The Japanese Health System and its coping mechanisms against COVID-19

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SUMMARY

Introduction: despite being the country with the highest average age globally, Japan has stood out in the fight against the COVID-19 (Coronavirus Disease 2019) pandemic by presenting low contamination rates by the virus and mortality. **Objective:** we aim to discuss the health strategies adopted by Japan in the face of the COVID-19 disease pandemic, as well as to evaluate data on Japanese contamination and mortality compared to the other four countries with the highest average age in the world (Italy, Germany, Portugal and Spain) and Brazil. **Methodology:** the search was carried out to evaluate Japanese health strategies by using the following databases: PubMed, Cochrane, and Scielo using a combination of the terms "Japan", "covid", "coronavirus" and "health systems" in English, Spanish and Portuguese. The COVID-19 infection data was extracted from the Our World in Data website, from January 25, 2020, to July 30, 2020. **Results:** Among the measures adopted by the country to face the pandemic, the early diagnosis and response to infection, contact tracing, early diagnosis and availability of intensive care for critically ill patients, and encouraging behavioral distancing measures stand out. Among the countries analyzed, Japan has the lowest rates of contamination and mortality in absolute terms by COVID-19. **Conclusions:** social distancing measures, early diagnosis, and treatment seem to have contributed to the success in combating COVID-19 in Japan. In the studied period, in a million inhabitants, Japan had 6.13 cases of covid while Brazil had 218.26 cases. As for the number of deaths confirmed by the disease, the first had a rate of 0.23 while the second had 5.16 cases per million inhabitants. Based on the knowledge of these measures, it is possible to seek similar mechanisms when designing health policies to face pandemics in other countries.

Keywords: Japan, COVID-19, SARS-CoV-2, Coronavirus, Health Systems.

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INTRODUCTION

Japan currently represents the third-largest economy globally, being considered an example in education, security, and technology[1]. In health, the country stands out for its universal health system established in 1961[2,3]; with its effectiveness and technological and economic development, it was possible to notice an improvement in the quality and expectation of life over the decades[1].

The Japanese health coverage system has as main characteristics: compulsory affiliation[2]; citizens are covered exclusively by national medical insurance or social insurance, with beneficiaries being co-responsible for paying a small portion of the expenses; beneficiaries have guaranteed access to different levels of care, including specialists[1,3]; institutions are reimbursed for patient expenses[4]. The co-payment portion varies according to age. It is observed that 20% of the costs are paid for those over 70 years old, and 10% for those over 75 years old[2].

With more than 127 million people, one of the main points discussed in the country's economy is the rapid process of population aging and low birth rates. Life expectancy in 2015 was 83.9 years, the highest among the Organization for Economic Cooperation and Development (OECD) countries, ahead of countries such as Sweden (83), Italy (82.6), South Korea South (82.1), and the United States of America (78.8)[1].

According to the European Center for Disease Prevention and Control (ECDC), Japan has shown low contamination rates and mortality rates from COVID-19, despite having the population with the highest average age in the world and the country with the highest proportion of individuals over 70 years of age. Among the risk factors for developing complications from the disease, including death, are male sex, age > 65 years, smoking, diabetes, systemic arterial hypertension, cardiovascular and respiratory disease[5].

The study aims to evaluate data on contamination and mortality from Japan, compared with other countries (Italy, Germany, Portugal, Spain, and Brazil) with the highest average age. Thus, we will also discuss the health strategies adopted by the country and the possible reasons why it has low mortality and contamination rates in the face of the COVID-19 pandemic.

METHODOLOGY

The study was performed using the following databases: PubMed, Lilacs, and Scielo using a combination of the terms "Japan", "covid", "coronavirus" and "health systems", in English, Spanish and Portuguese, without time limit. Data were evaluated during July 2020.

Data on the infection was taken from the Our World in Data website (https://ourworldindata.org/coronavirus#confirmed-covid-19-deaths-by-country), whose numbers are updated daily by the ECDC. The data correspond from January 25, 2020, to July 30, 2020, equivalent to 187 days. All calculations and graphs were based on a million inhabitants and represented on a logarithmic scale for better comparison conditions between countries.

The five countries that, according to the ECDC, have the highest average age were included in the evaluation: Japan (48.2 years), Italy (47.9 years), Germany (46.6 years), Portugal (46.2 years), and Spain (45.5 years). In addition, Brazil (33.5 years) was included, which appears in the 71st position. In addition, the study is based on a literature review of the leading information related to the topic.

RESULTS AND DISCUSSION

The situation of COVID-19 in the evaluated countries

According to data extracted from Our World in Data, we can see that among the six countries evaluated, Japan was the only one that did not exceed the range of 10 infections per million inhabitants (Fig. 1). Brazil had the highest number of infections, with a peak on July 30, 2020, with 218.26 cases per million inhabitants, Spain with 169.01 cases (March 31), and Japan last with 6.13 cases as of July 30, 2020.

Italy and Spain provided late control measures that may have contributed to the rapid transmission of the virus in these countries[6]. In countries such as China and South Korea, the implementation of social control measures resulted in around the 8th-11th days[7].

Regarding the number of deaths (Fig. 2), Spain came to account for the highest value, with a peak of 18.57 deaths per million inhabitants (April 25), Italy in second place (13.59 deaths on April 25), Brazil third (5.16 on July 26) and Japan again last (0.23 death on April 29).

It is important to note that the data on contamination by COVID-19 tend to represent a small portion of its real number, making it more reliable to assess the number of deaths[8]. According to a study developed by Li et al. (2020)[9], it is estimated that 86% of cases (95% CI: [82% – 90%]) are undocumented.

Japan had the lowest increase in deaths in absolute terms (after 30 and 60 days) when evaluating the absolute change in the number of deaths (Table 1) from the 10th day of infection in each country assessed.
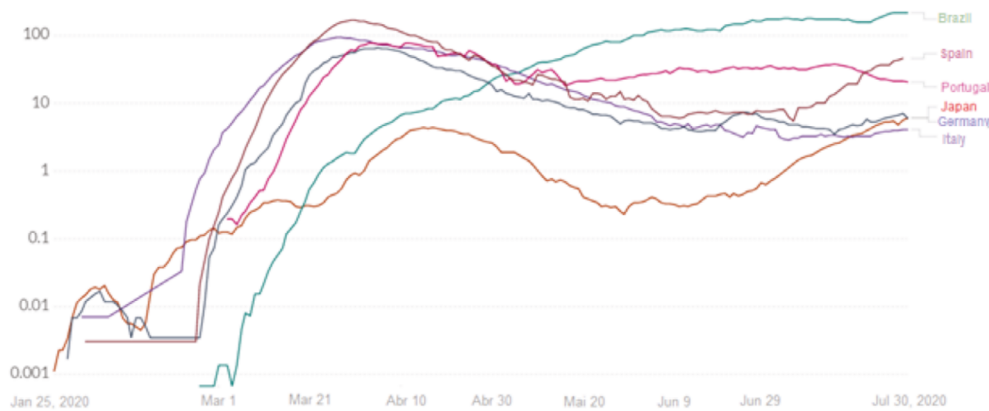

Figure 1. Number of confirmed cases of COVID-19 per million inhabitants, from January 25 to July 30, 2020.
Source: *European Centre for Disease Prevention and Control*. Available at: https://ourworldindata.org/. Accessed Aug 01, 2020.
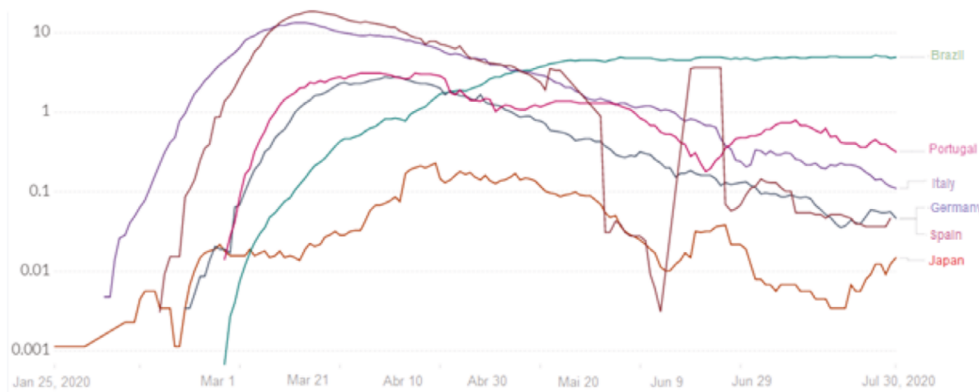

Figure 2. Number of confirmed COVID-19 deaths per million inhabitants, from January 25 to July 30, 2020. Source: *European Centre for Disease Prevention and Control*. Available at: https://ourworldindata.org/. Accessed 01 de ago 2020.

Table 1. Mortality rate per million inhabitants from the 10th day of the pandemic by SARS-COV-2, and in the two subsequent months.

Country	Date	10th day	40th day	Abs	Rel %	70th day	Abs	Rel %
Italy	02/26	0.31	12.07	+11.76	+3.799	4.62	+4.31	+1.393
Spain	03/10	0.09	16.81	+16.73	+19.550	4.21	+4.12	+4.821
Japan	03/11	0.07	0.03	+0.01	+79	0.14	+0.12	+764
Germany	03/16	0.32	2.37	+2.05	+651	0.55	+0.23	+74
Portugal	03/22	1.78	2.62	+0.84	+47	1.32	-0.46	-26%
Brazil	03/23	0.12	1.79	+1.66	+1.345	4.47	+4.34	+3.513

Date: initial day of SARS-COV-2 pandemic record, Abs: absolute change in the number of deaths since the 10th day of the pandemic, Rel: relative change in the number of deaths since the 10th day of illness.
Source: European Centre for Disease Prevention and Control.

Portugal stood out for high mortality on the 10th day of illness (1.78), but on the other hand, it was the only one with negative absolute (-0.46) and relative (-26%) values after 60 days. Brazil was the only country that maintained a higher number of deaths on the 70th day of illness than the 40th.

In a study developed by Hallal et al. (2020)[8], among the 48 countries that had at least 10 deaths as of April 18, only five had less than one death per million inhabitants on the 20th day of the pandemic: Japan, China, Pakistan, India, and Indonesia. Until July 30, according to Our World in Data, these five countries remained below this range.

Japanese strategies in the face of COVID-19

Japan had low rates of contamination and mortality by the virus despite the increase in age in recent decades and the consequent presence of comorbidities in the older population[10]. Then, this is a point that draws attention since a higher volume of deaths is expected in older populations.

On March 9, 2020, the Japanese Ministry of Health defined a strategy to combat the pandemic based on three fundamental points: early diagnosis and response to infection, early diagnosis, availability of intensive care for critically ill patients, and encouragement of behavioral distancing measures[10]. Testing capabilities, travel restrictions, and quarantine of ships with suspected cases of COVID-19 were also expanded[11].

Early diagnosis based on the expansion of virus testing was a strategy adopted by several countries. Japan had a low rate of testing per thousand inhabitants compared to the other countries evaluated (Table 2) despite being defined as a strategy to combat the pandemic by the Japanese Ministry of Health[10].

Table 2. Number of tests performed and number of tests per confirmed case for diagnosis of COVID-19 per thousand inhabitants.

Country	Number of cases*	Date with the highest number of cases
Portugal	1.56	05/17
Italy	1.05	05/22
Spain	0.97	05/01
Germany	0.96	07/26
Brazil	0.24	07/07-21
Japan	0.11	07/29

* *Number of cases per thousand inhabitants.*
Source: Our World in Data.

Social isolation is pointed out as the primary health strategy used by the Japanese government. About 74.5% of the population reported that they were following social isolation and 82.9% reported complying with care using masks[12].

In Brazil, one of the main difficulties pointed out is obedience to the recommendations of social isolation. Bezerra et al. (2020)[13] conducted a study to assess which mechanisms make it difficult to follow this orientation. They noticed that the main aspect of people with a higher educational level was social interaction (45.8%). In comparison, it would be financial restrictions for those with a lower educational level and income (35%).

Hypotheses for Japanese results in the face of COVID-19

Some hypotheses to explain why Japan has lower rates of contamination and mortality by COVID-19 have been discussed globally by several researchers. Iwasaki et al. (2020)[10] summarizes five of them: (1) Japanese culture, (2) previous exposure, (3) lower susceptibility to the ACE2 receptor, (4) human leukocyte antigen (HLA) difference, and (5) protection by the bacillus Calmette-Guérin (BCG) vaccine.

The first of them points out that it would be part of the country's culture to maintain a level of social distance and the fact that it is already part of local habits to use masks to avoid transmission of viral infections. In a previous study presented by Uchida et al. (2017)[14], with 13,127 children, the use of masks was considered a protective factor against seasonal influenza (p = 0.003; OR 0.859, 95% CI 0.778–0.949), indicating a good response in reducing the transmission of viral respiratory infections.

The second hypothesis would argue that the Japanese would have been exposed to milder versions of SARS-CoV-2 since there had been previous exposure to Chinese viruses, having then created immune protection and a greater degree of viral resistance[10]. This approach was pointed out after evaluating 3500 genomes of the etiological agent. However, it is understood that despite the similarities between these genomes, none of them would have more than 10 mutations, which would hardly incur the virus that triggered the pandemic.

The third and fourth hypotheses bring that some innate issues would reduce susceptibility to COVID-19. According to the first of them, the Japanese would have lower expression of the ACE2 receptor[10].

As it would be one of the receptors used by the virus to invade the respiratory tract cells, the Japanese would express less SARS-COV-2. The following hypothesis argues that, just as the presence of HLA-B*4601 has been associated with a greater risk of developing severe forms of the disease[15], the Japanese population could have some distinct HLA, although not yet defined reflecting greater immune resistance to the virus [10].

Finally, the fifth and final hypothesis suggests that the BCG vaccine would confer immunity to SARS-COV-2[10]. The problem with this approach is that so far, most studies that bring this relationship are limited to the level of experimental studies. However, it would be justified by the mechanism of induction of epigenetic genomic reprogramming of monocytes[16].

Challenges

The aging rate of the Japanese population has been one of the main issues discussed within the health system. In 2015, more than a quarter of the country's population (26.7%) was in the age group above 65 years of age. The country's aging rate has been faster than in other developed countries, such as France, which took more than 100 years to double the proportion of the population over 65 years of age, compared to Japan, which achieved this feat in just 24 years (from 7% in 1970 to 14% in 1994)[2].

Japan has promoted "The Community-based Integrated Care System" (CbICS), implemented in 2012, which would be a system of significant social assistance, based on: health care, nursing care, prevention, housing, and support to the needs of life[2]. This system deals not only with health issues but also with assistance and respect for the dignity of the elderly[17].

Limitations

Countries have different policies for carrying out diagnostic tests to detect SARS-COV-2, and also various tests can be used[8]. The accuracy of diagnostic tests is a widely discussed issue. In a meta-analysis developed by Castro et al. (2020)[18], it is estimated that the tests for the evaluation of IgM antibodies have 82% sensitivity and 97% specificity, IgG antibodies 97% sensitivity and 98% specificity, and molecular study by naso and oropharyngeal swab with 97% sensitivity and 99 % specificity. In a meta-analysis published by Zhang et al. there was even greater sensitivity in the evaluation of IgM and IgG by the gold-based colloidal immunochromatographic test compared to the ELISA technique (p<0.5)[19].

CONCLUSION

Social distancing measures, early diagnosis, and treatment seem to have contributed to the success in combating COVID-19 in Japan. In the period studied, in a million inhabitants, Japan had 6.13 cases of covid while Brazil had 218.26 cases. As for the number of deaths confirmed by the disease, the first had a rate of 0.23 while the second had 5.16 cases per million inhabitants. Based on the knowledge of these measures, it is possible to seek similar mechanisms when designing health policies to face pandemics in other countries.

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Author contributions
LSB: Conception, writing and corrections. MMBMS: text writing. JVBC: text writing. MGRP: guidance. CASA: orientation.

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