

Olympic Health Legacy; Essentials for Lasting Development of Host City

Young-Hee Lee* and Jung Moon Kim

Department of Rehabilitation Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea

The purpose of the Olympic Games should be to contribute to the social development by leaving behind economic, cultural and environmental legacies to the hosting region. While tangible examples such as venues are often recognized as representative legacies of the Olympics, intangible aspects such as the environment, culture, policy and human resources have been gaining in importance. The Olympic Games, at its most fundamental level, is a sporting event. Sports not only is closely related to the physical health, but is also instrumental to fostering mental health through inspiration. One of the most important sports legacies was the general change in the population's perception on sports and physical activities; due to such change, people were able to enjoy sports as part of healthy and active everyday life and benefit physically. However, compared to tangible legacies such as the facilities, social legacies such as the general health and their planning, execution and achievements are hard to monitor. Therefore, for the Olympics to leave behind socio-cultural legacies that contribute to the development of the hosting region, there must be a thorough business plan that takes into account region-specific purpose, and is divided into stages such as before, during and after the Games. Should the 2018 Winter Olympic Games hope to create continuing contribution to its hosting region, it must leave behind 'Health Legacies' that will enhance the happiness of the hosting region's population. To this end, establishment of region-specific purpose and systematic promotion of business via detailed analysis of precedents are a must. This article aim to review the health legacy endeavors of past host cities and suggest the appropriate forms of health legacy of 2018 Pyeongchang Winter Olympic and Paralympic Games.

Key Words: Olympics, Paralympics, Sports, Legacy, Health

INTRODUCTION

Pyeongchang, a small town located in the mountainous eastern region of the Republic of Korea, emerged victorious in its bid to host the 2018 Winter Olympic Games after two closely-fought but unsuccessful attempts. The 2018 Games will be Korea's second after 1988 Seoul Games, and the

third Winter Olympic event following the two previous iterations in Japan.

The hosting of the Olympics, which requires a substantial amount of funding, should not be an achievement in and of itself. The purpose of the Games should rather be to contribute to the social development by leaving behind economic, cultural and environmental legacies to not only the hosting region and nation, but also the surrounding countries and the entire world. While tangible examples such as venues and roads are often recognized as representative legacies of large-scale events such as the Olympics, intangible aspects such as the environment, culture, policy and human resources have been gaining in importance.

Received: February 4, 2013, Accepted: February 18, 2013

*Corresponding author: Young-Hee Lee

Department of Rehabilitation Medicine, Yonsei University Wonju College of Medicine, 20 Ilsan-ro, Wonju, Gangwon-do 220-701, Republic of Korea
Tel: 82-33-741-0661, Fax: 82-33-741-1409
E-mail: lee02@yonsei.ac.kr

The Olympic Games, at its most fundamental level, is a sporting event. Sports not only is closely related to the physical health, but is also instrumental to fostering mental health through inspiration. Shipway [1] has claimed that one of the most important sports legacies was the general change in the population's perception on sports and physical activities; due to such change, people were able to enjoy sports as part of healthy and active everyday life and benefit physically. However, compared to tangible legacies such as the facilities, transportation and venues, social legacies such as the general health and their planning, execution and achievements are hard to monitor. Furthermore, there is currently no evidence on whether such large-scale sporting events automatically confer benefits to the residents of the hosting region [2]. Therefore, for large-scale sporting events such as the Olympics to leave behind sociocultural legacies that contribute to the development of the hosting region, there must be a thorough business plan that takes into account factors such as region-specific purpose, and is divided into stages such as before, during and after the Games.

Two of the most significant objectives for Pyeongchang 2018 suggested in the bid-book are tapping into the great potential of Asian winter sports and contributing to the development of the hosting region [3]. Of these, the popularization of winter sports in Asia can be considered as an Olympic legacy rather than a legacy of the hosting region, and most of the legacies for the hosting region are usually focused on tangible assets such as facilities and venues. Should the 2018 Winter Olympic Games - which is, after all, set in a small city - hope to create sustainable contribution to its hosting region, it must leave behind 'Health Legacies' that will enhance the happiness of the hosting region's population. To this end, establishment of region-specific goals and systematic promotion of business via detailed analysis of precedents are a must.

This article aims to review the health legacy endeavors of past host cities and suggest the appropriate forms of health legacies for the 2018 Pyeongchang Winter Olympic and Paralympic Games.

SIGNIFICANCE OF OLYMPIC HEALTH LEGACY

Much has been written on the effect of the Olympics on the host regions, most of which have focused on the economic aspect [2]. While most of the Olympic Games' effects on the economy of the host region have been positive, there have been negative effects as well [4,5]. The positive reports have mostly been based on approximated data or analyzed data collected in the short period of time after the Games. As a result, the validity of such results is questionable [2].

While events such as the Olympics may provide much in the form of economic benefits, they can also have beneficial effects such as improved social participation, enhanced collective regional creativity and development of welfare. The improvement of quality of life, enhancement of the physical and mental health of the youth, and the betterment of health of the regional community are facets that often prove to be more essential than economic growth. Moreover, hosting a sporting event is often associated with an increase in self-esteem and self-realization of the regional population [1]. Such intangible legacies are more persistent and far-reaching than their tangible counterparts, and they also play important roles in better utilization of tangible assets. Hence, in order to sustain development of the host region, various efforts aimed at leaving behind sociocultural legacies as well as tangible ones must be made.

In recent Games, sociocultural legacies such as the culture, environment and the self-worth of residents have been grouped together and collectively referred to as the health legacy. The importance of sports in maintaining one's health, preventing diseases and curing them are no longer in doubt. The role of such large-scale sporting events in increasing participation in sports is imperative.

It has often been mistakenly claimed that there has been "no instance in which past Olympics have increased the participation in sports or physical activities." However, this statement is not entirely true for two reasons. Firstly, so far, no attempts have been made to collect and analyze evidence to support these claims, nor has there been any policy to effect such change [6]. Therefore, it can be asserted that the Olympic Games have never been systematically utilized to enhance the participation in physical activities and sports.

Yet, recent studies have shown that the perception regarding the importance of Health Legacy is steadily growing.

The Beijing Olympics Organizing Committee published a separate health legacy book that deals with improvements regarding the atmosphere, water supply, food, hygiene, and the general sense of health in Beijing due to the 2008 Olympics [7], while the official reports for the 2010 Vancouver Winter Olympics [8] and the 2012 London Olympics [9] describe the health legacy aspects in greater detail.

Medical papers on Olympic Games were first published in the 1960s, but they were infrequent and mostly dealt with illness, injury and doping during the Olympics. Nevertheless, since the year 2000 these papers have grown in both number and scope, and are increasingly dealing with legacies contributing to the medical development of the host nation such as public health and environment [10].

HEALTH LEGACIES IN RECENT OLYMPIC AND PARALYMPIC GAMES

1. 2008 Beijing Olympic and paralympic games

The concept of a health legacy from the 2008 games was first raised and formally discussed at a symposium in Lausanne in 2002 entitled “The legacy of the Olympic Games 1984-2000”. The concept was defined as: “The sustainable, positive health impacts on the host city or country, associated with the hosting of the Olympic Games.” That meeting agreed that the health care system would be improved by hosting the Games, especially in a rapidly developing city with a large population such as Beijing [11].

The health legacy of the Beijing Games improved capacity in traditional medical services required for hosting the Olympics; a strengthened public health system, including disease surveillance, risk management and health emergency response; an enhanced living environment for the host city citizens; and increased health awareness among athletes, visitors, and host country residents through successful health education and campaigns prior to and during the Olympic Games [12]. Beijing Olympic Health Services have not only left the host city with improved health infrastructures and advanced technologies, but also with an impressive resource of trained health professionals of great benefit to the host city long after the ending of the Games

[7].

Another pillar of the health legacy from Beijing Olympic Games is strengthened public health preparedness to respond to and manage quickly health risks associated with mass gatherings. The increased population and population density during the mega-event imposed higher risks of outbreaks of communicable diseases, transmission of diseases from host population to the visitors and vice versa, and potential terrorist attacks. In response to these challenges, Beijing successfully identified key factors to prevent disease outbreaks. Food safety and waters' sanitation were greatly improved to reduce diarrhea among travelers; emergency medical services were greatly enhanced, and so on. Most importantly, the Games left Beijing with a reinforced surveillance system and a strengthened capacity for public health risk management [12].

A unique aspect of the Beijing health legacy is an impressive improvement of the living environment for residents of the host cities [12]. With the Games came a renewed attention to environmental sustainability, an improved urban infrastructure and an educational program that brought Olympic values to 400 million school children across the country [13]. One example is the improvement of air quality. Concerted actions were taken to reach the WHO air quality standards of 2005. These actions saw the closure and transfer of 140 polluting factories, the development and implementation of new air pollutant emission standards, and the expansion of a continuous air quality monitoring network [14]. Another example is the success of smoking control in public places, leaving Beijing with a more stringent smoking ban, the first amendment to the regulations of 1995. These actions vividly illustrate how an international sports gathering can also serve as a catalyst to hold the host city to a higher standard in multiple aspects of health, and leave that city with a health legacy not just in terms of facilities, but also in policies and legislation [12].

The diverse public health education campaigns led by the government and NGOs before and during the Games are another interesting facet. The Games offered unprecedented mass media coverage and public attention to individual well-being. As a result, numerous campaign activities were carried out to advocate a healthy lifestyle, disseminate health messages, and raise awareness to health related issues

such as the importance of physical activity, the health hazards of smoking and second-hand smoke, an anti-doping exhibition, and prevention of HIV/AIDS stigmatization [12].

World Health Organization published the book so that the experience of the Beijing Games can be made available to a worldwide audience and thereby be a useful source of information for organizers of future mass gathering events [7].

2. 2010 Vancouver Winter Olympic and paralympic games

The Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games (VANOC) (2007) showed that following the Winter Olympics in Canada, there was an increase in fitness activity and use of facilities, especially by children, although this may relate to specific provision of activities and organized use of facilities through schools, local junior athletics teams and youth clubs. Vancouver's bid to host the 2010 Games was inspired by the belief that Olympic and Paralympic Games can lead to new partnerships that benefit communities long after the Games are over. IOC reported that the 2010 Vancouver Games generated tremendous interest among Canadians and left a legacy that will encourage sports participation at all levels – in terms of both improved facilities and greater opportunities for taking part [15].

To create and capture those sustainable social legacies, a non-profit organization, '2010 Legacies Now', was formed during the Vancouver bid process and is the first- ever legacy group to be in place before the start of any Games. Sustainability was another key value of VANOC which won several awards for environmental design [8,15,16].

With a focus on sport and recreation, healthy living, accessibility, arts, literacy and volunteerism, '2010 Legacies Now' took an innovative approach to leveraging the 2010 Winter Games, creating tangible legacies in more than 400 communities and neighborhoods throughout British Columbia (BC) [8].

Examples include

- 530,000 students in 1,400 schools leading healthier, more active lives thanks to Action Schools! BC, a program helping teachers incorporate daily physical activity and healthy eating lessons into classroom activities

- 200,000 people in over 100 communities, including children and youth, persons with disabilities, seniors and Aboriginal youth, participating in community- and school-based sports funded by the 'BC Sport Participation' Program.

- 200 national and international sport events hosted in 34 communities thanks to funding from 'Hosting BC'.

- 225 venues in 40 communities being showcased on 'HostingBC.ca' to encourage sport teams and event organizers to train and compete in British Columbia.

- 11,000 volunteers and 2,000 organizations using 'VolWeb.ca' to fill volunteer positions.

- 16,000 young students experiencing new arts, sport and recreation activities at 'Explorations' summer camps.

- 1,300 high-performance athletes receiving support each year from 'Game Plan BC' and other programs for coaching, training, competition, sport science and sport medicine.

'2010 Legacies Now' began to develop its post-Games plan for operations in 2008 by using the experience and knowledge it acquired during the previous eight years of its operation, during which it successfully drove social change in BC by creating capacity at the community level. In order to continue to be a leader in creating more socially sustainable communities, and in the absence of the magic of an upcoming event to act as a catalyst and accelerant, '2010 Legacies Now' looked across the globe at existing trends in the not-for-profit sector to identify where it could best add value to communities.

In February 2011, on the one-year anniversary of the Opening of the 2010 Winter Games, 2010 Legacies Now officially launched its new organization as 'A legacy of the 2010 Winter Games' – named 'LIFT Philanthropy Partners' [17]. The new venture philanthropy model will continue to carry on its work as an important social legacy of the 2010 Vancouver Winter Olympic and Paralympic Games.

3. 2012 London Olympic and paralympic games

A key feature of the successful London 2012 bid was the commitment to creating a lasting health legacy through a large-scale and sustained increase in sport and physical activity participation [18]. When the UK bid for the London 2012 Olympic and Paralympic Games, the vision was to also

use them to drive participation in physical activity up to and beyond the event as part of a unique health improvement legacy. In 2008, the Government published a Legacy Action Plan, which was further developed by the Department of Health in 2009 to develop work-streams supporting delivery of the Legacy Action Plan.

The National Health Service (NHS) London 2012 Program, established in 2008, is comprised of 4 work-streams, the first of which is the ‘Health Legacy’. The purpose of this work-stream was to serve as a foundation for the 2012 Games to create sustainable health benefits for Londoners [9]. NHS London worked with partners in the public and private sectors, including the Mayor of London, to develop and publish the ‘Go London’ Strategy in 2009. The strategy aimed to stimulate organizations to develop health legacy projects inspired by three themes as ‘Healthy Londoners’, ‘Healthy NHS’ and ‘London 2012 Olympic and Paralympic Games-Inspired.’

1) “Go London” program: The ‘Go London’ program has inspired and enabled over 200 health and wellbeing projects and initiatives across London. Many of the projects featured in this directory aim to help people who have long-term conditions, differing ability levels or who are inactive, to achieve benefits from increased physical activity. The ‘Go London’ strategy is designed to build on existing projects to strengthen London’s ability to create an active

population. Creating many different and very local opportunities for physical activity is the way to slowly change a culture.

The ‘Go London’ program is divided into 3 sections according to their focuses, and noteworthy programs of each section are in Table 1.

2) Independent evaluation of health service planning and delivery for London 2012: While other host cities had demonstrated some evidence of improving systems as a result of the Games, none had been successful in creating a lasting legacy of health improvement. The organizers of London 2012 were determined that London be the first to achieve this feat. They realized that previous Olympic and Paralympic host cities had stopped at publishing reports detailing health service planning processes for the duration of the Games, and decided that they would instead endeavor to evaluate, continuously and objectively, the impact of the Olympics to the health of host city. Due to their efforts, the London 2012 Games will be the first to commission and publish an independent evaluation [19].

This evaluation will make a valuable and substantial contribution to the Olympic and Paralympic and mass gathering literature, supporting future host cities to plan and deliver evidence-based programs. Conducted by the University College of London (UCL) Department of Applied Health Research, the principle aim is to evaluate and describe the

Table 1. Examples of ‘Go London’ program

Section 1: Physical activity for health and well-being	
Your personal best	GlaxoSmithKline and NHS London ran this program – in which people over 55 years of age, with long term conditions (LTC), were encouraged to become more active – through a high profile campaign headed by celebrity dancers.
My best move	A project that trained London GPs to become more aware of the impact of physical activity on diseases such as breast, prostate and bowel cancer, and Alzheimer’s disease.
Brain train	This project aimed to promote the benefits of physical activity to London’s IAPT (Improving Access to Psychological Therapy) workforce, and encourage the inclusion of exercise programs as part of IAPT care pathways.
Team up	This project involved London’s trainee doctors and dentists partnering with community organizations to promote health and wellbeing during 2012 and beyond. The project is being run by the London Deanery, which is responsible for the postgraduate training of London’s doctors and dentists.
Active celebration	This programme set out to target the least active members of the population, such as, 48.3% of people in Merton who do not participate in 30 minutes of sporting activity every week.
Active travel	This programme focused on increasing participation in walking and cycling in the lead up to and during the Games, and as a lasting legacy for London.
Inclusive and active 2	This program was created by the Greater London Authority (GLA), NHS London and Interactive, as the lead strategic development agency for sport and activity for disabled people in London

Table 1. Continued

Section 2: Child health in the olympic host boroughs	
Child's play?	<p>A new health analysis from the London Health Observatory (LHO) that provided a baseline picture of health to support health legacy planning and evaluation in the various boroughs. Using a whole range of publications from across the network of public health observatories in England, the LHO generated a comprehensive, baseline picture of the health prospects for the children of the Olympic boroughs on behalf of the Directors of Public Health.</p> <p>It presented 18 measures – chosen as good predictors of growth, development and life expectancy – in line with the Marmot Review of health inequalities. They covered the early years, beginning with the antenatal period, and ending with adolescence at the age of 18. To make these measures accessible to a wider audience, the LHO commissioned a unique illustration to accompany more conventional tables of data. Using a pictorial representation of a 400 m running track inside a sports stadium, <i>Child's Play?</i>, for the first time, used standardized statistical methods to show a child's journey from infancy to adolescence using "health hurdles" to illustrate the key challenges faced (Fig. 1).</p> <p>It also provided a "health forecast" by assessing the extent to which each of the health measures changed across the life stages for each of the six boroughs. The LHO commends commissioning a major cohort study representative of the children in the six host boroughs with follow up measurements to 2020.</p>
Love mums	Baby Feeding Friendly: a project that aimed to improve the model of care and increase breastfeeding rates in the borough. There was 10% increase in breastfeeding rates in Barking and Dagenham between April 2010 and April 2012
Us girls	A Sport England funded scheme that aimed to increase and sustain young women's participation in sport in disadvantaged areas. It was started in June 2011 and now has over 400 members.
Section 3: Transforming health systems and infrastructure	
Sir ludwig guttmann health centre	The Olympic Polyclinic at Olympic Park will form an important part of Games health legacy. The purpose-built facility, designed in consultation with the NHS, is due to be converted and refitted into the Sir Ludwig Guttman Health Centre after the founder of the Paralympics to benefit the local population after the Games and embody the spirit of health legacy in East London. The health center is scheduled to open in Summer 2013. The building was built by the Olympic Delivery Authority (ODA), the public body responsible for developing and building the venues and infrastructure for the Games. The ODA contributed £6m of the cost and the NHS funded £17 m.
MRC-NIHR phenome centre	Anti-doping facilities developed for the London 2012 Games are being deployed as a world-class resource to study the impact of genetics and environmental factors on metabolism. The MRC-NI HR Phenome Centre, the first of its kind in the world, will use the cutting edge facilities developed for the Games to help develop better and more targeted treatment for patients. Located in Harlow, Essex, the center will be funded over five years by the Medical Research Council (MRC) and the Department of Health's National Institute for Health Research (NIHR), who will invest £5 m each. The facility will develop state-of-the-art equipment and expertise based on the anti-doping facilities provided for the Games by GlaxoSmithKline (GSK) and operated by King's College London.
The institute of sports, exercise and health (ISEH):	A lasting legacy from the London 2012 Games will be delivered to support sporting achievements at all levels with the creation of a National Centre for Sport and Exercise Medicine (NCSEM) composed of three networked facilities nationwide; of which the London facility is the Institute of Sport, Exercise and Health (ISEH). The £10 m Department of Health funded institute will be a national and international hub for clinical and academic work in sport and exercise medicine and sports injuries. The Institute of Sports, Exercise and Health (ISEH)
Emergency planning	The programme, led by NHS London's Emergency Planning team, strengthened the resilience of London's NHS both for Games time and beyond, enabling it to efficiently respond to incidents such as outbreaks of infectious disease, terrorist attacks, severe weather and staff absences, and to continue providing quality healthcare services during an adverse event.
Syndromic surveillance systems	With the Health Protection Agency, NHS London installed software systems into Accident and Emergency departments and GP facilities in London and further afield to monitor the symptoms of patients attending. The system collates anonymous information about patients' symptoms to more rapidly identify and respond to infectious diseases or clusters of illness.
Heartstart	CPR training program for Volunteer. In preparation for the Games, 142 Heartstart sessions were delivered and 1,000 London Ambassadors (Volunteer) trained. This means 1,000 more people are now trained in what to do while waiting for an ambulance to arrive, and how to use one of the 750 publically available defibrillators that can help restart a heart. A total of 10 ambassadors were also approved as Heartstart trainers and ran their own Heartstart sessions, training approximately 20 per cent of the 1,000 ambassadors in CPR technique. Latest figures from LAS (London Ambulance Service), published in August 2012, showed an impressive increase in out-of-hospital cardiac survival rates, from 22.8% in 2011 to 31.7% in 2012
Summer lovin'	Campaign for sexual health

contribution made to health planning and health legacy of the 2012 Games by NHS London. More specifically the objective is to assess the impact of NHS London's 2012 Program, including activities delivered within the duration of the Games, emergency preparedness, demand management and health legacy work-streams.

To evaluate NHS London's work, UCL is gathering data from a wide range of sources from the ten months prior to, during and after the Games, including:

- Key individuals working for and with the NHS London 2012 team, to analyze the details of planning and delivery;
- Past Olympic reports from Sydney, Athens, Beijing and Vancouver, to understand the key issues at past Games and enable comparison; and
- NHS London documentation since the beginning of the

program, to appreciate longitudinal factors.

UCL's final report is due to be published on 31 April 2013.

London 2010 describes the key lessons described during this process as follows "Actions do not just happen by themselves and this particularly related to the efforts to leverage a health legacy in terms of increased physical activity for Londoners. Having a clear strategy (Go London!) and planning was essential" [19].

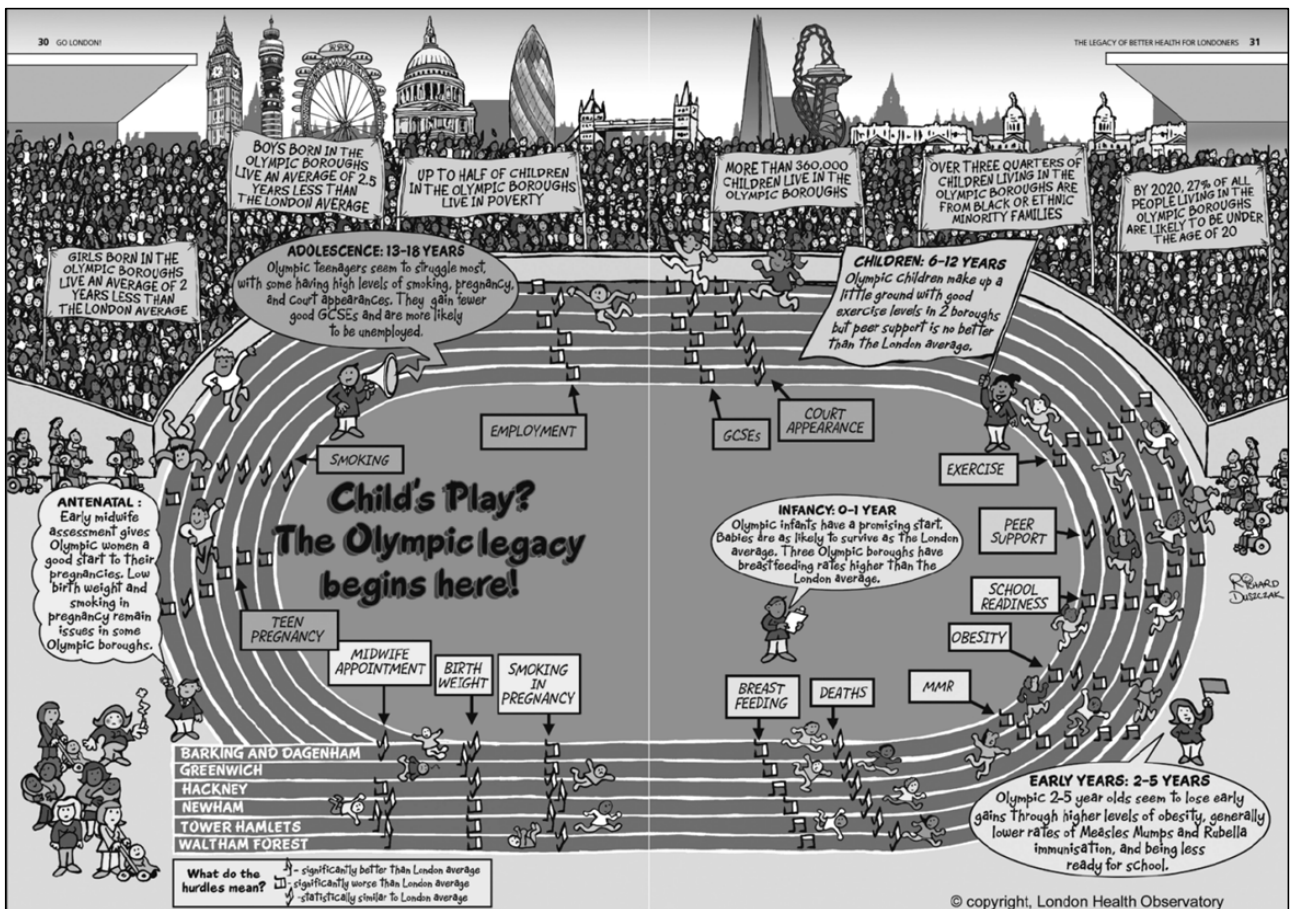


Fig. 1. "Health Hurdles". A pictorial representation of a 400 m running track inside a sports stadium, which show a child's journey from infancy to adolescence with key challenges faced, using standardized statistical methods Modified from [19].

SUGGESTIONS FOR LEAVING BEHIND HEALTH LEGACY TO CONTRIBUTE TO SUSTAINABLE DEVELOPMENT OF HOST REGION

1. The organizing committee, the government of the host city and its people must recognize the importance of intangible legacies obtainable from the Olympics

The Olympic Games can be an incredible catalyst for change. The lasting benefits include both tangible and intangible effects. Previous reports related to Olympic Legacies have often focused on the legacy potential of facilities, presumably to influence the participation among young children and adolescents. However, varying results have been found in relation to such legacies, and in some cases even negative legacies have occurred when such facilities were closed or not sufficiently funded [6]. It has been reported that the most important changes from recent Olympic Games have occurred due to intangible effects, such as health legacy [8,12,19].

2. The purpose of health legacy must be specific to the host region, and the action plan must be established in accordance with the host region

There are too many limitations in creating a sustainable Health Legacy with only the funding for the Olympics. Therefore, it is prudent to work with resources that will be invested to the host region regardless of the Olympics. This is the reason why the purpose of Health Legacy must be specific to the host region. In order to establish the region-specific purpose and action plan, the first course of action is to understand and analyze the issues regarding the health sector of the host region, before identifying those that may be coordinated with the preparation for the Games for their resolution. Also, the intangible legacies must make continued and active use of the host region's tangible legacies. The residents of the host region will be the ones who would take advantage of the facilities the most and participate in events after the Games.

3. The Legacy project must begin as soon as possible, and it must be joined by functional areas other than responsible legacy teams

Positive legacies do not just happen by themselves: they need to be carefully planned from the earliest possible stage and be integrated within the project's vision at every step. Games organizers should be reasonable and pragmatic in their approach and prioritize their decisions according to their vision and objectives [15].

4. Raising awareness and inducing public participation of residents regarding the Health Legacy is a must

Wider evidence from research on the social and the economic impacts of sports events and franchises, tourism and on community reactions to events supported the suggestion that positive perceptions of major events are an important foundation for using such events to develop physical activity, sport or health. The central message in relation to this theme is that if the population holds negative perceptions of, or attitudes towards, a major sport event, the potential to use such an event for the development of physical activity or sport, or the promotion of health is likely to be considerably reduced, if not negated [20].

The main recipients of Health Legacy are the residents of the host region. Hence, their participation is a must for such Legacy to contribute to the development and healthy living of the host region. In particular, it is probable that sports of Winter Olympics may be inaccessible to residents of the relatively rural host region due to its risk and cost. Therefore, various programs that familiarize these sports to the residents should be prepared. Volunteering is a great program for enhancing the perception of the residents because those who have volunteered have a tendency to actively participate in other events as well [20]. Volunteers at the 1994 Winter Olympic Games in Lillehammer, Norway, and the 2000 Olympic Games in Sydney perceived an increase in their skills after volunteering [21].

CONCLUSION

The residents of the Olympics host city expect economic development of the region through the Games. The result

from such potential economic gains ultimately results in happier lives that are closely connected with health and well-being. Therefore, not only the new facilities but also intangible legacies such as perception, institution and life-style that enable the inhabitants of host region must be left behind in order for the Olympics to contribute to the development of the host region. Analyzing the medical situation of the host region and the development plan and coordinating the result with the Olympics preparatory endeavors should allow leaving behind sustainable health legacy without additional cost.

For example, the imaging equipment, emergency medical equipment and ambulances may be placed in medically deficient regions, while the Olympics Medical Information System that networked the venues, Athletes' Village and Olympic medical institutions may be utilized to improve the emergency medicine, first-aid and public health system. Professional medical personnel and volunteers trained specifically for the Olympics may form a non-profit organization that efficiently participates in large-scale events to take place in the host region in future. Also, facilities and equipment invested in the Olympics may be assigned to major leisure, sports, tourist and convention locations, while the Olympic Medical Network joined by the local medical institutions and personnel may be improved and continuously operated to support the major businesses in the region.

Above all, the positive effect of the Olympics will be maximized and sustained if the tangible and intangible legacies of the Games ultimately lead to local pride and confidence for the inhabitants of the host region.

REFERENCES

1. Shipway R. Sustainable legacies for the 2012 Olympic Games. *J R Soc Promot Health* 2007;127:119-24.
2. McCartney G, Thomas S, Thomson H, Scott J, Hamilton V, Hanlon P, Morrison DS, Bond L. The health and socioeconomic impacts of major multi-sport events: systematic review (1978-2008). *BMJ* 2010;340:c2369.
3. POBICO. PyeongChang 2018 Olympic Bid Book. Vol. 1. PyeongChang, 2011.
4. Kasimati E, Dawson P. Assessing the impact of the 2004 Olympic Games on the Greek economy: a small macroeconometric model. *Econ Model* 2009;26:139-46.
5. Glesecke J, Madden J. The Sydney Olympics, seven years on: an ex post dynamic CGE assessment. Monash University, Center of Policy Studies, 2007.
6. Weed M, Coren E, Fiore J, Wellard I, Mansfield L, Chatziefstathiou D, Dowse S. Developing a physical activity legacy from the London 2012 Olympic and Paralympic Games: a policy-led systematic review. *Perspect Public Health* 2012;132:75-80.
7. WHO. The Health Legacy of the 2008 Beijing Olympic Games - successes and recommendations. World Health Organization, 2010.
8. VANOC. Vancouver 2010: Sustainability Report 2009-2010. Vancouver, 2010.
9. NHS London. Supporting the 2012 London Olympic and paralympic games: programme overview. In: London N, ed. Supporting the 2012 London Olympic and paralympic games. NHS London, 2012.
10. Lee YH, Kim JM. Analysis of trends in medical papers for Olympic Games in preparing 2018 PyeongChang Winter Olympic and Paralympic Games. The 43rd Korean Society of Sports Medicine Conference. Seoul, 2013.
11. Ljungqvist A. The health legacy of hosting the olympic games with particular emphasis on Beijing, in international convention on science, education and medicine in sport. Guangzhou, 2008.
12. Troedsson H, Ljungqvist A, Wei W, Dapeng J. Towards a healthier city with an Olympic health legacy. In: Dapeng J, Ljungqvist A, Troedsson H, editors. The health legacy of the 2008 Beijing Olympic Games: successes and recommendations. World Health Organization, 2010. pp4-8.
13. Rogge J. Truly exceptional games. Lausanne: International Olympic Committee, 2008.
14. UNEP. Independent environmental assessment, Beijing 2008 Olympic Games. UNEP, 2009.
15. IOC. Final Report of the IOC Coordination Commission: XXI Olympic Winter Games, Vancouver 2010. Lausanne: IOC, 2011.
16. Weiler J, Mohan A. Catalyst, collaborator, connector: the social innovation model of 2010 Legacies now - case study. 2010 Legacies Now, 2009.
17. Weiler J. The evolution of 2010 Legacies Now: A Continuing Legacy of the 2010 Winter Games through Venture Philanthropy. Vancouver, 2011.
18. CMS Do. Before, during and after: making the most of the London 2012 Games. London: Department of Culture, Media and Sports, 2008.
19. NHS London. Supporting the 2012 London Olympic and paralympic games: Go London! The legacy of better health for londoners. In: London N, editor. Supporting the 2012 London Olympic and Paralympic Games. NHS London, 2012.
20. Weed M, Coren E, Fiore J. A systematic review of the

evidence base for developing a physical activity and health legacy from the London 2012 Olympic and Paralympic Games. Canterbury: Centre for Sport, Physical Education & Activity Research (SPEAR),

Canterbury Christ Church University, 2009.

21. Kemp S. The hidden workforce: volunteers' learning the Olympics. *Journal of European Industrial Training* 2002;26:109-16.