Patterns of Environmental, Occupational, Lifestyle, and Other Risk Factors Contributing to Disease Burden in China and Japan: A Comparative Analysis from 1990 to 2021

Introduction

Environmental and lifestyle factors, among other risk factors, are critical in shaping disease burdens within any population. In both China and Japan, the impact of these factors is particularly pronounced due to their unique socio-economic landscapes and cultural practices. Environmental factors such as air pollution, water contamination, and exposure to hazardous chemicals have significantly contributed to respiratory, cardiovascular, and other chronic diseases. For instance, although improving, China's rapid industrialization and urbanization have led to severe air quality issues, with particulate matter (PM2.5) levels often exceeding safe limits. This has been linked to increased incidences of lung cancer and chronic obstructive pulmonary disease (COPD).[1-3] Conversely, Japan has implemented stringent environmental regulations that have mitigated some of these risks, although challenges remain.[4-5]

While there is research available on environmental and lifestyle risk factors in individual countries about specific diseases, comparative studies of these factors and their impact on mortality and overall health between China and Japan remain limited. Comparing China and Japan provides valuable insights into how different environmental and lifestyle policies and practices influence disease outcomes. Despite their geographic proximity and cultural similarities, the two countries have taken distinct approaches to managing public health risks. Japan's focus on preventive healthcare, rigorous environmental regulations, and promotion of healthy lifestyles offers a contrasting model to China's more rapid industrialization and urbanization, which have often prioritized economic growth over environmental and public

health. This study aimed to investigate and compare the primary contributors to disease burden between China and Japan.

Methods

The Global Burden of Disease (GBD) study is the most extensive global observational epidemiological study to date. Covering trends from 1990 to 2021, the latest GBD report provides data on mortality and morbidity across 204 countries and territories, encompassing 371 diseases and injuries and 88 risk factors.[6-8] The Global Health Data Exchange (GHDx) query tool, an online platform for health data offered by the Institute for Health Metrics and Evaluation, was utilized to collect annual age-standardized mortality rate (ASMR) and age-standardized disability-adjusted life years (ASDALYs) related to cardiovascular diseases (CVDs). In this study, twenty level 2 risk factors contributing to the disease burden in China and Japan were included.[9]

The selection of these risk factors was based on their relevance to the specific environmental, occupational and lifestyle contexts of the two countries. Data were extracted for each year within the specified period. Comparative analyses were performed to elucidate differences and similarities in the impact of these risk factors on the disease burden between China and Japan. Statistical methods used included age-standardization to account for differences in age distribution and regression analyses to determine the strength of associations between risk factors and disease outcomes. Additionally, sensitivity analyses were conducted to assess the robustness of findings.

To ensure the accuracy and reliability of the data, multiple quality control measures were implemented, including cross-validation with other data sources and consistency checks. The

findings were then interpreted in the context of existing literature and policy frameworks in both countries to provide a comprehensive understanding of the factors influencing disease burden in China and Japan from 1990 to 2021.[10]

Results

In 2021, the ASMR and ASDALYs by all causes in China were 644.68 (735.51 to 555.12) and 22717.19 (25903.34 to 19748.18) per 100,000, respectively. In contrast, Japan reported an ASMR of 311.07 (312.59 to 309.48) and ASDALYs of 16,186.72 (18,997.21 to 13,729.31) per 100,000. The AAPC for ASMR and ASDALYs in China were -0.46% (-0.36% to -0.55%) and -0.47% (-0.40% to -0.53%), respectively. In Japan, the AAPC values were -0.41% (-0.41% to -0.42%) for ASMR and -0.25% (-0.22% to -0.28%) for ASDALYs. Notably, reductions were more pronounced in females compared to males in both countries, with Chinese females showing a 0.53% decrease in ASMR and 0.50% in ASDALYs, while Japanese females showed a 0.45% decrease in ASMR and 0.21% in ASDALYs. This highlights the gender-specific differences in the health outcomes across both nations.

Air pollution, tobacco use, and high systolic blood pressure (SBP) are major contributors to ASMR in China, while in 2021, high SBP replaced child and maternal malnutrition as one of the primary contributors to ASDALYs.High SBP, tobacco use, and dietary risks are the top three contributors to ASMR in Japan. However, in 2021, high fasting plasma glucose replaced high SBP as a major contributor to ASDALYs. In 2021, tobacco use, air pollution, and high SBP were the primary causes of disease burden in Chinese males, while in Chinese females, the main contributors were high SBP, air pollution, and dietary risks. In 2021, tobacco use, high SBP, and dietary risks were the main contributors to ASMR in Japanese males, while tobacco use, high

SBP, and high fasting plasma glucose were the primary causes of ASDALYs. For Japanese females, high SBP, dietary risks, and high fasting plasma glucose were the leading factors contributing to ASMR, whereas high fasting plasma glucose, dietary risks, and high BMI were the main contributors to ASDALYs. Furthermore, all risk factors contributed to higher ASMR and ASDALYs in Chinese individuals compared to Japanese individuals, except for drug use in males and alcohol use in females.

Conclusions and Discussions

This study reveals significant differences in the disease burden and major contributors between China and Japan, as well as notable gender-specific patterns. The rapid industrialization and urbanization in China have led to severe air quality issues, with particulate matter (PM2.5) levels often exceeding safe limits, contributing to respiratory and cardiovascular diseases.[11] High SBP and smoking further exacerbate these health issues, leading to increased incidences of lung cancer, chronic obstructive pulmonary disease (COPD), and other chronic conditions. In contrast, Japan's primary concerns are high fasting plasma glucose and dietary risks. While Japan has implemented stringent environmental regulations that have mitigated some air pollution risks, the shift towards Western dietary patterns has led to increased prevalence of obesity, diabetes, and related diseases.[12] Additionally, gender-specific patterns indicate that males and females face unique health challenges in both countries, necessitating tailored public health strategies. Understanding these patterns of disease burden is essential for informing public health policies and interventions aimed at reducing the impact of preventable risk factors, ultimately improving population health outcomes in both China and Japan.[13]

Public health decision-makers in China and Japan should adopt different strategies to address their unique risk factors. In China, stricter air quality regulations are crucial to reduce particulate matter (PM2.5) levels, alongside strengthening anti-smoking campaigns and policies to curb smoking-related diseases. Promoting awareness, treatment, and control of blood pressure among the general public and encourage physical activity by creating more public spaces for exercise are also essential. Improving access to healthcare services, particularly for early detection and management of chronic diseases, is vital.[14]

In Japan, the focus should be on managing high fasting plasma glucose and dietary risks. This includes promoting healthy eating habits and regular health check-ups to manage blood sugar levels. Japanese diet was low in fat and high in complex carbohydrates, such as rice and noodles. High consumption of white rice (a refined carbohydrate) and noodles of refined carbohydrates can lead to rapid spikes in blood sugar levels. In addition, over recent decades, Japan has experienced dietary shifts, including increased consumption of processed foods, sugary beverages, and higher-fat diets. These changes can contribute to insulin resistance and elevated blood glucose, along with increased sedentary lifestyles due to increased office jobs and reduced manual labor. Encouraging physical activity and improving healthcare access for early detection and management of chronic diseases are also important. Additionally, fostering cross-country collaboration to share best practices can help address common challenges and improve overall health outcomes in both countries.[15]

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Table 1. Age-standardized mortality and DALYs rates per 100,000 population and the corresponding percentage change between 1990 and 2021, in China and Japan

		ASMR			ASDALYs		
		1990	2021	AAPC (%)	1990	2021	AAPC (%)
China							
	All	1198.16 (1294.10 to 1098.61)	644.68 (735.51 to 555.12)	-0.46 (-0.36 to -0.55)	43085.42 (47273.39 to 39330.62)	22717.19 (25903.34 to 19748.18)	-0.47 (-0.40 to -0.53)
	Male	1424.26 (1603.00 to 1258.62)	861.73 (1027.74 to 711.64)	-0.39 (-0.25 to -0.53)	47445.82 (52879.61 to 42524.56)	26375.84 (30440.73 to 22247.81)	-0.44 (-0.34 to -0.53)
	Female	1030.53 (1161.27 to 911.58)	484.20 (582.32 to 403.15)	-0.53 (-0.41 to -0.63)	39161.45 (43653.14 to 35074.22)	19531.87 (22872.71 to 16349.88)	-0.50 (-0.42 to -0.57)
Japan							
	All	529.28 (530.96 to 527.53)	311.07 (312.59 to 309.48)	-0.41 (-0.41 to -0.42)	21449.60 (24332.37 to 19032.94)	16186.72 (18997.21 to 13729.31)	-0.25 (-0.22 to -0.28)
	Male	696.54 (699.32 to 693.59)	416.22 (419.18 to 413.66)	-0.40 (-0.40 to -0.41)	24616.18 (27262.00 to 22385.66)	17654.58 (20246.08 to 15456.11)	-0.28 (-0.26 to -0.31)
	Female	409.95 (411.91 to 407.97)	226.19 (227.94 to 224.56)	-0.45 (-0.44 to -0.45)	18986.80 (22119.83 to 16373.10)	14983.56 (18092.57 to 12303.66)	-0.21 (-0.18 to -0.25)

ASMR: age-standardized mortality rate; ASDALYs: age-standardized disability-adjusted life years; AAPC: average annual percent change.

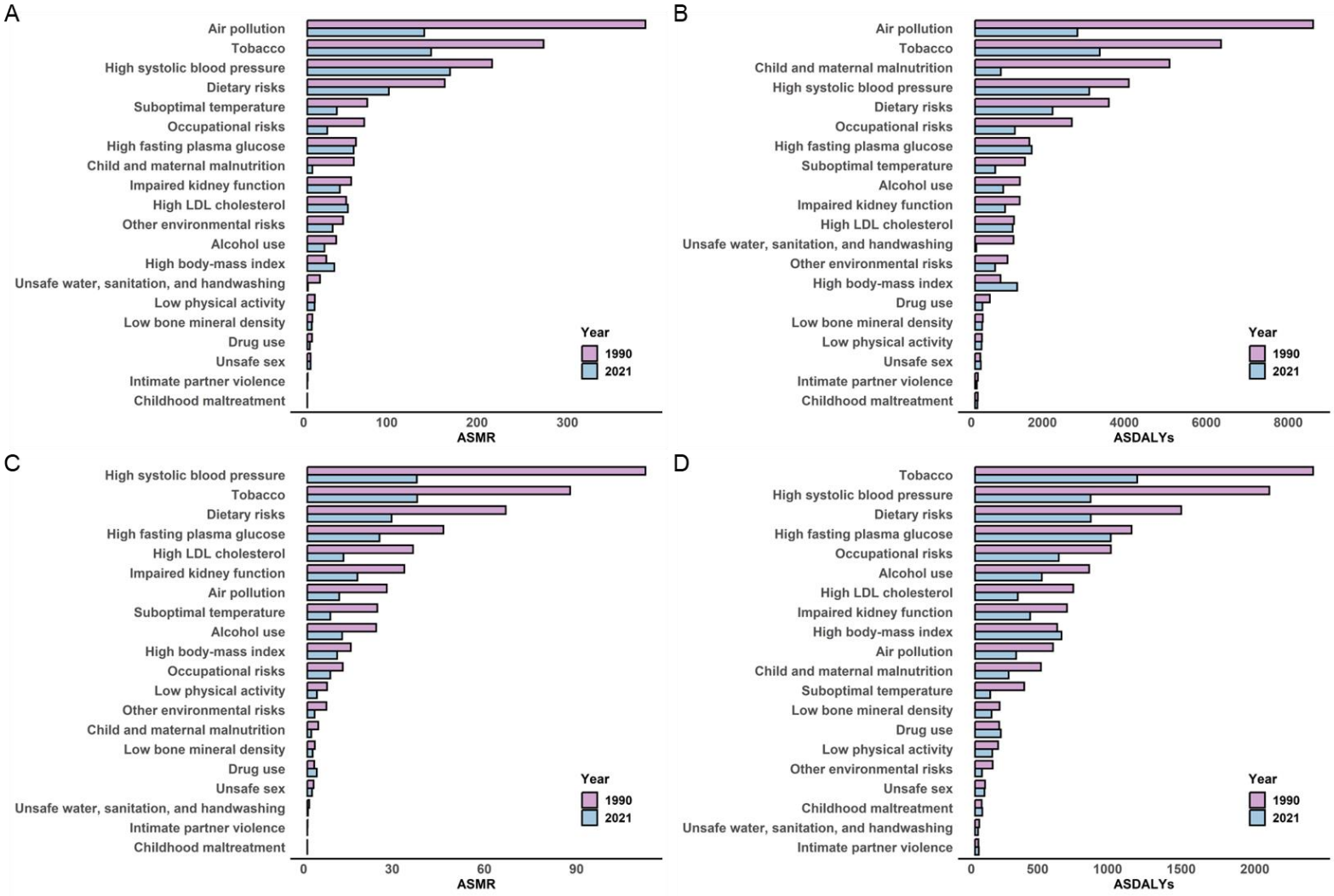


Figure 1. Level 2 risk factors contributing to disease burden in 1990 and 2021, in China and Japan. A: Risk factors contributing to ASMR in China; B: Risk factors contributing to ASDALYs in China; C: Risk factors contributing to ASMR in Japan; D: Risk factors contributing to ASDALYs in Japan. ASMR: age-standardized mortality rate; ASDALYs: age-standardized disability-adjusted life years.

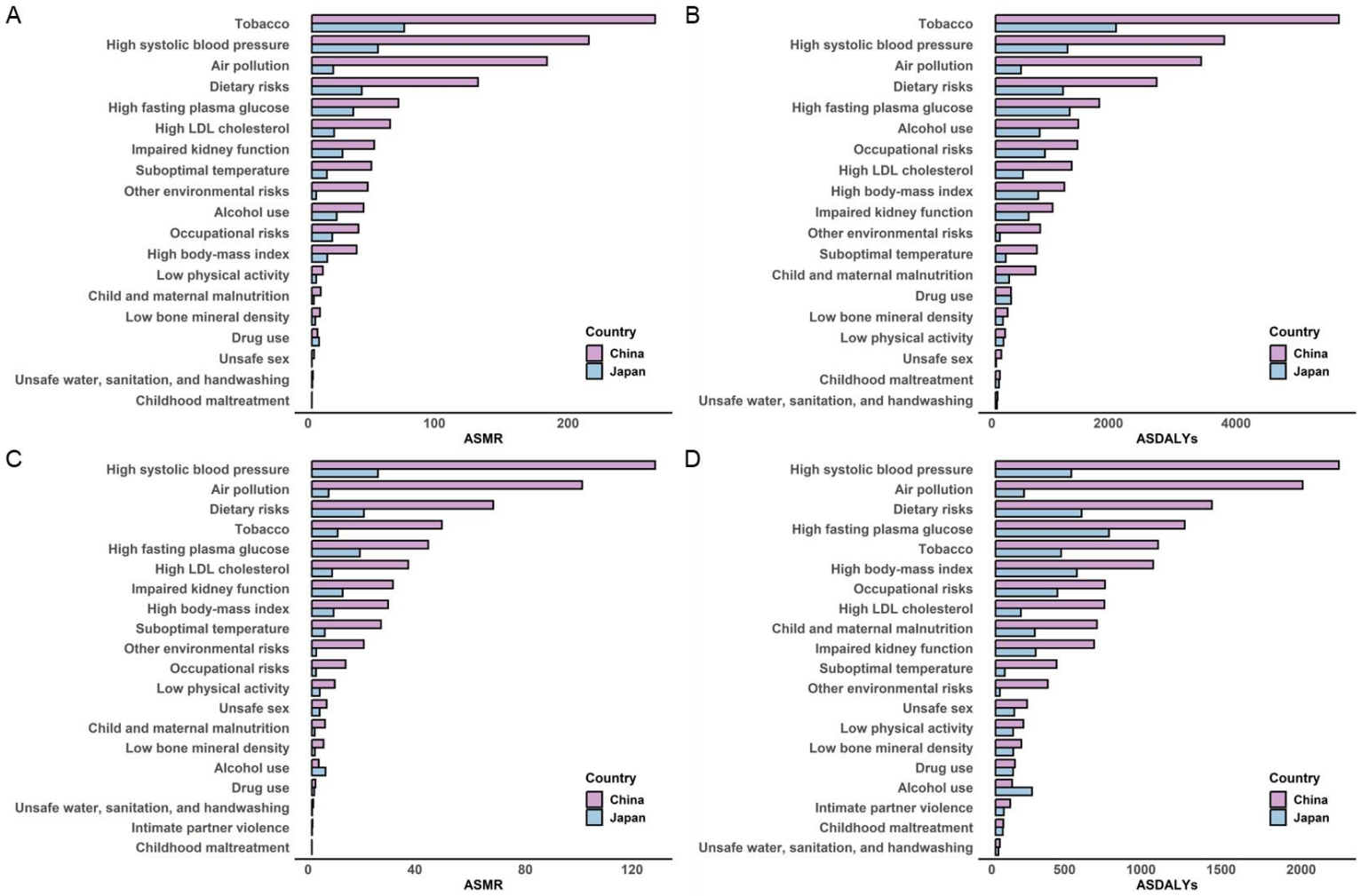


Figure 2. Level 2 risk factors contributing to disease burden in 2021 by sex. A: Risk factors contributing to ASMR in males; B: Risk factors contributing to ASDALYs in males; C: Risk factors contributing to ASMR in females; D: Risk factors contributing to ASDALYs in females. ASMR: age-standardized mortality rate; ASDALYs: age-standardized disability-adjusted life years.