

## REVIEW

# Area-Based Medicine in the Super-Ageing Society in Japan

Nobutaka Inoue<sup>1</sup>, Toshiyuki Matsumura<sup>2</sup>, and Hiroto Sakai<sup>3</sup>

<sup>1</sup>Department of Cardiovascular Medicine, Kobe Rosai Hospital, Hyogo, Japan, <sup>2</sup>Department of Cardiovascular Medicine, Kumamoto Rosai Hospital, Kumamoto, Japan, <sup>3</sup>Department of Cardiovascular Medicine, Hokkaido Chuo Rosai Hospital, Hokkaido, Japan

**Abstract :** Japan's health insurance system has reached a critical turning point owing to a decreasing birthrate, increasing longevity, and changes in disease trends. The Japanese government is promoting the establishment of a community-based integrated care system aimed at maintaining the dignity of elderly individuals and supporting independent living. This care system will ensure medical and nursing care, preventive measures, and independent living support. This type of care system should be based on the characteristics of individual geographical areas, as there are marked regional variations in patterns of aging, lifestyle, and the adequacy of local medical care. Therefore, it is important that medical services are tailored to fit the kind of medical care needed by residents of each geographical area and to provide medical services accordingly. In this paper, we propose a need for area-based medicine, whereby medical care is provided according to the characteristics of individual geographical areas in super-ageing societies such as that of Japan. *J. Med. Invest.* 67: 40-43, February, 2020

**Keywords :** community-based integrated care system, social stress, cardiovascular diseases

## INTRODUCTION

Populations worldwide are aging, and the rate of aging in Japan is particularly high. This trend is placing increasing pressure on health care systems to provide adequate care for elderly individuals. There are currently over 30 million people aged  $\geq 65$  years in Japan (1 in 4 people), and this number is predicted to peak at approximately 39 million in 2042. Moreover, the proportion of people aged  $\geq 75$  years is increasing noticeably. Under these circumstances, the demand for medical and nursing care for the elderly is expected to continue to rise particularly after 2025 when the baby-boomer generation, born between 1947 and 1949 (sometimes including 1950: currently 8 million people in Japan) reaches the age of  $\geq 75$  years. Japan is therefore facing the urgent task of addressing an increasing number of issues involving the aging population, including medical care and welfare, as the number of elderly individuals increases. However, in addition to population aging, a number of other issues have arisen and cannot be resolved using traditional healthcare and elderly insurance systems, indicating the need for the development of new medical approaches for the elderly people. Japan's health insurance system has therefore reached a critical turning point owing to factors including the declining birthrate, increasing longevity, and changes in disease trends.

## COMMUNITY-BASED INTEGRATED CARE SYSTEM IN JAPAN

The decrease in birth rate and increase in aging will lead to a rise in social security expenses and a decrease in social productivity. Further, while the number of people requiring nursing care will increase, the number of nursing care workers will decrease, leading to concerns over insufficient availability

of necessary services in the near future. In response, the Japanese government is promoting reforms to the social security and tax systems. In particular, the government is promoting the establishment of a community-based integrated care system, with the aim of maintaining the dignity of elderly individuals and supporting independent living. This comprehensive system will ensure medical and nursing care, preventive care, and independent living support. The community-based integrated care system is expected to enable individuals to enjoy the latter years of their lives in a familiar area (1).

The community-based integrated care system should be based on the characteristics of individual geographical areas. There are marked regional variations in the rating of age between towns and villages. Many locations have experienced depopulation, particularly in rural areas, in which the population decline is severe (2). In contrast, there is a lack of social support in urban areas. The paradoxical phenomenon of death resulting from loneliness in cities, termed "Kodokushi" in Japanese, has recently been recognized as a social problem. In the 1970s, when nuclear families became more advanced in Japan, this term appeared in a report regarding an incident in which the death of an elderly person living alone was discovered by a relative who visited after a long period. *Kodokushi* refers to death that goes unnoticed by anyone. As the population is concentrated in urban areas, it was believed that few people experienced loneliness; however, it is now widely understood that human interaction and communication tend to be poor in urban areas. In addition, it is understood that *Kodokushi* can occur in the immediate vicinity of one's home in Japanese urban areas.

In addition to health-related characteristics, there are regional variations in social infrastructure, income levels, living standards, consumption patterns, and welfare standards (3). These variations make it difficult to provide consistent preventive medical care. Therefore, regional variations in social backgrounds should be accounted for when developing preventive strategies and considering the demand for medical care. In other words, the medical care system should be structured into account for differences in the types of care required between different geographical areas.

Received for publication June 24, 2019; accepted January 5, 2020.

Address correspondence and reprint requests to Nobutaka Inoue MD PhD, Director of Department of Cardiovascular Disease, Vice President, Kobe Rosai Hospital, 4-1-23, Kagoike Touri, Chuo-Ku, Kobe 651-0053, Japan and Fax: +81-78-242-5316.

## REGIONAL DIFFERENCES IN DISEASE INCIDENCE IN JAPAN

Cerebrovascular disorders are one of the three main causes of death in Japan, with 111,973 deaths due to stroke in Japan in 2015. A report from the Ministry of Health, Labour and Welfare indicated that, relative to rates in other prefectures, the age-adjusted mortality rate for cerebrovascular disorders in 2015 was significantly higher in Aomori, Akita and Iwate prefectures in the Tohoku area, located in the northern part of Japan. Although the underlying cause is unknown, it is likely linked to the lifestyle habits of those living in the Tohoku area. The pathogenesis of cerebrovascular disorders is associated with hypertension, which can be prevented by a number of lifestyle changes such as reducing salt intake, increasing intake of vegetable and fruit consumption, limiting alcohol consumption, ceasing smoking, exercise participation, and weight maintenance. The lifestyle habits of residents differ between regions. According to the National Health and Nutrition Survey in Japan, residents in the Tohoku area consume more salt relative to those in other regions. In addition, the smoking rate in Hokkaido prefecture is highest followed by those in Aomori and Iwate prefectures (4). Furthermore, the exercise participation decreases in these areas in winter because of heavy snow coverage. Therefore, the regional difference in the age-adjusted mortality rates for cerebrovascular disorders could be partially explained by differences in lifestyle habits between geographical areas.

There is a strict time limitation on the indications for reperfusion therapy for cerebral infarction due to thrombosis. Patients who require reperfusion therapy must therefore arrive at a specialist stroke center within a limited period. Consequently, treatment for cerebral infarction is influenced by the level of medical care received, the number of specialized hospitals available, access to hospitals, and the medical emergency system. According to a reports published by Kumon *et al.*, of 329 secondary medical service areas in Japan, 32 (9.7%) and 90 (27.4%) lacked specialized stroke hospitals for reperfusion therapy with tissue plasminogen activator therapy and thrombectomy, respectively. The authors mentioned that these regional disparities were believed to have resulted from a shortage of stroke physicians in these areas (5). Regional differences in adequate medical care, particularly in the medical emergency system could also explain the regional difference in the age-adjusted mortality rates for cerebrovascular disorders. Moreover, such regional medical disparities have been reported in other countries. For example, Stolz *et al.* reported large regional differences in local thrombolysis rates in patients with acute ischemic stroke in the state of Hesse in Germany (6).

A recent study conducted by Nomura *et al.* indicated that the average life expectancy increased by 4.2 years (from 79.0 years to 83.2 years) between 1990 and 2015 (7). However, the difference in average lifespans between Japanese prefectures with the longest and shortest lifespans also increased from 2.5 to 3.1 years during this period, and this difference in healthy life expectancy increased from 2.3 to 2.7 years. This suggests that the disparity in the levels of health between prefectures is increasing, indicating a growing need to find ways to reduce the effects of regional differences.

## REGIONAL DIFFERENCES IN MENTAL STRESS IN WORKERS WITH CORONARY ARTERY DISEASE

Cardiovascular disorders, primarily those involving atherosclerosis, are another major cause of death in Japan. Advances

in medical research have uncovered the complicated nature of the pathogenesis of atherosclerosis-based cardiovascular diseases and implicated a number of contributing factors, among which stress is thought to play a pivotal role. Various types of stress including oxidative stress, mental stress, hemodynamic stress, and social stress are linked to cardiovascular diseases (8). An increasing number of studies have shown that the known traditional risk factors for atherosclerosis, such as diabetes, hyperlipidemia, hypertension and smoking cause oxidative stress in blood vessels. Further, oxidative stress has been linked to endothelial dysfunction, atherogenesis, hypertension, and the remodeling of blood vessels. Moreover, mental stress is strongly implicated in the onset of cardiovascular diseases. A number of studies have shown that social stress, which includes the stress associated with living alone and the absence of social support, negatively affects the prognosis of coronary artery disease (CAD) (9).

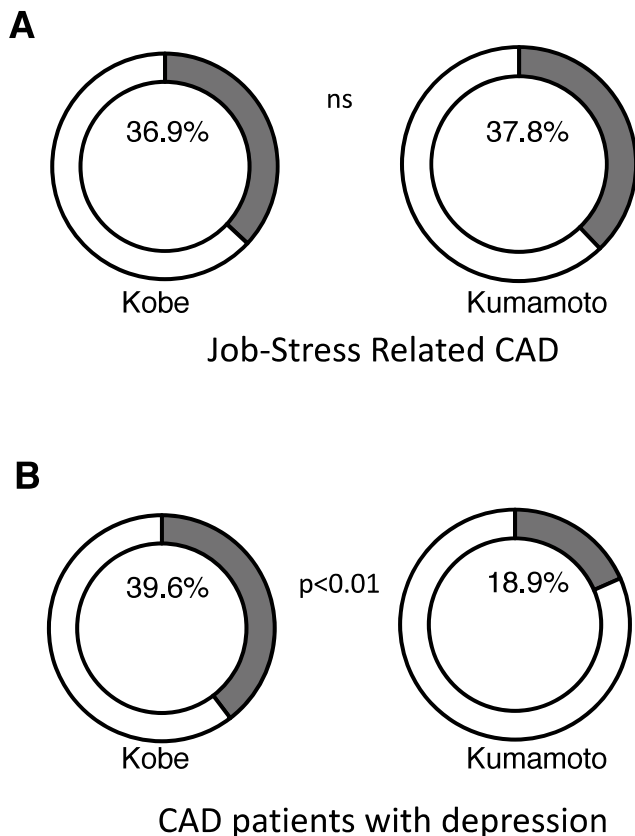
The quality and extent of social and mental stress can be a function of the living environment and the social infrastructure of the area in which an individual resides. Lifestyle is directly correlated with diabetes, hyperlipidemia, and hypertension and differs according to geographical region, as described above. This suggests that stress responses could also vary between regions.

We recently examined regional differences in occupational and psychological stress responses in workers with CAD receiving treatment at Kumamoto Rosai Hospital (n = 37) or Kobe Rosai Hospital (n = 111) (10). Kobe Rosai Hospital is located in the center of the Kobe metropolitan area, while Kumamoto Rosai Hospital is in Yatsushiro City, a rural industrial city on the Kumagawa River estuary in the Yatsushiro plain. The population and population density of Kobe were 1,534,000 and 2750 people /km<sup>2</sup>, while those in Yatsushiro were 126,000 and 185 people/ km<sup>2</sup>, respectively. The two hospitals have similar scales of operation and are pivotal providers of cardiovascular care in their respective cities. We evaluated occupational stress using the Job Content Questionnaire (JCQ), and job strain index (JSI), the ratio of job demands to job control estimated from the JCQ, and depression using the Self-Rating Depression Scale (SDS). The results showed that 36.9% of patients at Kumamoto Rosai Hospital and 37.8% at Kobe Rosai Hospital had a JSI of  $\geq 0.5$  and had been diagnosed with job-stress-related CAD (JS-CAD). Further, 18.9% of CAD patients at Kumamoto Rosai and 39.6% at Kobe Rosai Hospital had an SDS  $\geq 40$  (Figure 2). Our findings indicated a significant regional difference in the prevalence of depression in patients with CAD.

Recently, Ziarko *et al.* investigated the differences in depression severity, coping strategies for stress, and social support in patients with chronic diseases such as ischemic heart disease, diabetes mellitus, and rheumatoid arthritis between urban and rural regions in Poland. They demonstrated a significant difference in coping strategies between rural and urban areas. The authors speculated that this difference could have been caused by a rural-urban gap in access to material, educational, knowledge-related, or social resources. Therefore, stress responses could vary between regions and be influenced by the living environment and social factors in the area in which an individual resides (11).

## AREA-BASED MEDICINE IN THE FUTURE

Unlike traditional medical care, in which treatment is based mainly on the knowledge and experience of individual physicians, modern medicine is based upon evidence. In seeking to enhance patient-centered medical care, evidence-based medi-

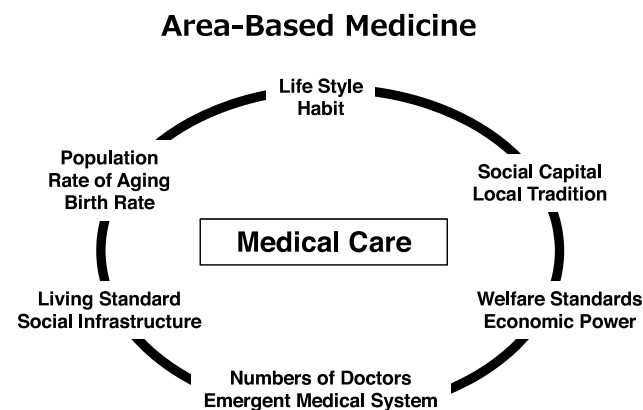


**Figure 1.** Occupational Stress and Depression in Workers Treated for Coronary Artery Disease (Kobe Rosai Hospital,  $n = 111$ ; Kumamoto Rosai Hospital,  $n = 37$ ). The job strain index, which provides the ratio of job demands to job control, estimated via the Job Content Questionnaire, was used as an indicator of occupational stress. Depression was evaluated using the Self-Rating Depression Scale. **A.** The proportion of workers with coronary artery disease who showed Job strain index values of  $\geq 0.5$  in Kobe Rosai Hospital and Kumamoto Rosai Hospital. Patients with job strain index values of  $\geq 0.5$  were categorized as having job-stress-related coronary artery disease. The prevalence of job-stress-related coronary artery disease did not differ between the two hospitals. **B.** The proportion of workers who had coronary artery disease and Self-Rating Depression Scale scores of  $\geq 40$  in Kobe Rosai Hospital and Kumamoto Rosai Hospital. There was a significant difference in the prevalence of depression in workers with coronary artery disease between the two regions.

cine (EBM) emphasizes the three elements; scientific evidence, the experience and knowledge of experts, and patient value. In EBM, epidemiological studies and proven scientific evidence are used to develop efficient high-quality medical care. However, because findings from such studies reflect the “average” populations, EBM treatment methods are not always effective for all patients. In response to this, the concept of the narrative-based medicine (NBM), whereby doctors are encouraged to listen carefully to individual patients’ “stories” to better understand their illnesses and their backgrounds and develop a good relationships with them, has been promoted (12). Given that scientific evidence from epidemiological research is not the only way to apply evidence to all patients, NBM is an attempt to respect patients’ subjective experiences in the establishment of treatment methods. Both EBM and NBM are expected to play cooperative roles in patient-centered medical care.

Moreover, medical treatment and care should account for regional differences in addition to EBM and NBM. As described

above, there are marked regional differences in lifestyle habits, the adequacy of medical systems, and the number of doctors. In addition to these health-related characteristics, there are regional variations in social infrastructure, income, living standards, consumption patterns, welfare standards, economic power, administrative initiatives, local traditions, and social capital. Medical care in all geographical areas is largely influenced by these factors. Moreover, many regions are experiencing depopulation, and the population decline is intense in rural areas, while lack of social support is a major problem in urban areas. Issues related to stress in urban, rural, and depopulated areas differ significantly. Therefore, it is difficult to promote preventive medical care in a consistent manner, and it is important to consider differences in regional social backgrounds in the prevention of cardiovascular diseases. Medical care systems in super-ageing societies, such as that of Japan, should account for differences in the types of medical care needed in individual geographical areas and provide medical services accordingly. Therefore, there is a need for “area-based medicine,” in which medical care is based on the circumstances surrounding residents in different geographical areas (Figure 2). Further, as social and human resources become more limited, strategies are needed to ensure that they are used effectively. To this end, it is important to identify the needs of individual geographical areas. Preventive medical care based on local lifestyle and health profiles may be one means of achieving this.



**Figure 2.** Area-based Medicine. There are marked regional differences in lifestyle habits, rate of aging, emergent medical systems, and the number of doctors. In addition to these health-related characteristics, there are regional variations in social infrastructure, living standards, welfare standards, economic power, local traditions, and social capital. Area-based medicine, in which medical care is based on the circumstances surrounding residents in different geographical areas, is the approach needed in the super-ageing society such as Japan.

## CONCLUSION

Societies are aging at a faster rate worldwide, and aging has been particularly rapid in Japan. The aging population is creating a burden on healthcare systems, which are pressured to maintain adequate levels of care for aged patients. In 2025, one in four people will be aged  $> 75$  years in Japan and it is expected that medical and nursing care needs will sharply increase. From the viewpoint of medical demand, it should be kept in mind that there are regional differences in types of medical care needed. Area-based medicine, in which regional medical care is based

on the situations in the surrounding residential area, seems to be necessary.

## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interests.

## AUTHOR CONTRIBUTIONS

NI, TM, and HS designed the review article. NI wrote the manuscript. All authors approved the final version.

## REFERENCES

1. Ministry of Health, Labour and Welfare. Establishing 'the Community-based Integrated Care System' 2018 [https://www.mhlw.go.jp/english/policy/care-welfare/care-welfare-elderly/dl/establish\\_e.pdf](https://www.mhlw.go.jp/english/policy/care-welfare/care-welfare-elderly/dl/establish_e.pdf)
2. Annual Report on the Ageing Society : 2018. Cabinet Office Japan [https://www8.cao.go.jp/kourei/english/annualreport/2018/2018pdf\\_e.html](https://www8.cao.go.jp/kourei/english/annualreport/2018/2018pdf_e.html)
3. Choice for the Future- Creating a Growth and Development Model Made in Japan Transcending Rapid Depopulation and Super Aged Society Cabinet Office Japan. [https://www5.cao.go.jp/keizai-shimon/kaigi/special/future/sentaku/index\\_pdf.html](https://www5.cao.go.jp/keizai-shimon/kaigi/special/future/sentaku/index_pdf.html)
4. The National Health and Nutrition Survey in Japan, 2016 <https://www.mhlw.go.jp/bunya/kenkou/eiyou/dl/h28-houkoku.pdf>
5. Kumon Y, Nishikawa M, Matsumoto S, Shinohara N, Tagawa M, Watanabe H, Kunieda T : Regional disparities of community medicine for acute stroke in Japan and solution strategy. *Japanese Journal of Stroke (Japanese)*. 41(2) : 93-94, 2019
6. Stolz E, Hamann GF, Kaps M, Misselwitz B : Regional differences in acute stroke admission and thrombolysis rates in the German federal state of Hesse. *Dtsch Arztebl Int*. 108(36) : 607-11, 2011
7. Nomura S, Sakamoto H, Glenn S, Tsugawa Y, Abe SK, Rahman MM, Brown JC, Ezoe S, Fitzmaurice C, Inokuchi T, Kassebaum NJ, Kawakami N, Kita Y, Kondo N, Lim SS, Maruyama S, Miyata H, Mooney MD, Naghavi M, Onoda T, Ota E, Otake Y, Roth GA, Saito E, Tabuchi T, Takasaki Y, Tanimura T, Uechi M, Vos T, Wang H, Inoue M, Murray CJL, Shibuya K : Population health and regional variations of disease burden in Japan, 1990-2015 : a systematic subnational analysis for the Global Burden of Disease Study 2015. *Lancet*. 390(10101) : 1521-1538, 2017
8. Inoue N : Stress and atherosclerotic cardiovascular disease. *J Atheroscler Thromb*. 21 : 391-401, 2014
9. Schmaltz HN, Southern D, Ghali WA, Jelinski SE, Parsons GA, King KM, Maxwell CJ : Living alone, patient sex and mortality after acute myocardial infarction. *J Gen Intern Med* 22 : 572-578, 2007
10. Matsumura T, Sakai H, Doi H, Fukuyama K, Shiraki H, Hirayama S, Kimata A, Inoue N : Regional difference in mental stress of workers with coronary artery disease : Importance of Area-based medicine. *JJOMT*. 67 : 67-72, 2019
11. Ziarko M, Mojs E, Kaczmarek LD, Warchol-Biedermann K, Malak R, Lisinski P, Samborski W : Do urban and rural residents living in Poland differ in their ways of coping with chronic diseases? *Eur Rev Med Pharmacol Sci*. (22) : 4227-34, 2015
12. Charon R, Wyer P : Narrative evidence based medicine. *Lancet* 371(9609) : 296-297, 2008