

Comparative analysis of diabetes prevalence in China and Japan

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Abstract. The prevalence and mortality rate of diabetes shows an increasing trend globally, especially in Asia regions. From 1980 to 2014, the global prevalence rate increased from 4.7% to 8.5%, while the figure for South-East Asia Region surged from 4.1% to 8.6% in the same period, which ranked the second-high rate globally. As the neighboring countries, China and Japan share many similarities. The researchers found that although there are many differences in the prevalence of diabetes between the two countries, the overall prevalence is both in a high level. Therefore, we'll collect the data about the regional differences between China and Japan, to compare and analyze the results reasons and solutions of two region's differences. The prevalence rate and the mortality rate are different in different gender and ages in both countries. Normally males got the greater chances to get diabetes, while females are more likely to die in this disease. As the reacerch shows that the diabetes caused by three main factors, they are smoking, high body mass index and low physical activity respectively. And the high body mass is the dominant cause. As the latest research, the scientist found some new ways to help the diabetes patients. We might could use several solutions to them in later years.

Keywords: Diabetes, China, Japan, Comparison.

1. Introduction

Diabetes is common chronic diseases, which can lead to blindness, kidney failure, heart attacks and many other complications, and endanger people's health worldwide.

In recent years, with the continuous development of social economy and the improvement of people's living standards, the incidence and prevalence of diabetes are on the rise. According to the World Health Organization, the number of people with diabetes has risen by more than 300 million in the past 50 years [1]. Now diabetes has become a special concern of governments, health departments and the majority of medical workers.

In China, due to the rapid development of the past 20 years, the living standards of residents have improved rapidly, and the prevalence of diabetes has also been rising like other developing countries, which has become an important social problem. By 2021, the number of people with diabetes in China has already It has reached 140.9 million, making it the number one country in diabetes [2]. As a country with a high aging population, China's neighboring, Japan, is also facing many problems caused by diabetes.

In the past 30 years, China and Japan have already carried out a lot of work on the education, prevention and treatment of diabetes. Since 1987, the "Chinese Medical Association Diabetes Branch" has held Sino-Japanese Diabetes Symposiums in China and Japan in turn every 2 to 3 years [3]. But what is the status of diabetes in these two countries? What are the reasons for the increasing prevalence of diabetes? Can we find better prevention methods from the perspectives of the prevalence of diabetes and the quality of the people in the two countries? A horizontal comparison of the diabetes situation in China and Japan is of great significance to the prevention and treatment of diabetes in China and the world.

This study is based on the national quality and diabetes prevalence of China and Japan, and makes a comparison, trying to find out the reasons for the rising prevalence of diabetes and a good way to prevent and treat diabetes.

In this study, the prevalence of diabetes was refined and compared in terms of prevalence, gender distribution, and trends, and the national quality was compared in terms of national dietary structure and physical activity. In order to find out how the national quality affects the prevalence of diabetes, and provide appropriate methods for prevention and treatment of diabetes.

2. Diabetes in China

As the research shows that the global prevalence rate of diabetes in 2021 is appropriate 10.5% (for people who between 20-79 years), compared to the figure for China is 10.6%, and generally the data shows an increasing trend globally [4]. For prevalence of diabetes in 2021, China ranked the fifth in the world [5]. The WHO divided diabetes into two categories. Type 1 diabetes is characterized by inadequate insulin synthesis. Type 2 is caused by the insulin in body is not effective. The rate of men getting Type 2 diabetes in China surged in last few years, it increased by 5% to 10%. At the same period, the number of adults who get pre-diabetes in China is get close to 500 million [6].

In 2016, for Chinese upper middle-income group. The number of diabetes death of female between 30-69 years old adults is much higher than the figure for male in the same age, which is 56000 and 37000 respectively. Also, the figure for diabetes deaths in old (upper 70) illustrates the same trend. The number of females who dead in diabetes was twice of that of males. (82400 vs. 49300). But the research shows that the males would be more likely to get the diabetes than females. The total prevalence rate in China is 9.4% in 2016. The males account for 10.5% in prevalence rate, while the females was 8.3%. The prevalence rate of diabetes in males who have the overweight problems was 37.2% in China, 33.6% females who have that problem got the diabetes too. In average, there are 35.4% people who was overweighting had the diabetes too. Which is the main risk factor to the disease. For people who are in obesity state, the females are more likely to get the diabetes, 8.5% of them got the diabetes in China, males are much lower which was 6.2% for that. 22.2% of males who was physical inactive got the diabetes, compared with the number of females which is 25.4% [7].

For the national response to diabetes, China already had several strategies. But in 2016 China didn't have plans to reduce citizens' physical inactivity. In 2017, Chinese government start to focus on the advertisement and the educations on diabetes. By the end of 2019, the central and provincial governments had issued a total of 91 related policies. They separate the strategies into four parts: popularization, guidance, payment and supervision [8].

For popularization, to improve the awareness rate of diabetes knowledge, Chinese government started to hold the popularization of World Diabetes Day [9].

3. Diabetes in Japan

In Japan, according to 2010 data, the prevalence of diabetes among adults younger than 80 years of age (20) is about 5%, and it rose to about 7.7% in 2012, reaching the peak of the data in the past ten years. Then it dropped to about 5.2% in 2014, and after that year, the prevalence rate showed an upward trend again, reaching above 6.5% in 2022. Although the prevalence of diabetes in Japan has shown an upward trend in recent years, it is not high compared to the values in many countries and the world average [10].

In 2016, for Japanese high-income group. Rather than China, the number of diabetes death of males between 30-69 years old adults is much higher than the figure for females in the same age, which is 770 and 2540 respectively. But the figure for diabetes deaths in olds (upper 70) gives the completely different trend. The number of females who succumb to diabetes was 6150, which is a little bit higher than the figure for males. The males got the greater chances to get the diabetes. The total prevalence rate in Japan is 10.1% in 2016. The males account for 11.5%, while the females

account for 8.5%. The prevalence rate of diabetes in males who have the overweight problems was 30.4% in Japan, 22.8% females struggling with the diabetes too. For people who are in obesity state, the number of people who got the diabetes by obesity was much smaller than the figure for China. In total, there are 3.5% of people who are in obesity get the diabetes, and the figure for both males and females are nearly the same (3.4% v.s 3.6%) [11].

Japanese government fully respond to making the policies to prevent the diabetes, they also got the operational strategies to reduce overweight and obesity. And they got the three main plans. Since 2008, they served the citizens between 40 to 74 years old to have some specific health check, and provide them the medical insurance. The people who had accept the health check in 2016 in Japan had reached to 53.1%. And since 2000, the government managed a national event which is called Healthy Japan 21, during planning, government Regularly investigate the eating and living habits of citizens. Which played an important role in the prevention of diabetes for Japanese government. Also, the rate of Japanese received the treatment of diabetes was much higher than the figure for Chinese in 2013(76.6% v.s 32.2%).

4. Comparison

Compared with the prevalence of diabetes in the two countries, on the whole, in 2019, patients in China (91,976,595.65) is far more than in Japan (9,308,101.57), almost ten times that of Japan, which is due to the fact that China's total population is more than ten times more than that of Japan (China's population in 2022 is 1.4 billion, and Japan's population in 2022 is 1.26 billion). Compared with the prevalence, on the whole, the prevalence rate in Japan has been higher than that of China in the period from 1990 to 2019, and the data of both countries have shown an overall upward trend. Comparing the diabetes mortality rates in the two countries, it can be found that between 1990 and 2019, Japan's mortality rate continued to decline, until 2019 was only 0.63%, while China's data continued to rise to 1.62%, while trends with prevalence show different results. The result as shown in figure1 to figure 1 and figure 2.

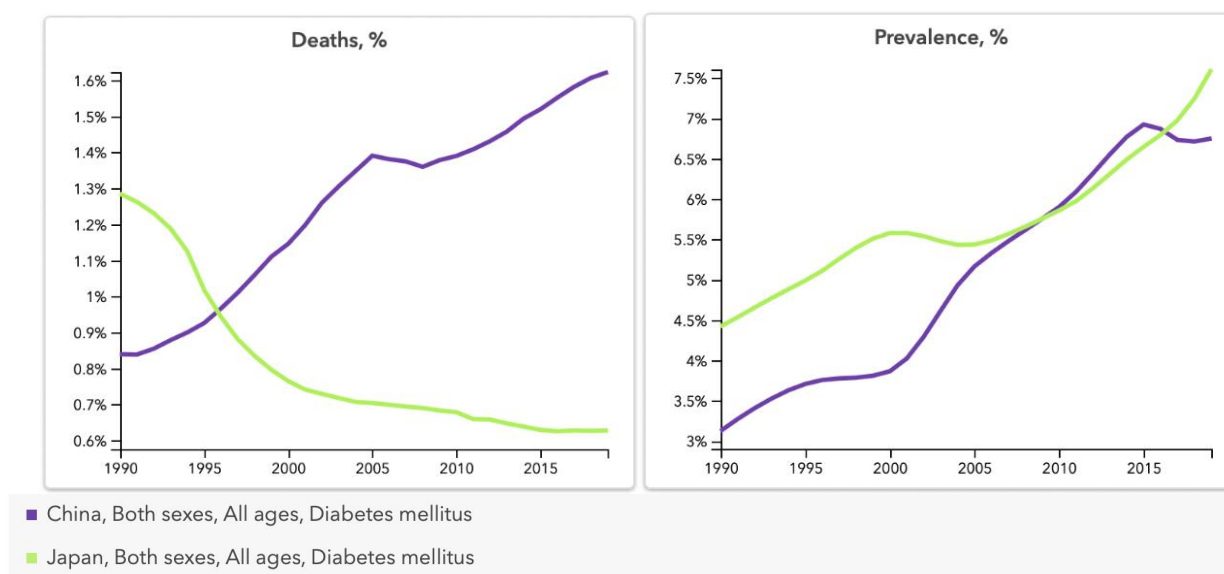


Figure 1. Comparison of diabetes death/prevalence rate of Japan and China of both sexes all ages.

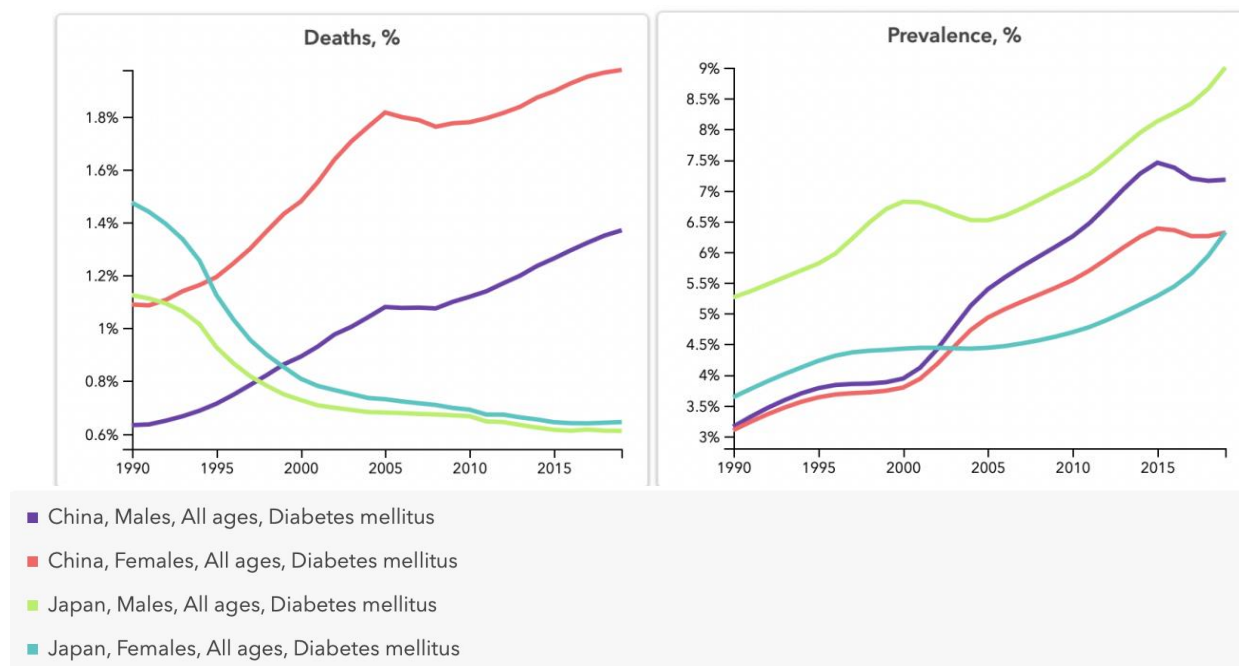


Figure 2. Comparison of diabetes death/prevalence rate of Japan and China of different genders.

Different genders also have different prevalences, and in both countries, women tend to have a lower prevalence of diabetes than men, while women have a higher mortality rate of diabetes than men; Among them, Chinese women have the highest mortality rate, and Japanese men have the highest prevalence. The result as shown in figure1 to figure 3.

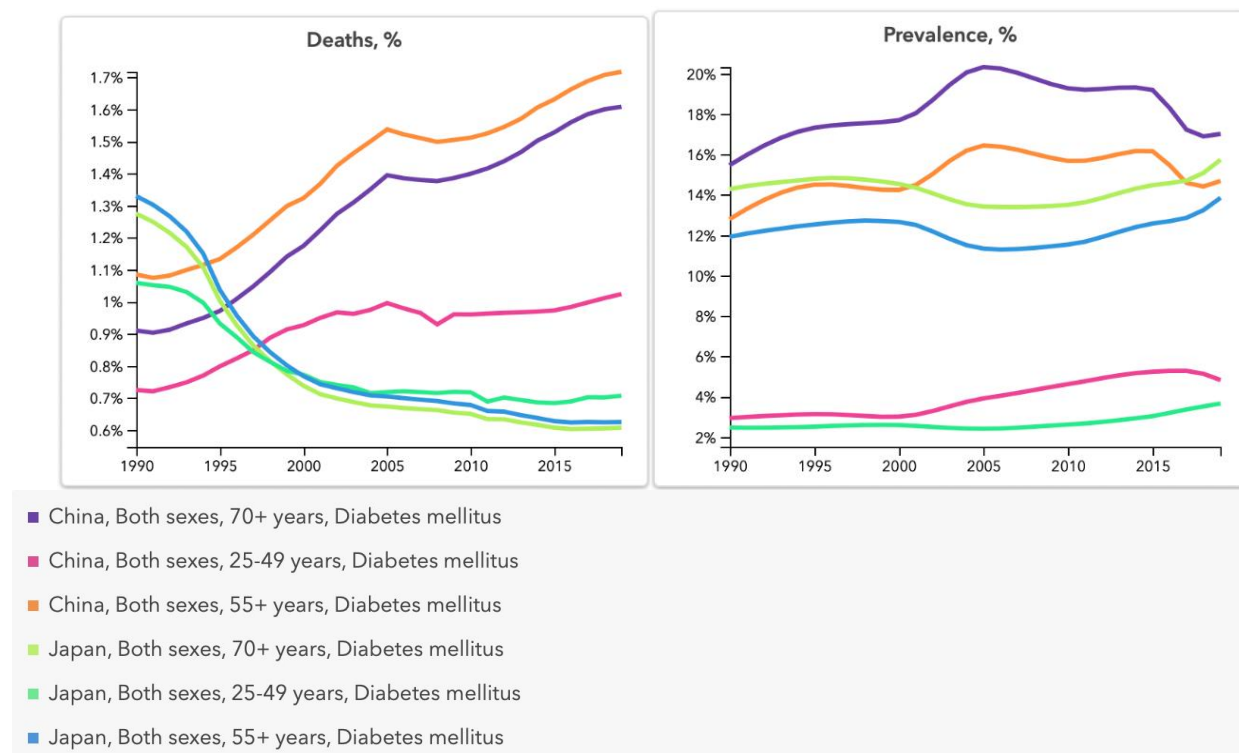


Figure 3. Comparison of diabetes death/prevalence rate of Japan and China of 3 different age groups.

In terms of age distribution, the mortality rate of people aged 55+ in China is much higher than that of 25-49 years old, and it shows an upward trend; The mortality rate of people aged 25-49 and 55+ in Japan showed a similar trend, both declining, and even after 2000, the mortality rate of the 25-49 age group was higher than that of 55+ year olds. In terms of prevalence, both countries are 55+

years old group higher, of which China is higher than Japan, for 25-49-year-old group, China has a higher prevalence than Japan. Then the prevalence of diabetes in the group aged over 70 years old in the two countries was compared, and it can be clearly found that the prevalence of the 70+ year old population is also higher than that of the 55+ year old group. From the above data, it can be concluded that the elderly population is more likely to get diabetes. Of course, it is worth noting that the diabetes mortality rate of the three age groups in Japan is declining, and after 2000, the mortality rate shows that the larger the age group, the lower the mortality rate. In China, the diabetes mortality rate of 55+ and 70+ years old is still higher than that of the 25-49 age group. From the above data, it can be found that the prevalence of diabetes in China is positively correlated with mortality, while in Japan, it is not, with a high and gradual increase in diabetes prevalence, and a low and decreasing mortality rate. The result as shown in figure 4.

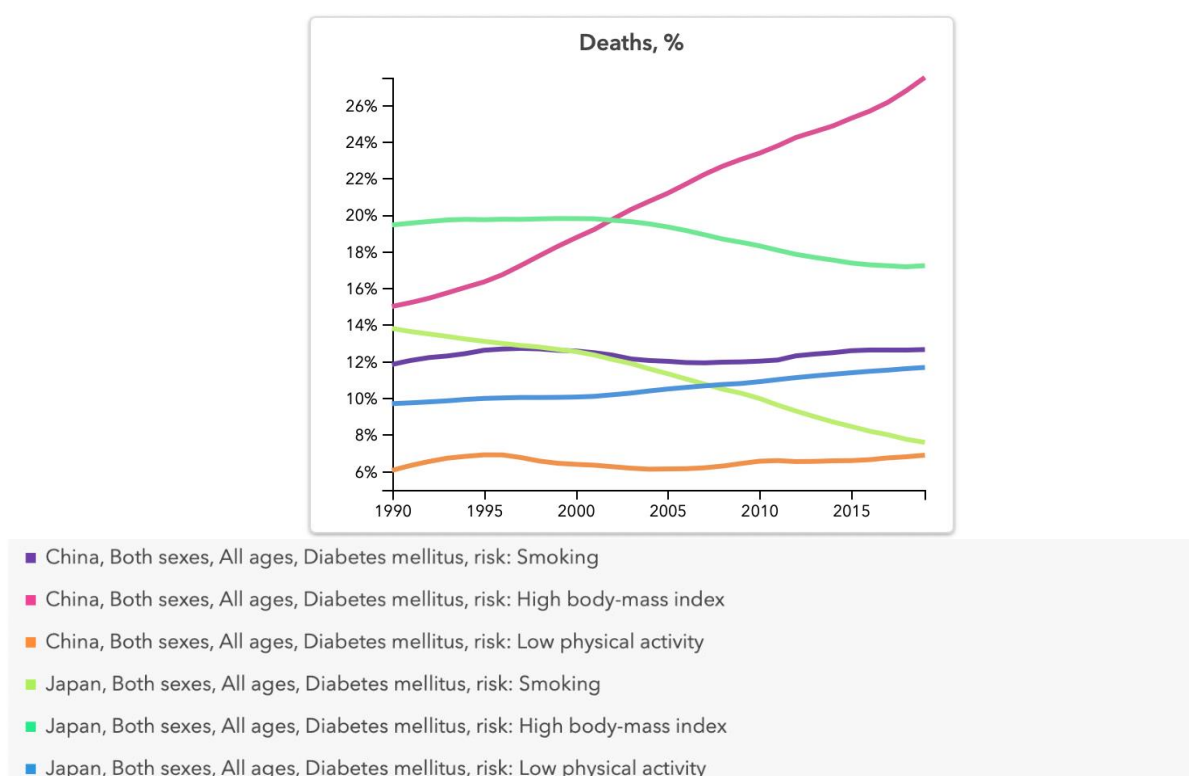


Figure 4. Comparison of diabetes death rate of Japan and China of 3 different risk factors.

Starting with the data on diabetes mortality caused by different risk factors, comparing the data of three different factors of high body mass index, low physical activity and smoking in both countries, it was found that for both countries, the data that the death rate caused by high body mass was greater than the data of smoking was greater than the data of low physical activity. Of course, for most people, the high body mass index is often accompanied by low physical activity. However, it is undeniable that these factors have an impact on the increase in the prevalence of diabetes. Comparing the situation between the two countries, China's diabetes mortality rate caused by high body mass index and smoking is higher and higher than that of Japan, while Japan's data are declining. But for the data on the death rate caused by low physical activities, Japan's is higher than China's, and it is slowly rising.

5. Discussion

5.1. The impact of economic development on prevalence

A comparison of basic demographic information and the economic conditions of the two countries can also identify important factors that contribute to the different trends in diabetes. Japan is a typical developed country, with a high level of economic development, is in a state of population decline

(death rate is greater than the birth rate) of the country, life expectancy in the world first (84.91 years), more than 10 years higher than the world average (72.98 years); while China is a well-known developing country, in recent years the rapid economic development, becoming the world's second largest economy, but also a well-known population of large (14 billion). It can be seen that although one is developed country and the other is developing country, Japan and China are both important economic components in the world. Regional disparities in the economic burden of medical care are prevalent worldwide. The review of health financing shows that six years ago, per capita health spending in high-income countries reached \$5,252, more than 100 times that in low-income countries. It is estimated that this proportion will continue to be the same by 2050, with significant inequalities in health services across different economic levels [12]. Judging from the two countries' policies on diabetes, Japan's relevant policies were introduced more than ten years earlier than China's, and China has the problem of uneven distribution of medical resources, and the proportion of people receiving treatment of diabetes is also much lower. Even in terms of GDP and the overall economy, China's economic level is very high, and the overall financial investment in medical care is not small, but China has a large population, and the medical resources that can be allocated to each person will be much less than that of developed countries such as Japan. Especially for diabetes, a chronic disease that requires long-term intervention and treatment, the amount of medical resources allocated per capita is very important for the recovery and stability of the patient. The smaller the number of patients each doctor supervises, the more comprehensive interventions can be made on the patient's condition, the more personalized treatment plans can be made, and the better the patient supervision. Therefore, for diabetes, economic development and national investment in medical resources are very important [13].

5.2. The influence of obesity caused by food culture on the prevalence

Of course, Japan is more generally considered to be a typical high-income country, while China has the problem of the gap between rich and poor. It is certain that in both countries with rapid economic development, obesity is widely regarded as an important cause of disease. Obesity leads to diabetes, which increases mortality and costs for community health care. If you can control your weight, your blood sugar will improve, your need for medication will decrease, and your quality of life will improve. Less than 4 percent of Japanese have a BMI over 30, while 15 percent of Chinese have a BMI over 30 [14,15]. The huge gap in obesity data may also be the reason why Japan's diabetes mortality rate due to high BMI is lower than that in China. Obesity rates are often associated with dietary culture and structure. Both countries belong to East Asian countries, so rice is the staple food, which is a high-calorie carbohydrate. The Japanese love to eat cold food, the Chinese prefer hot food, and they both think their preference is healthier and sterile. Except for some imported American fast food, traditional Japanese dishes such as sushi and sashimi have less oil and less seasoning, while most Chinese dishes focus on color and aroma, and use more seasoning and oil. Japan's very obvious dietary feature is the divided meal system, each meal is fixed and not excessive; China, due to some traditional cultures, prefers to use round tables to taste together, and it is difficult to control the amount of food. And because China has experienced famine and war in modern times, some elderly people insist on not wasting food and eat as many vegetables as they can. This habit continues to this day, which will lead to irregular, unhealthy and excessive diet.

The researchers looked at the effects of four diets on diabetes: a Mediterranean diet, a low carbohydrate/high protein diet, a vegan diet, and a vegetarian diet. Both can improve metabolic status, but the degree of improvement is different [16]. This shows that diet has an impact on the prevalence of diabetes, and it can also be seen that reducing carbohydrate intake and increasing fiber intake is beneficial to the improvement of diabetes.

5.3. The impact of age on prevalence

From the data in the comparison, we can see that the prevalence of older age groups (55+, 70+) is always higher than that of younger age groups (25-49 or below). Age is also a risk factor for

developing diabetes. A person's risk of developing type 2 diabetes increases dramatically after the age of 40 [17].

The prevalence is higher in Japan, and the aging population and rate of the two countries are compared, and the data show that: According to the statistical data of the Japanese government the year before last, more than 25% of the people in Japan were over 65 years old, accounting for more than a quarter of the total population, almost equivalent to the population of Poland [18]. In China, the proportion of people over 60 is expected to more than double in 20 years. Japan's aging problem is more serious (the comparison here is the rate, because the diabetes prevalence data compared above is also a percentage data), which may also be the reason for the higher prevalence of diabetes in Japan.

6. Suggestion

To prevent the diabetes, lifestyle is the main factor that we need to consider. And we suggest that do more sports to decrease the proportions of stored of fat, and maintain the suitable and healthy body mass. Also, to reduce the frequency of smoking or avoid smoking. For the treatment, the insulin-producing β -cells of people who have the sever diabetes normally can't work effectively. As for the latest research shows that the scientists find the new way to re-transcript the effective insulin. We might could use this new method in the follow-up treatment.

7. Conclusion

By the research we found that although China and Japan give the similar properties, some figures are still having the large differences. Generally, the prevalence rate of diabetes in Japan is lower than the figure for China. Surprisingly, the death rate for both gander and all ages are generally decreasing from 1990 to 2016. Especially for the patients upper 55 years old who had the greatest chance to infect the diabetes in Japan decreased from the first high death rate to the last but one between two countries. The income level, ages, smoking and high body mass would really influence the prevalence rate, and the problem of body mass is dominate. In case people to get the diabetes, we advise people decrease the smoking frequency and have a healthy lifestyle. This article is trying to help people to know more about the diabetes, and figure out as the neighbor countries, the different lifestyle influenced the huge differences in the diabetes data. We are looking forward some days in the future, we could heal the patients completely.

References

- [1] World Health Organization. (n.d.). (2022), Diabetes. World Health Organization. <https://www.who.int>
- [2] Sainz, N. (2022). 2021 diabetes atlas numbers. dia Tribe Change. <https://diatribechange.org>
- [3] MORI, M., et al. (2012). Analysis of Chinese Health Workers Learning in Japan for 20 years since 1987 by the Sasagawa Medical Fund – focus on acceptance of Chinese stomatologists – . Japanese Journal of Oral and Maxillofacial Surgery, 58(6), 350–356.
- [4] Wenyi Zhang, Jan 27, 2022 diabetes prevalence in adults in China 2011-2045, from <https://www.statista.com>
- [5] John Elflein, (2021), diabetes prevalence adults in selected countries 2021 from <https://www.statista.com>
- [6] World Health Organization, (2016), Healthy diet and exercise key to turning the tide from <https://www.who.int>
- [7] World Health Organization, Diabetes country profile, 2016, <https://cdn.who.int>
- [8] Ministry of Health of China, (2007), Notice on the Promotion of United Nations Diabetes Day 2007
- [9] National Healthcare Security Administration, et al. Guidelines on Improving the Outpatient Medication Guarantee Mechanism for Hypertension and Diabetes in Urban and Rural Residents
- [10] Japan - diabetes prevalence (% of population ages 20 to 79) 2022 data 2023 forecast 2010-2021 historical. Forecast 2010-2021 Historical. (n.d.). <https://tradingeconomics.com>

- [11] World Health Organization, Diabetes country profile, 2016, <https://cdn.who.int>
- [12] Chen, J., et al. Cluster analysis of differences in medical economic burden among residents of different economic levels in Guangdong Province, China. *BMC Health Serv Res* 20, 988 (2020).
- [13] Aras, M., et al. (2021). Obesity and Diabetes. *The Nursing clinics of North America*, 56(4), 527–541.
- [14] Senauer, B., et al. (1970). Why is the obesity rate so low in Japan and high in the U.S.? some possible economic explanations. *AgEcon Search*. <https://ageconsearch.umn.edu>
- [15] Liu Yuejiao. (2020). Report on Nutrition and Chronic Diseases in China (2020)
- [16] Khazrai, Y. M., et al. (2014). Effect of diet on type 2 diabetes mellitus: a review. *Diabetes/metabolism research and reviews*, 30 Suppl 1, 24–33.
- [17] Helmer, J. (2022). How age relates to type 2 diabetes. *WebMD*. <https://www.webmd.com>
- [18] D'Ambrogio, E. (n.d.). Japan's Ageing Society - European Parliament. <https://www.europarl.europa.eu>