity in each province that reports to the provincial government representative. The Ministry of Health is a major player in the provision of health care. In addition to the public sector, the private sector is also involved in providing health services (39).

The procurement of medical equipment for primary, secondary, and tertiary care is different. The National Committee for Medical Equipment is the main decision-maker in planning and replacing medical equipment in hospitals (40). Medical equipment for secondary and tertiary care are purchased or leased through a competitive public bidding process (4). The minimum requirements are announced by the hospital and at least 3 bids are needed. Decisions are made according to the most appropriate proposal. Medical supplies are obtained from the lowest-priced offer and must meet the standards announced by the buyer. For the prerequisite equipment, each hospital create a procurement committee and follow the public procurement law. Hospitals can purchase the medical supplies through their general or special budgets (39).

What is new? The Turkish Public Tender Law, implemented in 2002, sets out the principles and procedures of procurement by government agencies and institutions funded by public sources. The law was modified in 2008 with an emphasis on criteria beyond price, focusing on quality and value criteria as one of the criteria for evaluating options (40).

### Thailand

Procurement framework. The Thai health system is financed by the public government resources and earmarked





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tax. The 3 public health insurance schemes (government employee insurance, social health insurance, and universal coverage plan) are the main purchaser. Health services are mainly provided by the public sector so that public hospitals make up 75% and 79% of the total number of hospitals and hospital beds, respectively (41).

Capital medical equipment in larger specialist or tertiary care hospitals are funded using the capital budget of the Ministry of Health, while private hospital investment in high-cost medical equipment is decided by the hospital's executive team (41). The Thai medical equipment industry is governed by the 2008 Medical Equipment Act. Medical equipment in public hospitals are purchased in accordance with the government's procurement rule (42). The Ministry of Finance is responsible for determining these rules. As to the purchases under 0.1 million THB, the negotiated price will be taken, for purchases between 0.1 and 2 million THB, the request for quotation process will be used, and as to the purchases above 2 million THB, the competitive bidding approach needs to be applied (41). Besides, there is a reverse auction to achieve more savings in the government's budget. Given this, bidders could change their bids downward frequently within a specific period. The fair price and quality are the major factors considered in bidding.

What is new? Recently, traditional approaches have been changed to e-procurement. The main government goal for this change was to show efforts to enhance the procurement system and provide a conducive environment for contractors. The advantages of the new system are transparency, fair dealing, high competition, bidding process' prompt result, and traceable actions. Similarly, the government has gained a much more budget saving for about 10% to 20% off the standard price as an immediate effect of price competition (43).

### *Iran*

Procurement framework. Iran's health system is financed through its Government's general budgets, social insurances, and out-of-pocket payments. Universities of medical sciences manage health care in provinces. Services are provided by health care networks and hospitals. Public hospitals provide the vast majority of hospital services.

The Office of Medical Equipment in MOH and universities of medical sciences are responsible for overseeing the procurement of medical equipment. The procurement process must comply with the financial regulations of medical universities. Purchasing is divided into 3 categories: little, medium, and large. The threshold for these categories is announced annually by the government. In the first one, the person in charge of the purchase directly makes the purchase with the lowest price. In medium purchases, the request for the quotation process is performed and the lowest price is selected. In large purchases, the bidding process takes place. Tenders can be open and restricted, which is a 1- or 2-stage process. Managers with financial authority (eg, university presidents) can enter tenders into the tender's exemption process. Large purchases are made by universities of medical sciences or by a nongovernmental organization called Heyat Omana Arzi (Board of Trustees for Patients Treatments with currency saving) in which the Tender Commission and the Technical Committee play a key role. The Technical Committee has an advisory role and reviews the technical specifications of the products. With the approval of the technical characteristics of the alternative options, the decision will be made based on the lowest price.

What is new? Recently, because of sanctions and financial problems, as well as financing problems in public hospitals, the role of the Heyat Omana Arzi in the process of medical equipment procurement was outstanding. However, there is no change in the general plans and policies for the procurement of medical equipment.

## Discussion

Parallel to increasing health care costs and limited financial resources, the rising demand for long-term health care has prompted many countries to reorganize medical equipment procurement processes, as medical equipment accounts for a considerable portion of the costs. Before 2000, most countries used a decentralized process in the procurement of medical equipment, and hospitals as well as local institutions, managed purchasing products. Different approaches, inefficiency, and poor transparency in the process can challenge the system (16, 44). Hence, most countries moved to centralization and group purchasing organizations at the regional or interregional level. In Italy and Spain, autonomous communities and concips manage this process (28). In the United Kingdom and Canada, group purchasing organizations were increasingly used, although hospitals can still purchase the equipment themselves (24). Recently, in Iran, the use of the Heyat Omana Arzi has been increasing. This action was to manage financial resources in sanctions against Iran. Given the growing role of these group purchasing institutions, it seems that they will make a greater impact on this process in the future. Cost reductions, productivity, and higher purchasing knowledge are projected benefits of centralized systems, but coordination issues, anti-competitiveness, and a stronger focus on cost are potential drawbacks. While most countries are adopting a centralized procurement method to manage costs, it should be emphasized that the same solutions cannot be utilized for different hospitals and regions because they must satisfy the demands of different communities. Clearly, further information on the level of centralization in medical equipment procurement is needed.

The majority of the nations analyzed took steps to ensure that medical equipment purchases were in line with national health priorities and strategies. In this sense, most nations have implemented a list or database of medical equipment that can be purchased and distributed within the health system at the national level. In Italy, the National Medical Equipment Committee is responsible for defining and updating the medical equipment database (27). In Spain, autonomous communities have compiled a list of justified medical equipment at the regional level (28). In the United Kingdom, NICE introduces a list of medical devices that can be purchased and used (24). In





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Turkey, the National Committee for Medical Equipment is the main decision-maker in planning and replacing medical equipment in hospitals (40). Medical device businesses in Australia must register their goods in a national database before they may sell them in the Australian health market (37). These lists are thought to be a way to keep track of this area, albeit it may be difficult to verify compliance in practice due to a lack of financial resources and competing priorities, which can lead to unexpected resource allocation. A variety of actors and stakeholders have been involved in the medical equipment procurement process. Depending on the level of centralization, key actors were different between countries. In most countries, the MOH has been responsible for overseeing the procurement of medical equipment, although local governments, such as Canada, Spain, and Australia, as well as regulatory agencies such as the United Kingdom, Turkey, and Thailand, oversee the procurement of medical equipment. In all countries studied, hospitals have an important role and, in some countries, such as Canada, Spain, and Australia, physicians are key participants in the procurement process. In some countries, decision-making committees at the local level have a substantial role such as the United Kingdom, Iran, Turkey, and Thailand. Medical equipment committees and medical equipment technicians at the hospital level are involved in assessing needs, determining technical requirements, evaluating options, and determining their value. In Britain, Turkey, Iran, and Spain, the role of these committees is substantial. Manufacturers and distributors in many countries are also directly and indirectly involved in the medical equipment procurement process.

Tendering must be used to perform the procurement process in line with public procurement legislation in the countries. The bidders can participate in the auction based on the specifications and technical conditions advertised. Given these laws and the cost containment concerns of governments, price was the main criterion for decision-making in most countries and other criteria, such as quality, ease of use, innovation, etc. are less important. Although the lowest price approach can reduce costs, it can lead to inefficient and ineffective health care.

Changes in laws and regulations in recent years, especially in European countries, Canada, and Australia, have increased the simultaneous attention to price and quality in terms of value. The best value in different equipment depends on the balance of price and quality, however, in general, each of these criteria and subcriteria must be weighted. Changes to the Most Economically Advantageous Tendering evaluation criteria in Australia, Canada, and the EU included considering the overall cost of the device's lifespan rather than just its price, as well as quality standards (19, 28, 45). In most countries, such as the United Kingdom and Italy, health technology assessment is producing evidence for medical equipment procurement decisions (46, 47). In Thailand e-procurement was implemented to enact the value and transparency. No significant change has been observed in Iran in line with these changes in recent years. Significant results can be seen in the innovative experiences that some countries have used in the procurement of medical equipment. Using pretender measures, such as competitive dialogue, highlighting the role of decision-making teams in hospitals, and value analysis in procurement can be beneficial when considering total cost and quality criteria. Another significant change seen in several nations was the shift toward solution procurement. Sourcing systems allow bundling devices, consumables, and related services into a single contract, instantly lowering the total cost of ownership. Solutions allow to share compatibility risks with suppliers. While the importance of quality factors and service/solution procurement has clearly increased, partnership with suppliers to provide solutions tailored to the needs of health care providers will gain more importance for patients (25).

## Conclusion

Many countries have reorganized the mechanism of medical equipment procurement. Conventional price-based approaches have not met the cost containment goals, and most of the countries have moved to more strategic and value-based procurement. The level of centralization in decision-making varied between countries, although there was a growing trend to centralized approaches. Simultaneously, the influencing factors in the procurement of medical equipment were changed. The price of products is an important factor and recently the value has become more important in procurement. Sourcing solutions is a strategic change in medical equipment procurement. It helps to explicitly focus on the patient in the evaluation methodology and the definition of specifications. It is suggested that the role of decision-making teams and hospital committees in the procurement of medical equipment should be increased and that innovation and creativity in the implementation of the procurement process, such as competitive dialogue and seeking solutions, should be encouraged by managers and leaders. There is also a need for further studies on the application and effects of value-based approaches in hospitals.

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### *Conflict of Interests*

The authors declare that they have no competing interests.

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