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Enhancing Health Systems Competitiveness Through International Cooperation: A Big Data Analysis Among OECD Members

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Abstract

Given that health systems contribute to the sustainable development of countries, governments design health policies to guarantee their efficiency and competitiveness. Since isolated efforts are not enough to reach such objectives, countries recognize the necessity of international cooperation to improve Health's quality. This paper uses Big Data analytics to compare the top and bottom five health systems in the Organization for Economic Cooperation and Development (OECD), through the analysis of its disease data base. The analysis shows that these countries have the same most common diseases while differing on the less common diseases. Also, we find that OECD countries are aware of international cooperation due to structural changes originated by the World Health Organization. Finally, we discuss how cooperation among the top and bottom five health systems can enhance the efficiency of their health systems because knowledge's sharing is necessary, but not sufficient.

Keywords: Health Systems Sustainability, International Cooperation, Big Data Analytics

Resumen

Los sistemas de salud contribuyen al desarrollo sostenible de los países, por lo que los gobiernos diseñan políticas de salud para garantizar su eficiencia y competitividad; esto hace necesaria la cooperación internacional para mejorar la calidad en salud. Éste artículo compara los mejores y peores cinco sistemas de salud de la Organización de Cooperación y Desarrollo Económico (OCDE) a través del análisis de su base de datos sobre enfermedades mediante Big Data. El análisis muestra que estos sistemas coinciden en las enfermedades más comunes, pero difieren en las menos comunes. También, se muestra que los miembros de la OCDE son conscientes de la cooperación internacional debido a cambios estructurales originados por la Organización Mundial de la Salud. Finalmente, se discute cómo la cooperación entre los mejores y peores sistemas de salud puede mejorar su eficiencia debido a que el intercambio de conocimientos es necesario, pero no suficiente.

Palabras clave: Sustentabilidad de los Sistemas de Salud, Cooperación Internacional, Big Data Analytics.

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Introduction

The health system of a country plays a primary role in the improvement of life's quality within a country since its main objective is to fulfill the health needs of country's population. Then, a health system does not only oversee the supply of health services, but it also must take care that all its people have access to these services (Mehralian, and Shabaninejad, 2014). So, per the guidelines of the World Health Organization (WHO), governments must be able to guarantee a Universal Health Coverage (UHC) where all people have access to health services without compromising their financial stability (WHO, 2014). Reaching a universal health coverage is not an easy task mainly because it is necessary a competitive health system with the ability to satisfy all population needs while guaranteeing social, economic and environmental sustainability (Pratt, and Hyder, 2015).

Before to introduce the definition of a competitive health system, it is important to understand what a health system is. In the traditional literature, service provision, financing, stewardship and the generation of health inputs are the primary functions of a health system. Thus, a health system summarizes the interconnection between population, public health institutions, private health providers, and companies in the health industry. In other words, a health system is an arrangement of financial and management resources to deliver health services to the inhabitants of a country (Roemer, 1991; Reid, 2010; Farinha, Gouveia, and Nunes, 2015). The World Bank complements the previous definition adding that agents involve in a health system must promote, restore and maintain health (The World Bank, 2007). Nowadays, WHO members agree that healthcare systems are responsible for avoiding poverty related to illness (WHO, 2015). In this sense, these institutions play a significant role in assuring the sustainability of countries' productive activities. Consequently, a competitive health system is an organization that guarantees equity, effectiveness, efficiency and financial sustainability for the provision of health services to its inhabitants (Ozcan, and Khushalani, 2016).

Given the importance of health systems and globalization in the economic development of countries, Zakus and Bhattacharyya (2007) point out that governments require enhancing the competitiveness of their healthcare systems because international trade allows the propagation of contagious diseases. Hence, states appeal the international cooperation to share and discuss strategies for improving the competitiveness of their health systems. Notably, the Organization for Economic Cooperation and Development (OECD) establishes rules to manage, promote and maintain health among its 35 members. In its 2015 Report, this organization demonstrates that the life expectancy among the inhabitants of its members presents an increasing path in the last twenty years due to its measures (Pearson, et al., 2016). However, in the same report, the OECD recognizes

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that health systems of its members' present significant differences. For example, the WHO ranks the Spanish health system as the best OECD health system, with a universal medical coverage and a cost of 2,021 dollars, while the United States' health system is the worst, with no universal health coverage and a cost of 9,403 dollars (World Bank, 2016).

Although there exist health intermediaries that pursue the enhancement of health indicator at an international level, Murray (2016) aware the failures of this structure given the prevalence of diseases like tuberculosis in high-income countries and a loss of competitiveness of health systems around the world. In their conclusions, they emphasize that direct collaboration between countries can contribute to mitigating these problems. Even more, Kutzin and Sparkes (2016) point out that cooperation through the sharing of knowledge is necessary to guarantee that sustainability of health systems.

In this paper, we use Big Data Analytics to compare the health systems of Spain, South Korea, Japan, Italy, and Israel, with the health systems of Denmark, Germany, Belgium, Hungary and the United States. The top five health systems and the bottom five health systems, respectively, in the OECD, according to the 2016 Health Systems' Ranking of the World Bank. Using health data from the OECD, we find that these countries can share information among them to increase the effectiveness of their health systems.

The paper is organized as follows. Section 2 provides a brief literature review of the importance of health systems and competitiveness. Section 3 focuses on explaining how health systems fund their operations.

Literature Review

It is important to note that maintaining the effectiveness and efficiency of health systems is a government's objective since good health is one of the pillars that measures countries competitiveness (Sala-i-Martin and Artadi, 2004). Liaropoulos and Goranitis (2015) analyze how globalization has changed the distribution of health knowledge and costs, and how they have a direct impact on the competitiveness of Health's systems. Mainly, they show that international cooperation is necessary to improve the efficiency of health techniques and to reduce costs. Specifically, in periods of economic crisis countries cannot fulfill health systems objective. Using an econometric model, Farinhna, Gouveia, and Nunes (2015) demonstrate that the loss of competitiveness in health systems not only causes a detriment of countries' competitiveness level, this event has a negative impact on the economic development of countries.

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Given its importance in the development of countries, it is necessary to establish how to restore the competitiveness of health systems. Branston et. al. (2007) considers that competitiveness of health systems relies on democratic decision making since its implications in social welfare. Thus, the government must guarantee human resources together with economic resources. The health systems need skilled workers to oversee the structural deficiencies. Another branch of the literature focuses the enhancing of health systems through its industrial members. In other words, if a country wants a competitive health care system, it needs competitive health companies. A competitive business can define a strategic management that allows them to compete with local and global health providers (Porter, and Teisberg, 2011; Matlutova and Sabauska, 2013).

Our paper is closely related to the literature stream that suggests cooperation as a mean to share knowledge which drives costs reduction. Andermann et. al. (2016) analyze how governments must define incentives to promote collaboration between health researchers and health providers. It is important to note that the model of Andermann provides strategic for health knowledge transferring among health agents within and outside the country. So, the sharing experiences contribute to defining better health public policies against specific diseases (Lönnber, et al., 2017; Ferreira and Souza, 2017). Following this trend, Pratt and Loff (2011) identify that public health policy encourages a successful health production instead of to research and to invest in the elaboration of medicines for neglected diseases. The main reason behind this situation is the fact that the investigation on neglected diseases is expensive due to their complexity and they are not profitable because they low demand, or the social incapacity to acquire such medicines. In these situations, it is necessary the collaboration between public and private institutions to sharing of human, financial and capital resources (Pratt and Hyder, 2015).

The European Union (EU) recognizes the potential of collaboration to reduce health inequalities and its contribution to people's well-being. Nowadays, the EU dedicates efforts to design strategies to incentive the cooperation among its members due to the limited funding that each country owns and the increasing number of challenges that their health system must face (Sacrédeus, 2016). France is the leader in the designing of strategies to guarantee successful international cooperation. Among the agents in the French health system, the French Ministry of Foreign and European Affairs (FMFEA) oversees the development of strategies that enhance the cooperation between France and other countries or institutions. In the designing of these strategies, which focuses on the identification of the needs of weak health systems, prioritize them and invest in them (FMFEA, 2012). The Belgian approach of health cooperation defines strategies based on reaching financial sustainability through funding from different institutions (Parada, 2016).

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Health international cooperation is not exclusive of the European Union. Japan actively works on the driving of international cooperation in health care systems through the sharing of knowledge to generate more efficient and effective medical resources (Sugishita, Akashi and Kumakawa, 2016). Redaman-Maclaren et al. (2012) provide empirical evidence of how research collaboration, between Australians and Solomon Islanders research groups, increases the competitiveness of health systems in their countries. In this study, the authors report how cooperation between a low-income country and a high-income country contributes with the sharing of knowledge and resources. Our most significant contribution to this literature is the comparison between health systems with a high and a low level of competitiveness. Moreover, we suggest the information that can share to diminish the number of cases of diseases "apparently" eradicated.

A Big Data overview of OECD Top-Bottom Health Systems

As we mentioned before, the OECD also advises its country members to generate better health policies for the enhancement of their health systems through the measurement of health indicators. So, this organization has a set of health standards that non-member countries need to achieve if they want to belong to this group (OECD Health, 2017). OECD Health indicators cover various dimensions of health systems and include agents in the demand and supply side of the healthcare systems. Given its complexity, this organism defines different aspects (expenditure, status, resources, utilization, quality, protection, and funding) to fully understand the state of health systems (OECD Health, 2017).

Following 2015 Most Efficient Health Care Ranking of WHO, we perform a Big Data overview of OECD top five and bottom five health systems using the IBM's Watson Analytics tool. So, we get a data set with the number of cases by 104 diseases in the 35 OECD countries from 2000 to 2015.[2] Following, we explain the information that contains this data.

- Diseases, which includes the number of cases by disease, from Acute myocardial infarction, Acute upper respiratory infections, and influenza, Alcoholic liver disease, Alzheimer's disease, Anemias to Transient cerebral ischemic attacks and related syndromes, Tuberculosis, Varicose veins of lower extremities.[3]
- Country: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea,

[2] http://www.oecd-ilibrary.org/social-issues-migration-health/data/oecd-health-statistics/oecd-health-data-health-status_data-00540-en
[3] The total list of diseases can be found in http://www.oecd-ilibrary.org/social-issues-migration-health/data/oecd-health-statistics/oecd-health-data-health-status_data-00540-en

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Latvia, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

- Year: 2000 to 2015.

Figure 1 compares the number of diseases among the 35 OECD members. The top five countries in the number of sicknesses are United States, Germany, France, Italy and the United Kingdom. This Figure illustrates an interesting fact about the management and organization of OECD health systems. Note that the number of diseases in France excels over Mexico, where Mexico has the double number of inhabitants than France (OECD, 2017). Moreover, the French health system is the 15th more efficient health system while the Mexican health system is number 17th, which is coherent with the findings of Murray (2016); they indicate that disease registration system drives the competitiveness of health systems.

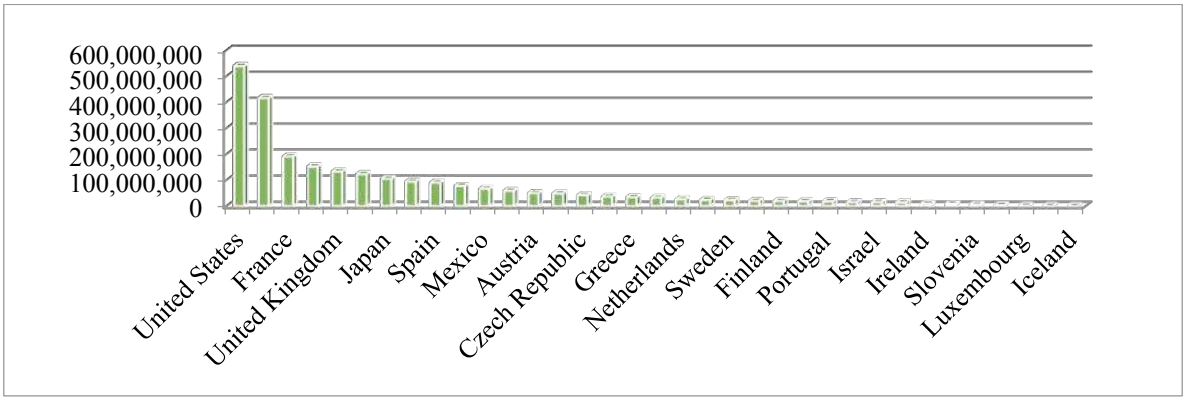
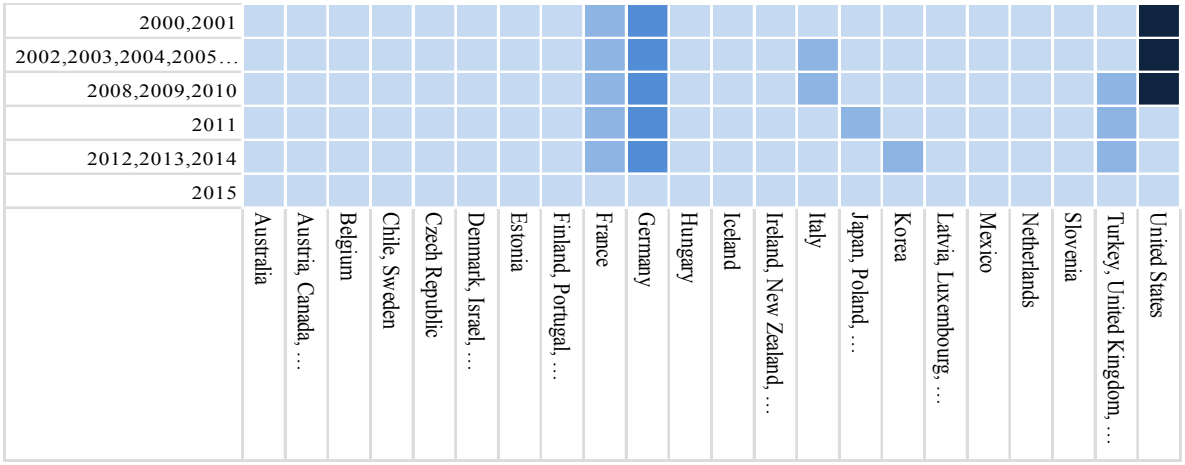


Figure 1. The number of diseases by country.

The Watson Analytics tool allows to know the number of illness by year and country, see Figure 2 (a). This figure emphasizes that 2011 is the year where countries present a structural change in the way their disease registration system works, which corresponds to the fact that WHO establishes the Political Declaration on Non-Communicable Diseases (WHO, 2014). The objective of this program is to diminish and prevent circulatory, digestive and respiratory diseases since its high prevalence in all countries in the WHO have an adverse impact on their competitiveness level (Kinge et al. 2017; Kontsevaya, Kalinina, and Oganov, 2013). However, it is important to note that United States, Germany, France, Italy, Japan, Poland, Korea, Turkey and the United Kingdom are the countries with the highest number of diseases and, in a certain way, they overshadow the behavior of other countries. Figure 2 (b) results from deleting previous countries, and we observe that the structural change of 2011 remains.

(a)



(b)

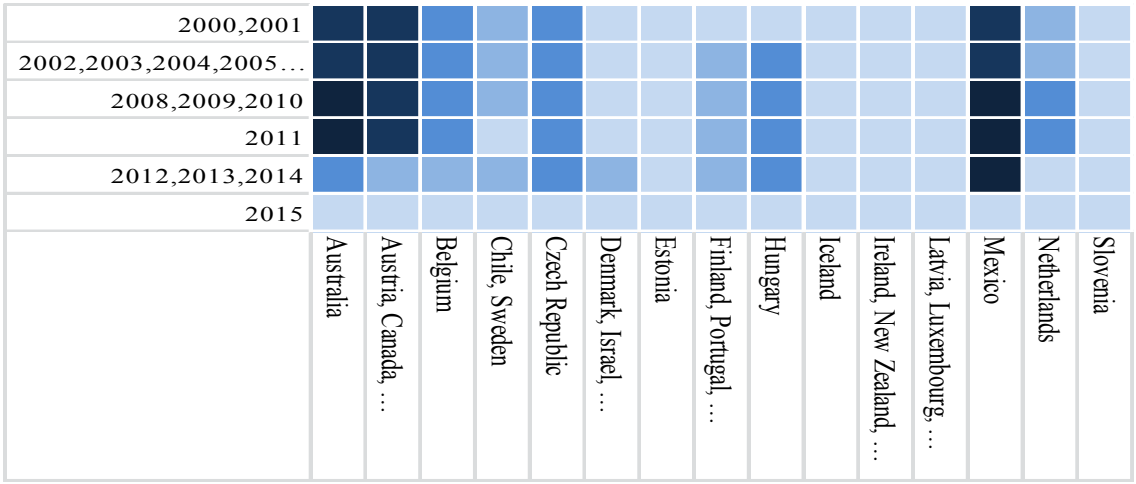


Figure 2. Impact a year and country in the number of diseases between 2010 and 2015.

COMPARING HEALTH SYSTEMS WITHIN THE OECD REGION

As we mentioned before, the OECD is an organization that pursues the enhancing of social networks through sharing valuable information about different health dimensions. Moreover, the international community recognizes the importance of health systems in the consolidation of social welfare, one of the pillars of sustainability. Consequently, the OECD enable sustainable processes to ensure the effectiveness of health systems within its member, but not limited to them.

In this section, we provide an overview of the health systems performance among the top and bottom five health systems, following the 2016 Health Systems' Ranking of the World Bank. The

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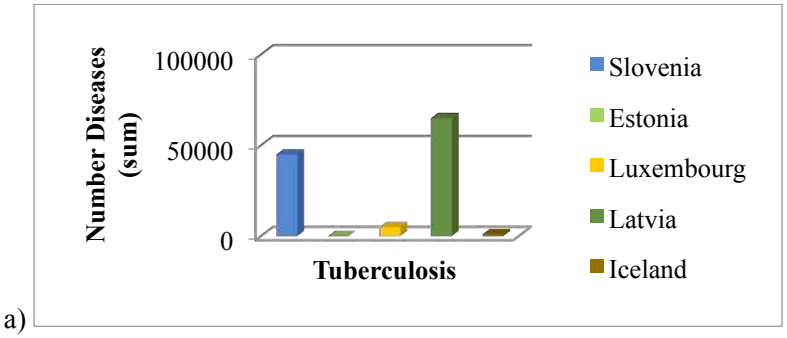
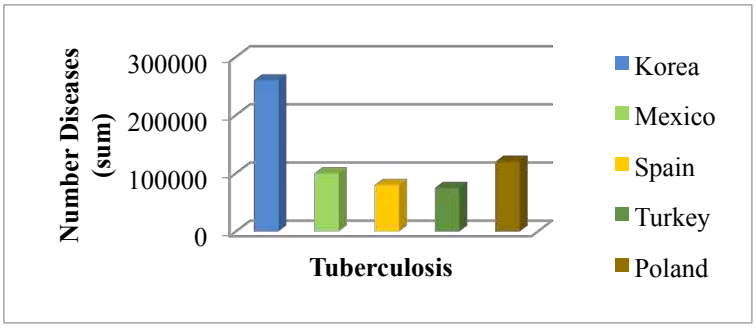
countries with top five most efficient health systems in the OECD region are Spain, Korea, Japan, Italy, and Israel, while the bottom five are Hungary, Belgium, Germany, Denmark and the United States. Although the empirical evidence suggests that health expenditure in OECD European countries presents a converging trend (Lau and Fung, 2014), health outcomes (life expectancy, mortality rate, potential years of life) are divergent (Panapolou and Pantelidis, 2011).



a)



b)

Figure 3. The lowest (a) and the highest (b) cases of tuberculosis in the OECD.

Concerning the number of diseases, Watson Analytics shows that the five most common conditions are the same for the bottoms and the tops: 1. Diseases of the circulatory system, 2. Diseases of the digestive system, 3. Diseases of the respiratory system, 4. Neoplasm and 5. Diseases of the musculoskeletal system. This is not surprising since it matches with the findings of the WHO in 2010-2011. However, there is an increasing health inequality in the OECD region even though countries share information continuously. For example, Korea presents more than 260 thousand cases of tuberculosis, around the 0.39 % per cent of the Korean population gives this disease; while the 0.19% of Spanish people suffer this disease (see Figure 3).

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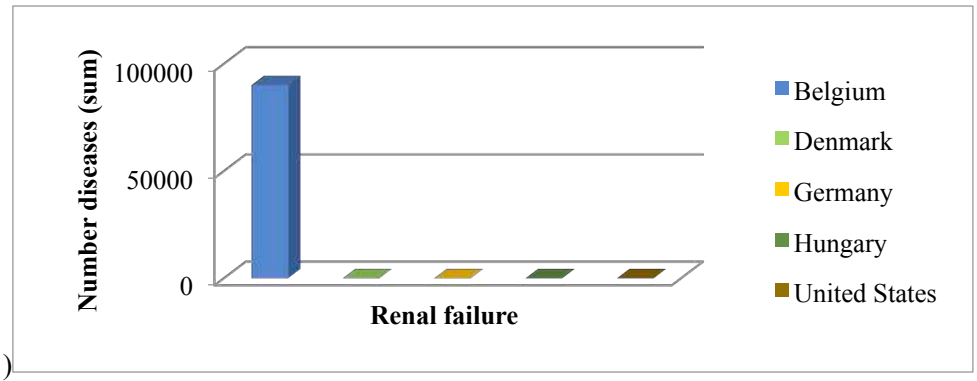

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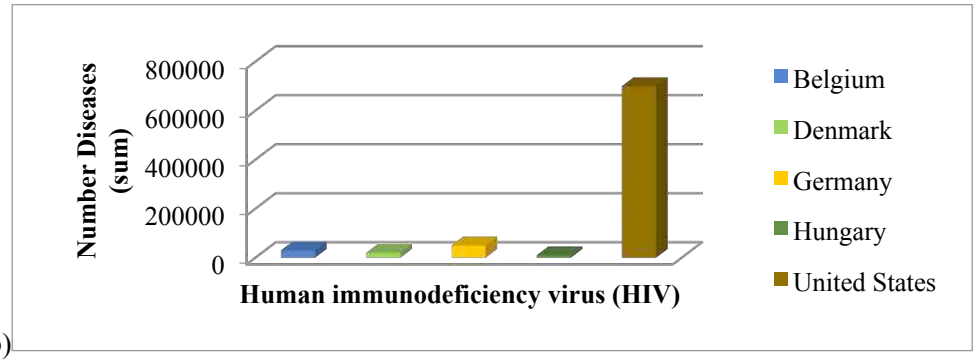

b)

Figure 4. Comparing renal failure (a) in Belgium concerning HIV (b).

In the case of the bottom countries, we have that Belgium has the largest number of renal failure' cases, among this group of countries, while the United States, with the less efficient health system, reports almost zero cases (See Figure 4).

The top five health systems in the OECD

Spain:

It's important to make clear that the health system in Spain has been improved during the past decade. A determining factor for the improvement is the 2010 Quality Plan that Spain has foreseen in Law 16/2003 of Cohesion and Quality of the National Health System. The plan promotes health care focused on patients and their needs. It supports health workers in promoting clinical excellence, and in adopting best practices based on the best available scientific knowledge (Plan,2010). It is important to recall that Spaniard government maintains a training program, since 2012, for all the agents involved in the health system. In this program, health agents learn about theoretical and technical aspects to improve health procedures (Merino et al., 2013).

The areas of opportunity detected by the OECD studies are (OECD-Spain,2017):

- Health expenditure per capita has been reduced.

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- The waiting time for some treatments like cataracts or hip surgeries has increased between 2010 and 2014.
- Prescription of antibiotics between 2005 and 2014 has increased, being above the average of the countries of the OECD.
- The number of nurses per capita is lower than other OECD countries.
- Although the trend is down, smoking is still a common habit among the adult population of Spain.

Korea

In the past 30 years, Korea has gone from having a limited medical infrastructure to a universal coverage system based on three pillars: The National Health Insurance Program, the Medical Assistance Program and the Long-Term Care Insurance Program (Song, 2009). The success of medical care in Korea is that patients have the freedom to go to any doctor or medical institution of their choice. Although there exists a referral system, referral tickets only serve for specialties; but patients can go to any hospital, without a referral ticket, in the case of emergencies, childbirth, dental care, rehabilitation, family medicine and hemophilic diseases.

Behind the Korean success, we identify continuous public policy oriented to develop medical technology. However, the 2016 report of the OECD in Kore identifies the following opportunity areas:

- Korea has a high expenditure in the pockets of its citizens "largest share of out of pocket consumption" compared to the average of countries in the OECD.
- Patients have unnecessary treatment; That means, a patient admitted to a hospital in Korea is likely to remain twice if an average patient in the other OECD countries.
- The suicide rate is the highest in the OECD area and has doubled since 2000.
- Smoking is the major risk factor concerning cardiovascular and cancer diseases.

Japan

Japan has achieved a society where people enjoy good health and longevity. Japan has maintained universal health care for more than 50 years and has a comparative advantage in the treatment and prevention of non-communicable diseases (Japan Government, 2015). The Japanese health system acquired its status from the political changes that Japan suffered between since the second world war. So, the improvement of health services is a primary objective for Japanese government given

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its limited resources, a reason that has boosted the competition among all the political forces within the country to improve Japanese health system (Reich and Shibuya, 2015).

Nowadays, the Japanese industries, in the overall, present a productivity with a negative impact on the Japanese health system (OECD-Japan, 2017). The opportunity areas for the Japanese health system are the following:

- The increase in life expectancy makes the requirements in the health area be modified by the needs of patients of older ages.
- Primary health services may have variations in the quality they offer.
- They have the highest rate of care in OECD consultations; This may reflect an inefficiency in the doctor-patient relationship.
- The suicide rate in Japan is the third highest among OECD countries. Mental health services have focused on institutional settings, with many in patients with extended stays.

Italy

The health system in Italy is a national service that provides free universal coverage. The national level is responsible for ensuring the general objectives and fundamental principles of the national health system. Regional governments are responsible for ensuring delivery of the benefits package to the population through accredited public and private hospitals (Scalzo, 2009). Thus, the health public policy in Italy establishes assignment mechanisms to allocate health services and resources. These mechanisms work by levels since the Italian government pursues a decentralized decision making by regions. So, Italian health strategies encourage planning and prevention.

The areas of opportunity detected by the OECD are (Italy,2015):

- There is considerable variability in care between the north and the south regarding the quality of services and health care provided to the population, with significant fluctuations among patients at the regional level, particularly if they need to receive care high level.
- Doctors in Italy prescribe too many antibiotics, and this is a sign of the poor quality of health care in the primary sector of the population.
- As in other European countries, the people in Italy is aging, and this goes hand in hand with chronic and long-term diseases.
- The rate of overweight children is among the highest in OECD countries.
- Although alcohol consumption on average has declined, consumption in young people is increasing. Specifically, the initiation of alcohol consumption occurs earlier and earlier.

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Israel

Israel has built a universal health system at a relatively low cost, a health spending close to7.5% of GDP in 2013, but with a high efficiency in the provision of health services. Also, it has developed a sophisticated program to monitor the quality of primary care through digital media (Shohat,2017). It is important to note that Israeli health public policies focus on management strengthening with the establishment of regulation, licensing, system coordination and information management offices (Kranzler et al., 2013).

Although the high performance of the Israeli health system, there are opportunity areas since the prevalence of "eradicated" diseases like tuberculosis (Danniel Chemtob and Rosenberg, 2010). The areas of opportunity detected by the OECD studies are (Israel,2016):

- The Israeli health system has a complex picture of inequality. Non-Jewish Israelis, poor socioeconomic groups and those living in the northern and southern regions of the periphery suffer from poor health and high-risk factors.
- The quality of hospital care is affected by a high rate of bed occupancy, on average occupancy is 94%.
- Although the training capacity of doctors has been increased in Israel, the number of new graduates about the population is still the lowest. There are 3.3 practicing physicians per 1,000 inhabitants, and half of them are 55 years of age or older and are about to retire. The number of nurses is about 5 per 1,000 inhabitants; When the OECD average is 9.1

The bottom five health systems in the OECD

Hungary

Although the public health system provides an almost universal health coverage, recent studies point out that this system does not only present a low level of efficiency. Authors like Gaál (2011) present evidence that Hungarian health provider is not competitive since its population extensively use cross-border health services.

For the improvement of health services quality, the Hungarian government maintains a continuous investment in health research and development with the collaboration of the Semmelweis University, since 1995 (WHO-Europe, 2016). Below, we mention some of the opportunity areas of the Hungarian health system

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- The establishment of an organizational framework for the adequate planning of health objective, and their implementation. Nowadays, the provision of primary health is made through the municipalities, while federal government oversees specialties.
- High level of inequality. Although the health coverage is almost universal, the distribution of health services is not uniform in Hungary.
- Dental health care and rehabilitative services are not enough to satisfy the needs of the population.
- A high level of corruption within public health institutions.

Belgium

Belgium has a mixed health system since the provision of health services is done by the government, patients, and industry. Since 2007, Belgium presents a health system in transitions due to the low level of effectiveness. Like other European countries, its aging people and fragile economic perspectives have caused an increase in the cost of health services with a consequent less competitive health system. So, in the recent years, there is a rise in the inequality among Belgian population (Vandenbosch, J. et al., 2016).

Since 2002, the Belgian government has implemented an incentive policy oriented to diminish the cost of health services. This system asks for justification in the use hospital beds: a bed without justification do not receive a federal incentive, which causes that hospitals cooperate to reduce health costs (Paris et al., 2010). However, the OECD economic survey of 2015 identifies the following challenges that Belgium needs to face in the improvement of its health system:

- Making better use of data due to the high complexity of the Belgian health system since there is no institution with the ability to centralize health information in Belgium.
- The implementation of strategies to reduce the high spending on pharmaceuticals. Belgian population has an excessive consumption of antibiotics and antidepressants.
- Pursuing the financial sustainability of attending immigrants.
- Decentralization of health services. The Belgian economic situation requires that public health institutions only focus on particular diseases instead of attending all possible diseases.

Germany

The German health system offers a level of infrastructure far above the average, contributing to high concentrations of access for the population, with practically no waiting times for elective

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surgeries. With over eight hospital beds per 1 000 inhabitants, Germany far exceeds the OECD average of 5 beds, even though their number has decreased by about 10% since 2000. Only two countries, Japan and Korea, offer more capacity in their hospital systems (OECD-Germany, 2016). Availability of health personnel, too, is well above average in Germany. There are more doctors (3.8 per 1 000 inhabitants) and nurses (11.4 per 1 000 inhabitants) than the OECD average (3.2 and 8.8 respectively).

Prevention policies are needed within German health system, particularly against obesity. The division into SHI and PHI remains one of the largest challenges for the German health care system – as risk pools differ and different financing, access, and provision lead to inequalities.

Denmark

In Denmark, universal health coverage and equity are the basis for the development and designing of public health policies (Olejaz et al., 2012). So, the Danish health system considers the national government as the maximum regulatory entity, while the country is divided into five territories and the primary health care services come from county councils. Also, hospitals are responsible for specialties. Since health services are free of charge for all Danish people and the European Union citizens, the Danish health system presents a loss in its competitiveness level because increasing costs. The 2017 Report of the Danish ministry of Health emphasizes that Danish people present a higher rate of chronic diseases like diabetes and pulmonary diseases. Around one million Danish people suffer at least one chronic disease.

Especially, the Danish health system, per OECD 2016 report, needs to address the following challenges:

- The rising costs due to an aging population, Particularly, it is necessary to reform in the primary health provision since there is financial pressure.
- Danish physicians are too specialized. It is necessary that the government incentives the formation of generalist physicians.
- Mental disorders are among the leading causes of death in Denmark, suicide rates remain high and with an increasing trend since 1990.
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United States

The United States health systems are characterized by the combination of different funding mechanisms: the government pays the health services of veterans, but productive workers get

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insurance from their employees (Davis, 2014). Also, for people over 65, there is Medicare under they pay a general insurance program. However, no universal health insurance treats all Americans. Thus, the health spending per capita in the United States is around $8713, which is greater than the average expenditure in the OECD ($3453). Consequently, United States population receive health services only if they can afford them (Moses III et al. 2013; States News Services, 2017).

Even though the United States is the leader in the cancer treatment due to the high investment in health research, the inequalities across the country and the high costs of health services diminish the competitiveness and productivity of the United States health system (Rice, et al., 2014). The WHO identifies the following problem to increase the effectiveness of health services provided in the United States (WHO, 2016):

- Health public policies do not focus on primary health care for poor communities. Particularly, a universal medical coverage is necessary to reduce inequalities and poor development in distinct zones.
- It is necessary the establishment of an injuries prevention policy. Car crashes and gun shots are the most common injuries in the United States, and they do not present decreasing trends.
- The financial sustainability of health services. As we mentioned before, health spending in the United States is one of the largest, among the OECD countries. Thus, it is necessary to reduce costs in the following years.

Conclusions

The present paper presents a descriptive overview of health systems cooperation among the OECD country members. Using group analytics, we find that 2011 represents a breaking point in the way that OECD countries report diseases, which provides empirical evidence that WHO Political Declaration on Non-Communicable Diseases have a direct impact on the way that OECD countries develop strategies for the improvement of their health systems' efficiency. Also, the paper focuses on showing the differences and similarities between the top and bottom five health systems, according to the 2016 Health Systems' Ranking of the World Bank, to identify opportunity areas among OECD health systems.

The Watson Analytics software finds that the most common diseases are the NCDs for both, the top and bottom five health systems in the OECD. However, there are significant differences in the less frequent diseases, like tuberculosis and renal failure, which indicate the existence of opportunity

areas for both groups of countries. Specifically, the United States can share information about the treatment of tuberculosis with Korea, since the first has a minor number of cases per capita. Also, Belgium can learn from the top five health systems of how to treat renal failure because this disease does not represent a public health problem in countries with a more efficient health system.

Analyzing health strategies and challenges after 2011, we find that aging population and financial sustainability are the main concerns of bottom health systems. This explains why countries like Germany, Belgium, and Denmark, with a high human development index, are among the least efficient health systems in the OECD, under third countries like Mexico and Turkey. In other words, it is necessary to guarantee funds in these countries. In this last point, it is important to remark that international financial cooperation is a feasible strategy since countries like Japan and France have supported health systems in Africa with funding.

The paper address that United States and Hungary health systems present notable differences in their structure, concerning other OECD countries. First, the United States health system is the most expensive health system with the worst outcome since its structure incentives an increase in the inequalities rates. On the other hand, Hungarian health system also has a low competitiveness level due to the prevalence of corruption. Thus, for both countries are necessary the strengthening of the central entity to regulate health agents more efficiently. In this sense, it can be useful that Korea and Italy share information with the United States and Hungary to solve their organization problem. Korea has high health costs with good outcomes due to a public policy oriented to the development of medical techniques and the investment on infrastructure, while Italy central health institution, despite its multiple regions, provides with health resource to all its regions.

Finally, it is important to note that all countries care about financial sustainability, and the evidence shows that sharing of knowledge is not the unique way in which OECD countries cooperate. So, in future work will be interesting to determine if financial cooperation it is possible in all the OECD region and not only from Japan to other countries.

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