

## THE ROLE OF TECHNOLOGICAL INNOVATIONS IN RISING HEALTH CARE COSTS

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### Abstract

*Despite the rising resources devoted to health care in various countries particularly in recent years, health services could not have been delivered at the extent of desired coverage and quality to the citizens. This paper examines the technology factor, considering the financial scheme of the sector, among various basic reasons of this fact what some of the current research argue. In this regard, the developments in health care sector in Turkey along with the OECD countries for this end are emphasized. Indeed, technology suppliers have charged the cost of investments in R&D in the sector from both own citizens and the technology importers. Consequently, Turkey as a technology importer should make a choice about the coverage extent in accessing to the technological advances in health sector for its citizens. In Turkey the studies related to planning and settling policies in health sector appear that they could not grasp neatly this phenomenon. This study aims at shedding some light on the matter so as to fill this void.*

**Keywords:** *Health care costs, health care technology, health care innovations, health insurance models.*

### Özet

*Sağlığa ayrılan kaynaklar çeşitli ülkelerde özellikle son yıllarda artmasına rağmen, sağlık hizmetleri arzu edilen kapsamda ve kalitede ülkelerin vatandaşlarına verilememektedir. Bu çalışma mevcut bazı araştırmaların savunduğu bu sorunun*

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*çeşitli temel nedenlerinden biri olan teknoloji faktörünü, sağlık sektörünün finansman yapısını dikkate alarak, incelenmektedir. OECD ülkeleri ile birlikte Türkiye'nin sağlık sektöründeki gelişmeler bu çerçevede dikkate alınmaktadır. Aslında, teknoloji üreten ülkeler bu sektörde AR&GE'ye yaptıkları yatırımların maliyetini hem kendi ülke vatandaşlarından ve hem de ithal edici ülkelere karşılamaktadırlar. Sonuç olarak, teknoloji ithal eden bir ülke olarak Türkiye sağlık sektöründeki teknolojik gelişmelerden vatandaşlarını ne ölçüde yararlandıracağına karar vermek durumundadır. Türkiye'de sağlık sektöründe planlamaya ve politikalar oluşturmaya yönelik çalışmalar bu konuyu netlikle kavrayamamış görünümündedir. Bu çalışma bu boşluğu doldurma konusunda aydınlatıcı olma amacına yöneliktir.*

**Anahtar Kelimeler:** Sağlık maliyetleri, sağlık teknolojileri.

## 1. AN OVERVIEW OF THE SUBJECT

Health care, beyond that of market oriented commodities and services, has particular characteristics specific to its own nature, which are different than that of the other public or mixed goods and services (which embody the characteristics of both public and private sectors commonly); first of all, health is an issue between life and death<sup>1</sup>. So it is a universal fact that everybody should be accessed to basic health care, and specific health services should be made accessible for whom in need of them equally at the extent of available resources considering the highest quality and technology. However, even though the expenditures on health care has significantly increased in particular for the last few decades in many of the world nations, health care could not have been made available being accessed to at the extent of desired coverage and quality to the citizens. This tendency is anticipated to last in industrialized countries, at least in the United States (US) because of its unique health care system, in the future under the present circumstances (CBO, 1993).

In contrast, the health statutes of societies could not have been developed significantly in parallel to such rises in health spending. Even though these consequences are obviously influenced by the system of delivering health care and its finance scheme, almost all countries with their substantially different models in health sector have complained from the same problem. Indeed, the health services provided are simply one of the inputs that determine the health status of a society. Such factors as genetic endowment, education, housing, working conditions and environment,

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<sup>1</sup> Certain characteristics of and why government has to intervene in delivery and financing of health care are exclusively explained in Donaldson & Gerard, 1993: 12-48.

feeding, culture and habits that influence the life-style of a society are also accepted as significant inputs of its health stock (Donaldson & Gerard, 1993: 179).

Furthermore, the determinants of health care spending levels (such as per capita spending on health care or percentages of spending on health care in GDP) across countries have to be considered entirely different than that of growth in health care spending. A common empirical finding that the elasticity of expenditures on health care with respect to income lies between 1.18 and 1.36 has led many economists to discuss about whether health care is a 'luxury good'. But this conclusion can be criticized for several reasons. First, health care is unambiguously a necessity rather than a luxury good. Second, per capita spending on it cannot be explained by income alone beyond the empirical finding. Indeed, beside income level such factors as financing model in particular and reimbursement method by insurance companies play important role in determining of health care spending level. Moreover, variation in health care spending levels across countries depends on various cultural and historical factors as well as income levels. The international data implemented in the empirical studies is in small samples, inadequate and in different definitions for certain variables. So, the empirical finding that relies on international comparisons is misleading (Donaldson & Gerard, 1993: 169-173; 181-182).

On the other hand, Newhouse (1992) has found that a trivial portion of growing health care costs is contributed by the aging of the US population, below the 10 % by growth in income, about 12.5 % by the compensation schemes of the financial intermediaries between consumers and providers of health care. Further, once these factors and several others as well are considered, all together of those variables explain below the 50 % of the growing health expenditures. This leaves a substantial residual role for technological innovations take in explaining the rising health care costs (Folland, et al, 1993: 385). But, it is difficult to measure to what size technology has contributed to the rising costs. Some researchers attempted to estimate the impact of technology on the US health care expenditures, for instance, using more easily identifiable sources and without making a distinction between expanded application of existing technologies and introduction of new technologies. Empirical evidence from these types of partial studies supports that improvements in quality of health care and medical technology explain between 10-40 % of the rising health care spending over the relevant period (Neumann & Weinstein, 1991: 22-24). So, many health economists believe that technological change is a primary factor of rising per capita health care expenses over this period (CBO, 1991: xii).

Although the OECD countries, in which Turkey takes place, display a substantial diversity in delivery and financing systems of health care, per capita real spending on health care has grown faster than per capita real GDP in majority of them, so that the share devoted to health care from GDP has risen in these countries. However, all of them have been exposed to the same costly innovations in health care sector. Hence, this technology-oriented argument of the rising health care costs facilitates to explain the observed consequence (Rosen, 2002: 213).

This paper attempts to investigate technological innovations in the sector regarding the finance scheme of health care among various factors as the main source of this problem. In order to grasp the phenomenon better, first, how the mechanism runs in the unique US system in this regard is elucidated. The argument put forward explicitly first by Weisbrod (1985) was improved with some successive hypotheses and examples in his later paper (Weisbrod, 1991), even though he did not specify a complete model and test it sufficiently. Then, the situation in Turkey comparing to that in the OECD countries is illuminated.

With regard to the main hypothesis, technology suppliers must charge the cost of investments in R&D in the sector from the users of own citizens and the beneficiaries outside the producer country whoever import the technology. In this respect, Turkey, as in the second category, is a country that imports technology heavily in health sector. The price index of expenses on health care are realized notably greater than the general consumer price index (CPI) and the price indices of expenditures on various consumption sets of goods and services in Turkey between 1987 and 2002.

As a result, Turkey should make choice about the coverage of its citizens in accessing to the technological innovations and advances in health sector and to what extent it could enable to its citizens benefit from those, and hence to what size of their costs it is able to afford when it establishes the policies with regard to allocating from the scarce resources to the health care sector. In Turkey the studies related to planning and settling policies in health sector appear that they could not grasp neatly this phenomenon. This study aims at shedding some light on the matter so as to fill this void.

## **2. THE FINANCE SYSTEM OF HEALTH CARE- TECHNOLOGICAL CHANGE RELATIONSHIP**

According to Weisbrod (1991: 524), the long run growth of health care expenditures is a product of dynamic interaction of the research and development (R&D) process with the health care insurance system. That is,

R&D is influenced by expected utilization of innovations in the sector, which relies on the insurance system. Reciprocally, the demand for health care insurance depends, in part, on the state of technology, which reflects R&D in prior periods. Thus, technological change is hypothesized as both an exogenous variable affecting the demand for the insurance and its structure, and an indigenous variable being influenced by the insurance system in the model.

However, in order to grasp the issue more clearly, first of all, we should understand the health care system and its finance method in the US. As a producer and a consumer influencing the pace and direction of health care R&D with its enormous size, the US is unique country. For most other countries, the R&D process in health care sector is simply exogenous to the system. The US health care system is financed primarily through private insurance system. Government subsidizes it by tax exemptions on the component of income devoted to buy insurance in the private market. On the other hand, government pays the costs of health care in particular context of poor people through the Medicaid program, and it regulates and supports the health care costs of old and disabled people through the Medicare program under these social insurance schemes<sup>2</sup>. In other words, even though health care sector is heavily subsidized by government sources as in most other countries because of its specific characteristics which is different from other commodities, even from other mix public goods and services such as education, the intensity of subsidy is lower than most of them and the sector runs much effectively under the private market incentives among all of the industrialized countries. There is no a specific public budget constraint on the size and allocation of the US health spending. In contrast to the case that a closed budget is devoted probably in major part to primary health care on which there is a public consensus in majority of countries, the US has applied an open-ended public budget for health care; whether the public sources would be spent on primary medical care or on high-tech medical care depend in major extent on the free choice of individuals (Donadson & Gerard, 1993: chap. 14; Wiener & Hanley, 1992: 47-48).

The US health care system is able to provide the highest quality care, without delays in access, to those who have a sufficient coverage of health insurance or otherwise can afford it regardless of the cost. Access to both primary and high-tech care is fairly easy. After all, the US has high-tech health services much more than any other country in the world. Consequently, the easy availability of high-tech services has led to both inappropriate use and high costs in health care sector (Wiener & Hanley,

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<sup>2</sup> See about the finance programs in the US health care sector Rosen, 2002: 168-169 and chap. 10.

1992: 47; CBO, 1991: 5, 26). Moreover, Americans now believe that because enhanced health care affects length and quality of life, high quality of care ought to be made available widely regardless of a citizen's ability to pay. This challenge also results in pressure on government to increase the subsidies to health care so as to spread the technology over the larger utilization (Weisbrod, 1991: 525).

Actually, in addition to per capita income level reached, the initial roots of this phenomenon have been raised from the historical development of government subsidies and the reimbursement method of these funds to health care by the way of health insurance system in the US. That is, on the one side government with personal income tax exemptions on expenses for health care has promoted private insurance, on the other side government itself in particular through its Medicare and Medicaid programs has provided public health insurance. The mix of private and government insurance has changed as well during the period since the end of World War II. While total private spending on health care has grown almost six times, government expenditures on that have been fourteen times in the same period. Insurance coverage for major or catastrophic health care costs has also risen sharply (Weisbrod, 1991: 526). As the share of the federal government spending on health care was simply 8.9 % in 1960, it surged up to 22.6 % by 1970, 28.9 % by 1980 and 30.9 % by 1991, respectively. This soar in the share of government funds is major extent attributable to the introduction of Medicare and Medicaid programs into the health care system respectively over time in the relevant period<sup>3</sup>. However, the share of state and local governments has survived around 12 % in the period of 1960-1991 (Warshawsky, 1991: 10; CBO, 1993). Further, if we add the tax portion that government gives up to collect through personnel income tax exemptions for health care insurance payments to promote private health insurance, the share of government subsidies and funds for health care would be even larger. Today, government pays about 45 %, private health insurance pays approximately 35 %, consumers pay around 17 % and other institutions pay the remaining portion of health expenses (Rosen, 2002: 203). In this way, Leu (1986) in his work concluded that the higher the public/private ratio in total funding of health care, the higher the total spending on it (Donaldson & Gerard, 1993: 173).

Consequently, under the current system, in broad term specific to the US, all forms of subsidies encourage utilization of health care (primary or high tech) by creating wide and deep health care insurance coverage (private

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<sup>3</sup> See Steuerle & Bakija (1994) as a selective work about actuarial imbalances in the US federal health care insurance programs (especially hospital insurance part of the Medicare program) under the aggregate federal social insurance system.

and public), and hence increase expenditure on health care. On the other hand, the uncontrolled nature of hospital reimbursement by insurance companies in the US both stimulated technological progress towards more costly provision of health care and weakened incentives for cost control. The introduction of Medicare and Medicaid programs in the system led, at least initially, to cost inflation (Donadson & Gerard, 1993: 171).

Thus, the competitive shape of health care sector in the US has created a rigorous demand for the latest medical innovations. It is likely that some of the care provided with the aid of new technology is wasteful simply because of partial payments of the technology cost by the beneficiaries. That is, excessive spending on new technology may not be due to the technology, but to the way that hospitals are reimbursed for it. Nonetheless, the possibility that technological advance is a source of excessive health care spending may not be ruled out entirely. If it reflects consumer's preferences and willingness to pay, it does not need worry about that (Edgmand, et al., 1998: 142-143). But, it does not so because of the own specific nature of health care. In fact, cost increases are not often caused by the technology, but instead they are raised from the un-optimal use of expensive high-tech capital investment in the sector (Udvarhelyi, 1994: 58).

Alternatively, in a study Goddeeris (1984) shows that some innovations may have an influence of reducing the welfare even though they improve health status for the persons in specific conditions, especially because of the market imperfections in financing of health care costs, even if the insurance is itself purchased optimally. Thus, the costs of expensive innovations may be born largely by people who never need to use them via the insurance system. In short, technological change distorts the decisions of individuals by urging them to buy more coverage of insurance with higher prices, in spite of they probably would not need to use them, so that while few people take important benefit from those, so many people can overuse them without a significant contribution to their health status since they have already paid for the cost.

As a result, alternative insurance systems will have differing long run incentives on the demand for innovations. The two sorts of insurance payment mechanisms ('retrospective', which pays a provider on the basis of costs incurred; and 'prospective', which pays sums independent from costs incurred) imply different incentives for both the development and the diffusion of innovations. Retrospective pricing encourages develop new innovations that improve the quality of care regardless of the effect on cost. On the other hand, prospective payment encourages develop innovations that reduce costs, but decreases the quality of care somewhat (Weisbrod, 1991: 537).

Furthermore, after the transition into the managed-care system and widespread utilization of that since the beginning of 1990s in the US, the waste in health care sector and hence the growth in costs are diminished without damaging the quality. Pessimists, however, argue that this decline will be temporary because new and tremendously expensive innovations have permanently increased the health care costs (*The Economist*, 1998; 1998a). On the other hand, there are simply two countries in the OECD group, the US and Turkey, that do not have a universal health care insurance program, with large fractions of their populations without any coverage or under-covered. Currently almost 18 % (about 44 million people) of the US population is uninsured, and the uninsured component has been growing over time. There appears a vicious circle between the rising costs of health care and the coverage (in deep and wide context) of health care insurance. The rising unemployment rate, in particular, and health care costs have led to more uninsured people, and in turn this has fed the health care costs, so on. A percentage rise in the financial cost of health care causes a half million more uninsured in the system. This is so because the uninsured people because of the rising health care costs tend to delay care at the beginning stages of the illnesses until they reach serious conditions at the stages that their cure are too expensive. Hence, the rising health care costs lead to the rising health care insurance costs, and the people in low-income category could not buy the insurance. However, this low income group without health insurance as a major fraction of the population needs rigorously health care and is benefited from that more than the remaining population (Rosen, 2002: 210-211; Marks, 2002).

### **3. COST-REDUCING AND COST-RISING TECHNOLOGICAL CHANGES IN HEALTH SECTOR**

The fast advancement of technology in health care industry has led to some economic concerns about possible effects of this development. Weisbrod (1991) broadly explains how technological progress influences health care cost, and what kinds of technological advances become cost-rising or cost-reducing, via health insurance system (i.e., reimbursement structure of sources to health care). The key in this argument is whether technological progress increases the demand for health insurance or not and influences the definition of health insurance scheme. To the extent that insurance coverage is defined to include both the existing and expected technologies with out of pocket payments in low rates regardless of their costs, the R&D sector will continue to face incentives that reward costly innovations relative to cost-reducing ones because of higher marginal returns

on them. In such a reward system, new technologies may be developed even as they are welfare-reducing in the sense that the insured population is not willing to pay the real cost of developing and applying the considered technology.

However, it is still ambiguous that technological advances would necessarily increase health care expenses, rather than decrease them as in other sectors. In this sense, if a previously untreatable illness becomes treatable via an innovation, an individual could face a larger and unpredictable medical care cost than the former case. Hence, both the mean and variance of his health care expenditure could increase and his demand for insurance is expected to rise. On the other hand, an innovation that reduces the mean and variance of expected health care spending on a specific disease would decline the demand for insurance. For instance, in treatment of specific diseases, some innovations reduced the demand for insurance by decreasing both the expected cost of treating that illness and the cost variance such as in polio vaccines. Yet, it is not clear whether life-extending technologies are expenditure-rising. On the other hand, organ transplant is an innovation that has increased both the mean and variance of desired individual expenses with respect to medical need. Thereby, the growth in insurance coverage reflects that the predominance of technological progress in recent decades has increased the means and variances of expected health care expenses on corresponding various diseases, rather than reduced them. In other words, the sector has tended to develop a growing number of new technologies that cause higher health care expenses (Weisbrod, 1991: 530-533).

Alternatively, the technological advances can be separated into two groups as 'little-ticket innovations' and 'big-ticket innovations'. The former includes primary changes in the number of simple diagnostic procedures used such as laboratory tests. Cost-rising uses of little-ticket technologies were characteristic of the years of 1951-1971. But, during the 1971-1981 period, uses of these small cost technologies are stabilized. In contrast, the introduction of new big-ticket technologies was characteristic of the 1971-1981 period. These affected certain patient cases, particularly treatment of breast cancer and myocardial infarction. The utilization of them tended to raise costs per case substantially (Folland, et al., 1993: 583-584).

Moreover, Weisbrod (1991: 533-534) states that health care technology pursues three phases within a dynamic process. At 'non-technology' stage, information about disease is so poor that there is almost nothing to be done with technology for it, such as in intractable cancer. 'Halfway technology' stage is not able to do very much for disease, but adjusts to disease or postpones death, such as in organ transplantation's.

'High technology' stage is a consequence of a really understanding of disease, such as in antibiotics for bacterial infections. Thus, the cost function of any specific disease might be an inverted-U shaped. Health care costs are expected to be highest in the case of halfway technologies with regard to the disease. The costs in both non-technology and high technology cases are likely to be low. The aggregate impact of innovations on health care costs will depend on the relative extent to which halfway technologies are replacing lower and less cost technologies, or those are being replaced by new higher technologies. The development of halfway technologies was implicitly encouraged by the cost-reimbursement insurance system until recently. So, depending on whether technological change is predominantly from non-technology to halfway, rather than from halfway to full or from non-technology to full, the demand for insurance is likely to differ. The demand should tend to increase most rapidly when changes in technology are cost-rising, halfway type.

In addition, some authors emphasize the possible impact of technological progress on administrative costs of health care sector. Administrative simplifications through the use of computer technology can reduce health care administrative costs. The information structure of health care industry is worse than in any other one. Health care institutions spend so less of their operating budgets on information systems relative to most other institutions. On the other hand, the development and application of health oriented telecommunication (HOT) systems improve the quality and delivery of health care. HOT technologies provide significant cost savings for businesses through improved information processing and new innovations that offer advances over current health care strategies. They guide patients to take more control over their own health care as well (Brain, 1992: 76-78; Udvarhelyi, 1994: 54).

#### **4. THE TURKISH EXPERIENCE WITHIN THE OECD GROUP**

The system of the Turkish health sector has not been properly and efficiently operating in both delivering health care to the citizens and in financing of that for a long time, but this matter has been seriously emphasized only during the recent decade. There are a large number of agencies engaged in providing and financing health care services. Health services are provided by various (in major part, public) autonomous institutions, which lead to inefficient organization and management structure in the system. The existing diverse management models have caused such serious problems as duplication of resources and fragmentation of services

(WHO, 1996). There is not an efficient referral chain operating among the health care providing units at different stages and institutions. People with simple health complaints or who have tremendously complex health problems have been left alone and do not know where to apply within this complex mechanism. Even the reference hospitals at the third stage have very often provided simple health care services that can be dealt with at the primary care stage. The hospitals at the second stage have provided health care services in major part in such category, which consist of between 80-90 % of the entire care (DPT, 2001).

Access to health services is not currently universal in the Turkish health system (WHO, 1996). 78.6 % of the population is covered within the health insurance system by the 1998 figure, which has reached 86.4 % with 'green card' implementation in the system until the end of 1999. So a large fraction of the population is still not under the coverage of health insurance. Of the aggregate health care expenditures, roughly 70 % is realized by public sector and 30 % is realized by private sector. Considering the financial resources, approximately 43 % of the health care services are financed through tax revenues, 25 % from the insurance premiums, and the remaining 32 % via out of pocket payments (user charges) by the customers. However, major part of the people under the social insurance program is not satisfied with the provided health services. Most of the people who buy a private health insurance have a social health insurance as well. Even people covered under a social insurance scheme have compensated some health care charges by out of pocket payments (DPT, 2000; 2001).

On the one side, the demand for health care in terms of coverage and quality has increased in all communities because of developments in demographic and socio-economic factors. On the other hand, because resources devoted to health care could not been utilized effectively and efficiently for several reasons, the societies could not receive appropriate health care adequately at reasonable costs to themselves. Moreover, this burden on them has grown over time even though the quantity and quality of health care received do not change. Annual average growth rates in real per capita health spending are realized as 3.3 % in the OECD countries and as 3.1 % in the EU, which are greater than that in real per capita GDP of 2.3 % in both by 1 % and 0.8 %, respectively, between 1990 and 2000. In all but four OECD countries, health spending has grown faster than GDP in this period. Likewise, in Turkey health spending has grown faster than GDP by 2.2 % between 1990 and 1998, which is greater than that of the OECD and EU mains. Average annual growth rate in real per capita health spending is 5.3 % in both Turkey and Portugal in the considered periods, which is greater than all OECD countries except Ireland and Korea. Thereby, the share of health spending in GDP has increased in all but four OECD

countries in the same period. The OECD and EU means in that with 7.1 % and 7.4 % in 1990 have reached 8 % in both groups of countries in 2000. The most resources to health care sector are devoted by the US and following that by Switzerland with shares of 13 % and 10.7 % in GDP, respectively, in 2000. Turkey is the country among the OECD group which has devoted the lowest resource to the health sector from GDP, with 4.8 % in 1998, although it has increased the share from 3.6 % in 1990 to this number (Table 1).

As shown in Table 2, the OECD countries have very diverse per capita income levels which are quite associated with per capita spending on health care and with per capita expenditure on R&D and have rather diverse shares of public sector in financing the health care. Per capita expenditures on health care as the OECD and EU means are \$ 1,876 and \$ 2,024, respectively, in 2000. This number is the highest with \$ 4,631 in the US while it is the lowest with \$ 303 in Turkey. The shares of public sector expenses on health care in the sector are 72.6 % and 74.7 % as the OECD and EU means in that order. This figure is the highest with 91.4 % in a former socialist country, the Czech Republic, and the lowest with 44.3 % in the US. It is 71.9 % in Turkey.

Although the OECD countries have fairly disparate health care systems in both providing and financing the health services, almost all of them have experienced the rising health care costs as mentioned above. Likewise, in Turkey the price index of expenditures on health care is realized significantly greater than the general consumer price index (CPI) and the price indices of expenses on certain baskets of consumption goods and services between 1987 and 2002 (Table 3). Turkey has displayed a price index of expenditures on health care greater than the CPI by approximately 40 % when the last a couple of years are considered in the period. In the same way, the figure is greater than those by roughly 60 %, 25 %, 35 %, 45 % and 40 % respectively regarding the spending on housing, on transportation and communication, on nutrition, on fabrics and on cultural and fun activities.

This rising health care costs, despite the quantity and quality of health care received do not change, have urged many countries to reform or at least partially revise their health care systems in either delivery or financing of it or in both. In this regard, since the first serious attempts in the late 1980s, the discussions on reforming the Turkish health system have intensified. There have been consistent amendments to this initial design in the late 1980s until today, whereas a noticeable progress has not been realized yet (WHO, 1996). The results of a serial comprehensive research (DPT, 2001) have exclusively pointed out the diagnosis in key problems and

**Table 1. Growth in health spending across OECD countries between 1990 and 2000**

Country:	Growth rate (%) in real per cap. health spending	Growth rate (%) in real per cap. GDP	Growth rate in health spending relative to that in GDP	Health spending as % of GDP in 1990	Health spending as % of GDP in 2000
Australia	3.1	2.4	0.7	7.8	8.3
Austria	3.1	1.8	1.3	7.1	8.0
Belgium	3.5	1.8	1.7	7.4	8.7
Canada	1.8	1.7	0.1	9.0	9.1
Czech Republic	3.9	0.1	3.8	5.0	7.2
Denmark	1.7	1.9	-0.2	8.5	8.3
Finland	0.1	1.8	-1.7	7.9	6.6
France	2.3	1.4	0.9	8.6	9.5
Germany	2.2	0.2	2.0	8.7	10.6
Greece	2.8	1.9	0.9	7.5	8.3
Hungary*	2.0	2.7	-0.7	7.1	6.8
Iceland	2.9	1.6	1.3	7.9	8.9
Ireland	6.6	6.4	0.2	6.6	6.7
Italy	1.4	1.4	0.0	8.0	8.1
Japan	3.9	1.1	2.8	5.9	7.8
Korea	7.4	5.1	2.3	4.8	5.9
Luxembourg**	3.7	4.5	-0.8	6.1	6.0
Mexico	3.7	1.6	2.1	4.4	5.4
Netherlands	2.4	2.3	0.1	8.0	8.1
New Zealand	2.9	1.5	1.4	6.9	8.0
Norway	3.5	2.8	0.7	7.8	7.5
Poland**	4.8	3.5	1.3	5.3	6.2
Portugal	5.3	2.4	2.9	6.2	8.2
Slovak Republic	--	4.0	--	--	5.9
Spain	3.9	2.4	1.5	6.6	7.7
Sweden	--	--	--	--	7.9 <sup>b</sup>
Switzerland	2.5	0.2	2.3	8.5	10.7
Turkey***	5.3	3.1	2.2	3.6	4.8 <sup>b</sup>
UK	3.8	1.9	1.9	6.0	7.3
USA	3.2	2.3	0.9	11.9	13.0
Mean_OECD	3.3	2.3	1.0	7.1	8.0
Mean_EU15	3.1	2.3	0.8	7.4	8.0

Source: OECD Health Data 2002; \*\*\* The data with regard to Turkey in the columns between 2 to 6 relies on DPT source at < <http://ekutup.dpt.gov.tr/ekonomi/gosterge/tr/1950-98/> > and the growth rates are accounted for the period between 1990 to 1998. (--) implies unavailable data; \* and \*\*, respectively, represent the data between 1991-2000 and between 1990-1999. (b) stands for the data in 1998.

**Table 2. Expenditures on health care and on R&D across OECD countries**

Country:	Per capita GDP at 2000 \$, PPP*	Per cap. tot. expend. on health, at 2000 \$, PPP	Pub. expend. as % of tot. expend. on health, 2000	Per cap. Expend. on R&D, \$ 2000	Expend. on R&D as % of GDP, 2000	Expend. on R&D in pharmaceuticals as % of that in bus sec.
Australia	26,300	2211	72.4	364 <sup>b</sup>	1.51 <sup>b</sup>	--
Austria	27,000	2162	69.7	486	1.80	--
Belgium	26,200	2269	71.2	484 <sup>a</sup>	1.98 <sup>a</sup>	--
Canada	28,200	2535	72.0	515	1.84	6.8 <sup>b</sup>
Czech Republic	14,300	1031	91.4	193	1.35	--
Denmark	29,100	2420	82.1	577 <sup>a</sup>	2.09 <sup>a</sup>	--
Finland	25,200	1664	75.1	848	3.37	3.4 <sup>b</sup>
France	24,400	2349	76.0	518	2.15	12.8 <sup>c</sup>
Germany	25,900	2748	75.1	643	2.48	6.5 <sup>c</sup>
Greece	16,800	1399	55.5	107 <sup>a</sup>	0.67 <sup>a</sup>	--
Hungary	12,400	841	75.7	100	0.81	--
Iceland	29,000	2608	84.4	645 <sup>a</sup>	2.33 <sup>a</sup>	--
Ireland	29,200	1953	75.8	313 <sup>a</sup>	1.21 <sup>a</sup>	--
Italy	25,100	2032	73.7	249 <sup>a</sup>	1.04 <sup>a</sup>	8.3 <sup>b</sup>
Japan	26,100	2012	76.7	774	2.98	5.9 <sup>c</sup>
Korea	15,200	893	44.4	403	2.68	--
Luxembourg	46,900	2613 <sup>a</sup>	92.9 <sup>a</sup>	--	--	--
Mexico	9,100	490	46.4	34 <sup>a</sup>	0.40 <sup>a</sup>	--
Netherlands	27,800	2246	67.5	536 <sup>a</sup>	2.02 <sup>a</sup>	--
New Zealand	20,200	1623	78.0	203 <sup>c</sup>	1.11 <sup>c</sup>	--
Norway	30,200	2268	82.8	492 <sup>a</sup>	1.70 <sup>a</sup>	--
Poland	9,600	557 <sup>a</sup>	71.1 <sup>a</sup>	67	0.70	--
Portugal	18,000	1441	71.2	128 <sup>a</sup>	0.75 <sup>a</sup>	--
Slovak Republic	11,600	690	89.6	80	0.69	--
Spain	20,100	1556	69.9	180	0.94	--
Sweden	24,800	1748 <sup>b</sup>	83.8 <sup>b</sup>	888 <sup>a</sup>	3.78 <sup>a</sup>	15.2 <sup>c</sup>
Switzerland	30,100	3222	55.6	797	2.64	--
Turkey	6,400	303 <sup>b</sup>	71.9 <sup>b</sup>	38 <sup>a</sup>	0.63 <sup>a</sup>	--
UK	24,500	1763	81.0	453	1.86	21.9 <sup>b</sup>
USA	35,600	4631	44.3	963	2.70	7.6 <sup>c</sup>
Mean_OECD	24,000	1876	72.6	458	2.24	9.8
Mean_EU15	24,400	2024	74.7	535	1.88	11.4

Source: OECD Health Data 2002; \* National Accountants of OECD Countries, Main Aggregates, Vol. 1, July 2002. OECD in Figures: Statistics on the Member Countries, Observer 2002 / Supplement 1; and OECD data at < <http://www.nsf.gov/sbe/srs/seind02/c4/tt04-16.htm> >. (--) implies unavailable data; (a), (b), and (c), respectively, represent the data for 1999, 1998, and 1997.

**Table 3. Development of health care price index over time relative to the indices of spending on certain groups of consumption goods and services in Turkey**

Year:	Health care/ gen. cons. price index	Health care/ dwelling	Health care/ trans & comm.	Health care/nutrition	Health care/ fabrics	Health Care/ cult. & fun activities
1987	1.02	1.00	1.00	1.00	1.00	1.00
1988	1.05	1.33	1.02	1.00	0.82	1.06
1989	1.10	1.57	1.06	1.01	0.84	1.12
1990	1.08	1.58	0.99	0.96	0.82	1.14
1991	1.19	1.70	1.04	1.05	0.95	1.24
1992	1.19	1.64	1.01	1.05	1.02	1.20
1993	1.21	1.61	1.09	1.08	1.03	1.17
1994	1.25	1.80	1.11	1.10	1.07	1.23
1995	1.18	1.72	1.14	1.01	0.93	1.21
1996	1.21	1.67	1.08	1.08	0.96	1.17
1997	1.21	1.66	1.04	1.05	1.03	1.20
1998	1.31	1.74	1.22	1.14	1.16	1.22
1999	1.41	1.64	1.28	1.33	1.35	1.26
2000	1.45	1.59	1.28	1.41	1.51	1.38
2001	1.42	1.53	1.21	1.42	1.50	1.40
2002*	1.39	1.57	1.15	1.30	1.44	1.46

Source: Calculated based on the TCMB data at < <http://tcmbf40.tcmb.gov.tr/cgi-bin/famecgi> > (updated in 06. 2002). \* The data for 2002 is prediction.

suggested the solution ways with regard to operating effectively and efficiently the health care system both in delivery and financing of it. However, even though these proposals lead to eliminate inefficiencies in the system and hence to decline health care costs as far as implemented, this would be simply one time reduction in the costs rather than permanent one. That is, even if the system runs most efficiently, the costs would rise given that the system is broadly open to the utilization of innovations in health sector.

Investments in R&D activities are quite large and distributed disparately across the OECD countries, and innovation producers have charged in any way the costs of R&D investments in the sector. Per capita expenditures on R&D are averaged as \$ 458 and \$ 535 correspondingly in the OECD and EU groups in 2000. This number is the highest with \$ 963 in

the US and the lowest with \$ 34 in Mexico following it with \$ 38 in Turkey within OECD. Expenditures on R&D in pharmaceuticals<sup>4</sup> are 9.8 % and 11.4 % of that in business sector as the OECD and EU means, in the same way (Table 2). Hence, very few numbers of rich countries have invested in R&D and innovated new items so that they can impose monopoly prices on their innovations at least for some time.

In contrast, Turkey has imported a major part of the medical appliances and equipments. It was between 85-90 % of the total expenses on those items, which amounts \$675 million in 1998; 25 % of which from Germany, 21 % from the US, 7 % from the UK and the remaining from the other innovation producers. The demand for these medical items is estimated to have grown at an annual rate of 12 % during the 1990s. This growth is also expected to last steadily in the future because the demand for innovations in the health care sector has been consistently rising particularly from the upper- and middle-income people (TRADE PARTNERSUK, 2002). Therefore, what types of innovations and at what extent will be open to the use of the citizens through government regulations and subsidies in both sides, delivery of and financing the services, of the health care system should be considered in planning and establishing the policies regarding the Turkish health sector.

## 5. CONCLUSION

Technological progress in health care sector is a major candidate among others contributing to the rising health care costs. Some consistent analytical hypotheses and empirical findings have at least partially supported this argument. However, despite significant conceptual and practical problems to be overcome so as to measure the likely contribution of innovations to the rising health care costs, further empirical evidence is rigorously required to diminish the doubts about the argument.

The US citizens have benefited from the highest quality of medical care to the extent that they can afford the cost of it. There is no such a facility in any other country even though there exist people who are able to afford it. However, the diminishing returns to health care caused by the rapid technological changes are likely to realize as they are improving the health status. In addition to an opportunity cost of resources advocated to the technological advances in health care sector, there could be other expenditures that contribute to health improvement such as expenses on

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<sup>4</sup> The data regarding expenditures on R&D directly in health sector across the OECD countries could not be obtained, but they are so likely to mimic a similar pattern as do expenditures on entire R&D activities.

specific education programs. In short, there should be a balance among the expenditure programs for a social optimum.

Thus, the welfare effects of technological advances require more research and empirical tests. Moreover, foreigners' demand for health care innovations can be estimated in order to predict what their contributions to the technology-related costs would become.

As a result, there appears a trade off, partially at least, between the speed of innovations in health care sector and the growth of health care costs for the citizens of any country. But with only one distinction, the citizens of technology producing countries have compensated the cost directly as far as the provision and finance schemes of health care have allowed to innovate further, whereas the citizens of technology importing countries have compensated the cost indirectly through importing their costs into the country as far as the provision and finance schemes of health care have allowed to import innovations further from the producer countries.

In a broad extent, while the beneficiaries of rapidly developing innovations in health care sector have to bear their costs in the private sector-oriented US system, all citizens together have to bear the burden in the government-constrained systems of most OECD countries either from a common social insurance fund or from tax revenues. On the other hand, if the citizens of technology importers, like Turkey and many OECD countries, have a consensus on benefiting the citizens from rapidly developing innovations in health care they have to bear their costs altogether. In this case, since a demand above the essential need for technological innovations is most likely to occur, it would result in overuse and higher costs in health care. Because finding out where the real need coincides with the effective demand in health sector is a major problem, it is very difficult to minimize the distortions and vest of resources.

In this regard, we may suggest that Turkey should first of all design its health care system in an effective and efficient form. Besides, the importance should be given to the protective health care along with curative one, and hence beyond health care to the other inputs of health status such as education, housing, the life style and feeding. Consequently, the citizens may be benefited from the existing health care innovations based on a cost constraint by rationing the real neediness degree of the society according to their ability to pay some portion or all of the full ticket. Thus, an acceptable portion only of the entire cost by the society would be easily transferred from the common funds to these citizens in real need. The vital thing here is to grade the real neediness extent for the right health care innovations and for right rate of income transferred. Furthermore, the rising demand for and hence dependence on innovations abroad can be lessened by devoting more

resources into the R&D activities in the Turkish health care sector; thus the fraction of health care innovations that has been imported from abroad could be declined through assimilating and imitating them over time.

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