



Knowledge Translation for Cardiovascular Disease Research and Management in Japan

Nusrat S Shommu and Tanvir C Turin

University of Calgary, Department of Family Medicine, Calgary, Alberta, Canada

Knowledge translation is an essential and emerging arena in healthcare research. It is the process of aiding the application of research knowledge into clinical practice or policymaking. Individuals at all levels of the health care system, including patients, healthcare professionals, and policymakers, are affected by the gaps that exist between research evidence and practice; the process of knowledge translation plays a role in bridging these gaps and incorporating high-quality clinical research into decision-making. Cardiovascular disease (CVD) management is a crucial area of healthcare where information gaps are known to exist. Although Japan has one of the lowest risks and mortality rates from CVDs, an increasing trend of cardiovascular incidence and changes in the risk factor conditions have been observed in recent years. This article provides an overview of knowledge translation and its importance in the cardiovascular health of the Japanese population, and describes the key steps of a typical knowledge translation strategy.

Key words: Knowledge translation, Cardiovascular diseases, Management

Copyright©2017 Japan Atherosclerosis Society

This article is distributed under the terms of the latest version of CC BY-NC-SA defined by the Creative Commons Attribution License.

Context

Many great discoveries aiming at benefiting people are made every year by health researchers; however, very few are implemented in the healthcare practice. As a result, patients in both developed and developing countries are deprived of the benefits of the latest treatments, improved diagnosis, or better clinical interventions¹. Lack of proper implementation also leads to ineffective or inefficient interventions, which positions patients at a significant risk and burdens the healthcare system resources^{2, 3}. Inefficient application of research findings is the result of a knowledge exchange gap existing between the researchers and end users, including patients, healthcare professionals, and policymakers. It is crucial to reduce this knowledge gap and apply valuable research findings in healthcare practice. Proper dissemination of research evidence to the end users, which is only recently referred to as “knowledge translation,” is an effective means of bridg-

ing the existing information gaps.

What is Knowledge Translation?

In general, knowledge translation indicates the meaningful sharing of information with the general audience to bridge any information gap. For health scientists, knowledge translation refers to the appropriate interpretation of knowledge so that it is appropriately applied in the clinical practice, patient lifestyle, or policymaking³. Various terms have been used worldwide to describe the process of translating knowledge into action. For example, the terms “implementation science” or “research utilization” are frequently used in the United Kingdom and Europe; “dissemination and diffusion,” “research use,” and “knowledge transfer and uptake” are generally used in the United States; and “knowledge transfer and exchange” and “knowledge translation” are frequently used in Canada⁴. Knowledge translation is formally defined by the Canadian Institutes of Health Research (CIHR) as a dynamic and iterative process that includes the synthesis, dissemination, exchange, and ethically sound application of knowledge to improve health, provide more effective health services and products, and strengthen the healthcare system⁵. This definition has been adopted by other renowned organizations, includ-

Address for correspondence: Tanvir C Turin, Department of Family Medicine, University of Calgary, G012, Health Sciences Centre, 3300 University Drive NW, Calgary, Alberta, Canada, T2N 4N1

E-mail: turin.chowdhury@ucalgary.ca

Received: December 11, 2016

Accepted for publication: June 5, 2017

Table 1. Definitions of CIHR Knowledge Translation terms⁵⁾

Term	CIHR Definition
Synthesis	“The contextualization and integration of research findings of individual research studies within the larger body of knowledge on the topic.”
Dissemination	“Identifying the appropriate audience and tailoring the message and medium to the audience.”
Exchange of knowledge	“The interaction between the knowledge user and the researcher, resulting in mutual learning.”
Ethically sound application of knowledge	“Activities for improved health that are consistent with ethical principles and norms, social values, as well as legal and other regulatory frameworks.”

ing the United States National Center for Dissemination of Disability Research (NCDDR) and the World Health Organization (WHO). CIHR has clearly explained the terminology used in their definition of knowledge translation, which is described in **Table 1**.

Importance of Knowledge Translation

The practice of using research evidence reliably in health care planning and delivery is inadequate due to the shortage of proper knowledge translation activities, resulting in misguided decision-making and the creation of care gaps^{4, 6)}. These care gaps might exist among all stakeholder groups, including healthcare providers, patients, managers, and policymakers, as well as across almost all healthcare disciplines, including chronic cardiovascular disease (CVD)^{4, 7)}. For instance, several randomized trials have reported that treatment with statin decreases the risk of coronary heart disease⁸⁾; however, despite their useful effects, statins have been considerably under prescribed to the patients⁷⁾. This explains how the information gap between research and healthcare practice caused by inefficient knowledge transfer can eventually deprive cardiovascular patients of beneficial treatment. Proper dissemination of research knowledge to healthcare practice would help build an effective healthcare system and alleviate the existing care gaps.

Exquisitely, clinical practice guidelines (CPGs) are supposed to alleviate the information gap in the healthcare system. As defined by American Academy of Family Physicians (AAFP)⁹⁾, “Clinical practice guidelines are statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options.” Nevertheless, various limitations restrict the implementation of CPGs; for instance, few limitations include the inaccessibility of guidance during care, absence of patient-specific guidance, inapplica-

bility in local settings, long lifecycle of guideline development, lack of active user involvement, and absence of tools to assess the impact of CPG¹⁰⁾. Hence, the healthcare systems still face over-use or under-use of services and widespread differences in the service quality among providers, hospitals, and geographic locations. It is essential to develop evidence-based CPGs ensuring proper implementation.

Knowledge Translation in Cardiovascular Disease

CVDs are the leading cause of death worldwide. As reported by the World Health Organization, approximately 7.5 million people died (31% of all global death) due to CVD in 2012, and this figure will exceed 23 million by 2030¹¹⁾. Although the risk of mortality from CVD in Japan is amid the lowest of all industrialized countries^{11, 12)}, an increasing trend of CVD incidence has been observed among the Japanese population in recent years¹³⁻¹⁸⁾. The high HDL-cholesterol levels found in Japanese people significantly reduces the mortality risk by coronary heart disease¹⁹⁾; however, hypertension is a stronger risk factor for stroke than hypercholesterolemia, and these two factors act synergistically to increase the mortality risk from coronary heart disease in this population^{18, 19)}. To add to this concern, a change in the status of the CVD risk factors has been observed during the last few decades. The previously reported decline in hypertension and cigarette smoking among the Japanese people has plateaued¹⁷⁾. In addition, an escalation in obesity, total serum cholesterol, and metabolic disorders has been observed along with the change in dietary habits and westernization of lifestyle in Japan^{13, 18, 20-25)}.

It is crucial to mobilize the knowledge about this changing CVD pattern among the clinicians, policymakers, and general public. Audiences in Japan need to be aware of the cardiovascular impact of a westernized lifestyle and should be encouraged to adopt

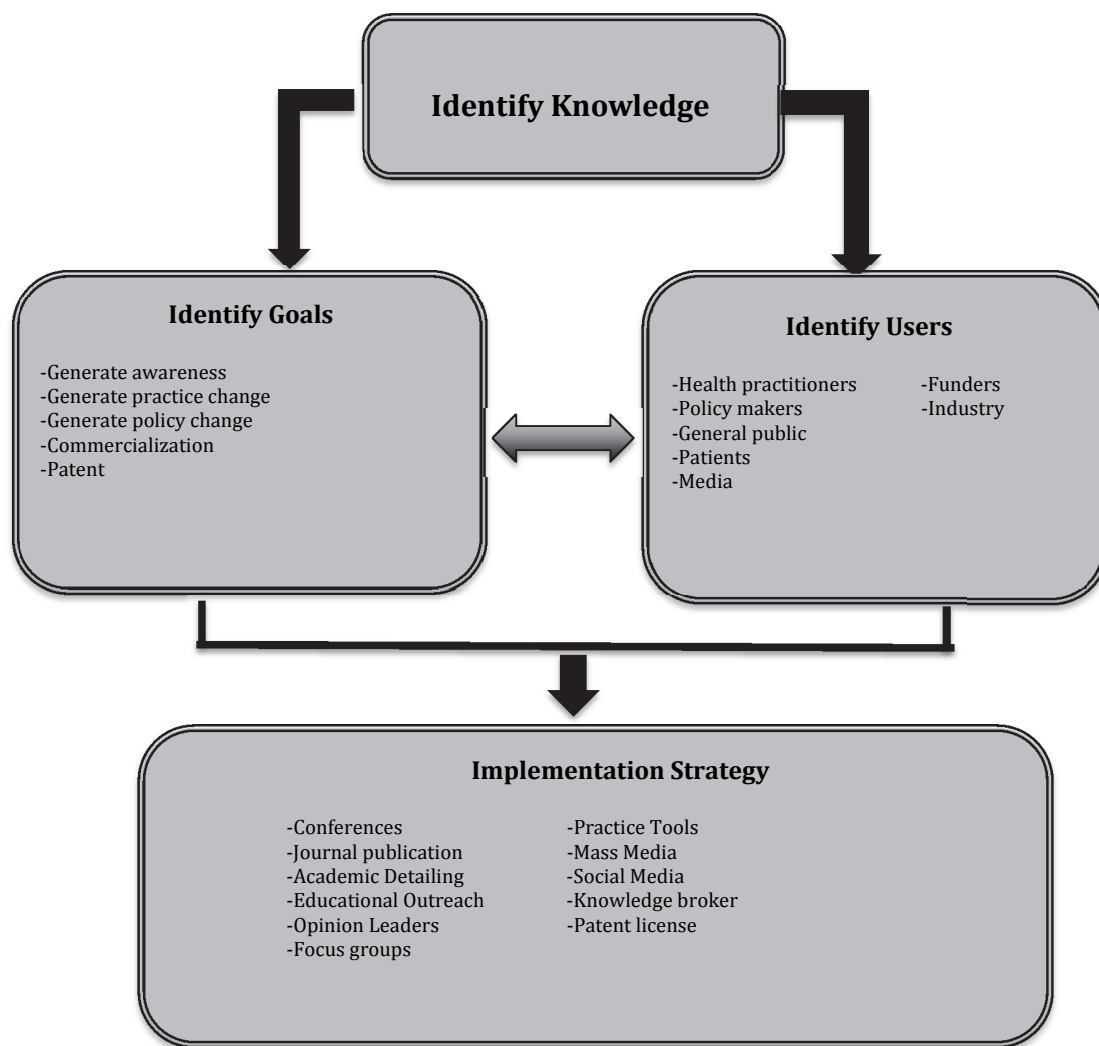


Fig. 1. From identifying knowledge to defining goals and users to choose the appropriate implementation strategies.

healthier lifestyle choices. Diets such as the Dash-sodium and Med-diet are advocated for reducing hypertension and risk of CVD. These diets are characterized by a high intake of olive oil, fruit, nuts, and vegetables; a moderate intake of fish and poultry; a low intake of dairy products and red meat; and wine, in moderation, consumed with meals²⁴. Knowledge of these diets needs to reach to the Japanese population. Moreover, recent studies have reported that the guidelines and charts for CVD risk assessment developed years ago, and that are currently followed by clinicians in Japan, are not representative of the current health scenario in Japan^{25, 26}.

In 2012, the Japan Atherosclerosis Society (JAS) published an updated guideline on the diagnosis and prevention of atherosclerotic CVDs in Japan. This version especially focused on the cerebrovascular dis-

ease, peripheral arterial disease, and coronary artery disease, which occur in association with atherosclerosis and is closely related to dyslipidemia²⁷. The revision of this version considers the effects of increasing westernization in the Japanese population. In addition to providing updated CVD screening criteria and a restructured risk stratification strategy, the 2012 guideline proposes revised management and treatment targets for CVD patients. There is an urgent requirement for clinicians and policymakers to incorporate the updated clinical guidelines in their practice. An integrated effort from all stakeholders or knowledge users can control the increasing risk of CVD among the Japanese population, which requires a strategic knowledge translation plan to be developed and appropriately implemented.

Knowledge Translation Strategy

Knowledge translation is an open-ended process to which researchers can adapt according to the nature of the research. An effective scheme initially requires identification of the research knowledge to be disseminated among the target users, followed by a combination of one or more implementation strategies that can then be used depending on the goals, the users, and the means available²⁸⁾. The next step involves evaluating the outcomes and impact of the knowledge implementation on the target users. Strategies should be sustained if the feedback is positive and revised if it is negative. The steps are discussed in detail below.

Step 1: Identify and Select Knowledge

Health researchers often generate an ample amount of knowledge. This plethora of information may be of significant value to the researchers; however, it can be a burden for certain audiences. While all knowledge does not need to be translated, we need to ascertain the important messages we would like to convey. Much information relevant to a specific audience often masks the essential message, so it is crucial to extract the most salient points to convey the intended message, which should be brief and tailored to the needs of the reader.

Step 2: Adapt Knowledge According to Target Users

For effective knowledge translation, it is essential to use a clear, concise, audience-focused set of statements²⁸⁾. The intended messages may need to be tailored multiple times depending on the goals and target audience. Several goals and target audiences can be selected based on the nature of the research finding. To control the increasing cardiovascular risk in Japan, an all-encompassing approach is required that would target a wide range of users, including health practitioners, policymakers, cardiac patients, general public, advocacy groups, and media. As the goal is for knowledge users to recognize the elevated risks for cardiovascular fatality, adopt a healthy lifestyle, and follow updated clinical guidelines, the goals would be to raise public awareness and to generate public action, practice change, and policy change. **Fig. 1** lists certain possible goals and target users for knowledge translation activity after identifying the content for translation.

Notably, the messages need to be tailored to the various user groups, for example, clinicians versus policymakers. The language used should also be appropriate for different target users. For example, the term “cardiovascular” is familiar to health practitioners but may be confusing to the patients, general public, and policymakers. In the present scenario, the intended

Box 1. Examples of various types of messaging based on different target audience.

For clinicians:

- Save patients from the increasing cardiovascular fatality
- Encourage patients to adopt a healthy diet and lifestyle
- Revise existing risk assessment charts
- Incorporate updated guidelines in clinical practice

For policymakers:

- Support initiatives that improve the awareness of heart disease prevention
- Enforce reductions in tobacco use
- Update existing outdated CVD risk assessment charts and guidelines

For the patients and general public:

- Protect your heart health
- Eat a healthy diet comprising less saturated fat, sugar, and salt
- Quit smoking
- Exercise regularly
- Visit your doctor for regular checkups

messages could be customized for the various audience groups as the example provided in **Box 1**.

Step 3: Implementation Strategies

Assessing the possible barriers to knowledge use is important before commencing any intervention. Available resources and the manpower required to disseminate customized knowledge to the target audience need to be considered in the implementation process. Background and level of understanding of the target audience are also important factors in tailoring the information presented. The type of knowledge translation strategy applied also depends on the intended goals and the specific target audience. Depending on the availability of resources, use of multiple strategies in combination is often more effective. **Fig. 1** lists some of the conventional implementation strategies used in knowledge translation. Notably, being innovative in identifying the knowledge translation channels increases the possibility of greater reach to the intended audience.

Conferences and journal publications might prove useful for sharing knowledge with the physicians; however, they will not be effective means for generating public awareness of an issue. Opinion leaders, well-known spokespersons, or organizations with the ability to influence public opinion in a specific area, could be targeted in the healthcare sector to help generate understanding amid the general population regarding the importance of controlling cardiovascular risks and adopting a healthy lifestyle. They can also advocate the policymakers to revise regulations for food and

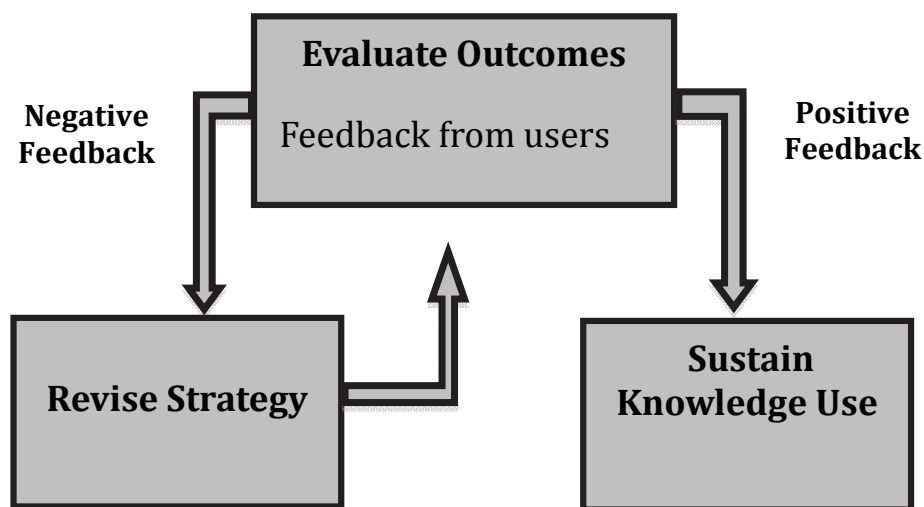


Fig. 2. Monitoring cycle in knowledge translation.

tobacco manufacturing. Mass media and social media are two other powerful means of reaching and influencing the public. Effective dissemination strategies include newspaper articles, television commercials, talk show segments, and posts on various social media platforms educating Japanese people about increasing cardiovascular risks and the importance of a healthy diet, regular exercise, and regular physical checkups. Health practitioners could be sent frequent reminders to recommend appropriate diagnosis and treatment for CVD risk factors such as hypertension, hypercholesterolemia, etc., and to encourage the patients to adopt a healthier lifestyle.

It is also essential to involve the stakeholders in the knowledge translation process. Focus groups may help stakeholders feel invested in the implementation strategy. These are small interactive groups comprising 6–12 participants who share similar backgrounds or interests when questioned about their perceptions, opinions, beliefs, and approach about a product, service, or concept. Separate focus groups for different participants in the implementation process—opinion leaders, policymakers, and health practitioners—could be formed to gather their specific opinions and feedback. Multiple focus groups gathered at various stages of the knowledge translation process could help determine the strategy strength and assess any barriers to knowledge use encountered in the process to aid in developing the most effective approach.

Step 4: Monitoring, Evaluating, and Sustaining Knowledge Use

Assessing the outcomes of any intervention, both intended and unintended, is a crucial component of

knowledge translation. **Fig. 2** illustrates the monitoring cycle of knowledge translation. Opinion leaders and mass media should regularly promote the intended message. Knowledge use can be monitored in social media by tracking the number of likes, shares, and comments. As the intervention is intended to change the public behavior, outcomes should be evaluated via feedback from the public. Focus groups comprising a small number of public representatives could be held to obtain their perspectives about the intervention effect in terms of overall lifestyle change. Based on the feedback from the focus groups, large-scale public surveys could be conducted to gain additional information. Positive feedback would imply that the strategy is successful and should be sustained, whereas negative feedback would require measures to address the problems and a revised strategy to be implemented. The outcomes and impact of the strategy should be monitored until the desired change is observed, in this case, reduced cardiovascular risk.

Effective Cardiovascular Knowledge Translation Programs

Recently, the Stanford South Asian Translational Heart Initiative (SSATHI) has launched a program comprising skilled researchers and clinicians to address the unique cardiovascular distresses of the South Asian population²⁹. The program aims to teach South Asian people the measures to protect themselves from CVD. An expert research team examines the nontraditional risk factors such as elevated lipoprotein levels, insulin resistance, low HDL, and relevant genetic mutations, whereas the clinicians focus on risk reduction, preven-

tion, and treatment. After knowing the family history and conducting a thorough diagnostic evaluation, short-term goals are set for patients based on their risk levels. Patients return for a second visit approximately 2 months later, where the physician scores the cardiovascular risks, reviews the lab test results, and refers the patient to a dietitian for consultation. After 6 months, the biomarker screening is repeated and a long-term plan is developed during the third visit. This initiative is a good example of knowledge translation involving patients, health practitioners, and researchers aimed at improving cardiovascular concerns in the South Asian population.

The Canadian Hypertension Education Program (CHEP) is another example of a successful knowledge translation program that aims to reduce the impact of hypertension on CVD in Canada³⁰. Each year the program rigorously appraises the data from hypertension research worldwide and makes evidence-based recommendations in clinical practice to improve the diagnosis and management of hypertension. The program also significantly contributes in disseminating these recommendations to the target groups throughout the country and assessing their impact in improving the health of Canadians with hypertension. CHEP demonstrates an effective adoption of knowledge dissemination to reduce the burden of hypertension; thus, it improves the cardiovascular health of the target population.

Conclusion

Research evidence demonstrates that cardiovascular risk is increasing among the Japanese population. Gaps in clinical risk assessment and guidelines have also been reported; however, the benefits from the research findings will not be realized unless the knowledge is disseminated to the appropriate audience³¹. The research needs to be translated from evidence to practice, to reduce the gap between knowledge and its users. Japanese people need to understand the severity of the issue and should learn to protect themselves by adopting a healthier lifestyle and undergoing regular clinical checkups that follow proper risk assessment guidelines. In order to raise awareness of the issue, implement improved population health, and update clinical practices and guidelines, a strategic knowledge translation plan involving a collaborative effort of individuals from various user groups, including opinion leaders, clinicians, policymakers, and researchers, is vital.

Competing Interests

The authors declare no conflicts of interests.

Reference

- 1) Haines A, Kuruville S, Borchert M: Bridging the implementation gap between knowledge and action for health. *Bull World Health Organ* 2004; 82: 724-731; discussion 732
- 2) Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, Robinson N: Lost in knowledge translation: time for a map? *J Contin Educ Health Prof* 2006; 26: 13-24
- 3) Hemmelgarn BR, Manns BJ, Straus S, Naugler C, Holroyd-Leduc J, Braun TC, Levin A, Klarenbach S, Lee PF, Hafez K, Schwartz D, Jindal K, Ervin K, Bello A, Turin TC, McBrien K, Elliott M, Tonelli M: Knowledge translation for nephrologists: strategies for improving the identification of patients with proteinuria. *J Nephrol* 2012; 25: 933-943
- 4) Straus SE, Tetroe J, Graham I: Defining knowledge translation. *CMAJ* 2009; 181: 165-168
- 5) CIHR (2009) About knowledge translation
- 6) McGlynn EA, Asch SM, Adams J, Keesey J, Hicks J, DeCristofaro A, Kerr EA: The quality of health care delivered to adults in the United States. *N Engl J Med* 2003; 348: 2635-2645
- 7) Majumdar SR, McAlister FA, Furberg CD: From knowledge to practice in chronic cardiovascular disease: a long and winding road. *J Am Coll Cardiol* 2004; 43: 1738-1742
- 8) LaRosa JC, He J, Vupputuri S: Effect of statins on risk of coronary disease: a meta-analysis of randomized controlled trials. *JAMA* 1999; 282: 2340-2346
- 9) AAFP (2017) Clinical Practice Guideline Manual. Kansas, USA: AAFP
- 10) Fox J, Patkar V, Chronakis I, Begent R: From practice guidelines to clinical decision support: closing the loop. *J R Soc Med* 2009; 102: 464-473
- 11) WHO (2014) Cardiovascular Diseases
- 12) Uemura K, Pisa Z: Trends in cardiovascular disease mortality in industrialized countries since 1950. *World Health Stat Q* 1988; 41: 155-178
- 13) Kitamura A, Sato S, Kiyama M, Imano H, Iso H, Okada T, Ohira T, Tanigawa T, Yamagishi K, Nakamura M, Konishi M, Shimamoto T, Iida M, Komachi Y: Trends in the incidence of coronary heart disease and stroke and their risk factors in Japan, 1964 to 2003: the Akita-Osaka study. *J Am Coll Cardiol* 2008; 52: 71-79
- 14) Nishiyama S, Watanabe T, Arimoto T, Takahashi H, Shishido T, Miyashita T, Miyamoto T, Nitobe J, Shibata Y, Konta T, Kawata S, Kato T, Fukao A, Kubota I: Trends in coronary risk factors among patients with acute myocardial infarction over the last decade: the Yamagata AMI registry. *J Atheroscler Thromb* 2010; 17: 989-998
- 15) Rumana N, Kita Y, Turin TC, Murakami Y, Sugihara H, Morita Y, Tomioka N, Okayama A, Nakamura Y, Abbott RD, Ueshima H: Trend of increase in the incidence of acute myocardial infarction in a Japanese population:

- Takashima AMI Registry, 1990-2001. *Am J Epidemiol* 2008; 167: 1358-1364
- 16) Liu L, Ikeda K, Yamori Y: Changes in stroke mortality rates for 1950 to 1997: a great slowdown of decline trend in Japan. *Stroke* 2001; 32: 1745-1749
 - 17) Ueshima H: Changes in dietary habits, cardiovascular risk factors and mortality in Japan. *Acta Cardiol* 1990; 45: 311-327
 - 18) Kubo M, Kiyohara Y, Kato I, Tanizaki Y, Arima H, Tanaka K, Nakamura H, Okubo K, Iida M: Trends in the incidence, mortality, and survival rate of cardiovascular disease in a Japanese community: the Hisayama study. *Stroke* 2003; 34: 2349-2354
 - 19) Hirata A, Okamura T, Sugiyama D, Kuwabara K, Kadota A, Fujiiyoshi A, Miura K, Okuda N, Ohkubo T, Okayama A, Ueshima H: The Relationship between Very High Levels of Serum High-Density Lipoprotein Cholesterol and Cause-Specific Mortality in a 20-Year Follow-Up Study of Japanese General Population. *J Atheroscler Thromb* 2016; 23: 800-809
 - 20) Fujishima M, Kiyohara Y, Ueda K, Hasuo Y, Kato I, Iwamoto H: Smoking as cardiovascular risk factor in low cholesterol population: the Hisayama Study. *Clin Exp Hypertens A* 1992; 14: 99-108
 - 21) Kodama K, Sasaki H, Shimizu Y: Trend of coronary heart disease and its relationship to risk factors in a Japanese population: a 26-year follow-up, Hiroshima/Nagasaki study. *Jpn Circ J* 1990; 54: 414-421
 - 22) Shimamoto T, Komachi Y, Inada H, Doi M, Iso H, Sato S, Kitamura A, Iida M, Konishi M, Nakanishi N: Trends for coronary heart disease and stroke and their risk factors in Japan. *Circulation* 1989; 79: 503-515
 - 23) Ueshima H, Tatara K, Asakura S, Okamoto M: Declining trends in blood pressure level and the prevalence of hypertension, and changes in related factors in Japan, 1956-1980. *J Chronic Dis* 1987; 40: 137-147
 - 24) Chan Q, Stamler J, Griep LM, Daviglus ML, Horn LV, Elliott P: An Update on Nutrients and Blood Pressure. *J Atheroscler Thromb* 2016; 23: 276-289
 - 25) Kuwabara K, Harada S, Sugiyama D, Kurihara A, Kubota Y, Higashiyama A, Hirata T, Nishida Y, Kawasaki M, Takebayashi T, Okamura T: Relationship between Non-High-Density Lipoprotein Cholesterol and Low-Density Lipoprotein Cholesterol in the General Population. *J Atheroscler Thromb* 2016
 - 26) Nakai M, Miyamoto Y, Higashiyama A, Murakami Y, Nishimura K, Yatsuya H, Saitoh S, Sakata K, Iso H, Miura K, Ueshima H, Okamura T: Calibration between the Estimated Probability of the Risk Assessment Chart of Japan Atherosclerosis Society and Actual Mortality Using External Population: Evidence for Cardiovascular Prevention from Observational Cohorts in Japan (EPOCH-JAPAN). *J Atheroscler Thromb* 2016; 23: 176-195
 - 27) Teramoto T, Sasaki J, Ishibashi S, Birou S, Daida H, Dohi S, Egusa G, Hiro T, Hirobe K, Iida M, Kihara S, Kinoshita M, Maruyama C, Ohta T, Okamura T, Yamashita S, Yokode M, Yokote K: Executive summary of the Japan Atherosclerosis Society (JAS) guidelines for the diagnosis and prevention of atherosclerotic cardiovascular diseases in Japan -2012 version. *J Atheroscler Thromb* 2013; 20: 517-523
 - 28) Barwick MB, D. Lockett, D. M. Buckley, L. Goering, P. (2005) *Scientist knowledge translation training manual*. Canada: The Hospital for Sick Children, Toronto, Ontario, Canada
 - 29) SUMC (2014) *Heart Disease in South Asians: A Global Epidemic*
 - 30) Tobe SW, Touyz RM, Campbell NR: The Canadian Hypertension Education Program - a unique Canadian knowledge translation program. *Can J Cardiol* 2007; 23: 551-555
 - 31) Ian DG, Jacqueline T: *CIHR Research: How to Translate Health Research Knowledge into Effective Healthcare Action*. *Healthcare Quarterly* 2007; 10: 20-22