The Health Legacy of the 2008 Beijing Olympic Games

Successes and Recommendations

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World Health Organization
Western Pacific Region

EDITED BY: Jin Dapeng
Arne Ljungqvist
Hans Troedsson

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Arne Ljungqvist (International Olympic Committee)
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Finally, we wish to express our particular appreciation of the tireless and efficient work that has been conducted by Zhen Xiaozhen in her capacity as project manager.

Jin Dapeng, Arne Ljungqvist, Hans Troedsson

Preface

The Olympic Games in Beijing turned out to be truly exceptional. The Games became a great success not only for the host city and country, but also for all the visitors and, most importantly, the athletes. The Games also offered a unique opportunity to leave a lasting legacy to the benefit of the population in and around Beijing. The legacy included improved overall living conditions as a consequence of the particular measures that were taken by the Beijing authorities in terms of improving infrastructure; the introduction of traffic regulations and a smoking ban; and also the promotion of healthy lifestyles, just to mention a few. Since some of those measures will remain and the awareness of healthy lifestyles has been promoted, there is no doubt that the Games will leave a lasting legacy which will be positive for the health of the Beijing population.

The IOC is extremely pleased by the initiative that was taken jointly by the parties involved in the Beijing Games to have the "Health Legacy of the Beijing Games" documented in this book. The IOC is particularly satisfied that the World Health Organization has decided to publish 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.

Dr Jacques Rogge
President, International Olympics Committee

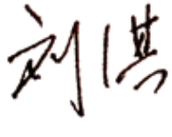
Preface

The successful Beijing Olympic and Paralympic Games of 2008 have left the citizens of Beijing and China with many benefits of great worth, amounting to a combination of both material and spiritual wealth. The contribution of the medical and health services constitutes an important component of the overall Olympic legacy.

In the course of preparing and hosting the Games, the medical and health workers in the capital city worked remarkably well. They ensured public health security, offered high-standard medical and health services, saved lives and in particular provided special medical support to the opening and closing ceremonies of both games. They won high praise for their superb skills and outstanding performances. I would like to seize this occasion to extend my heartfelt thanks to all of them who made important contributions to the success of these games.

Medical and health services are a great vocation that is dedicated to the wellbeing of the people. In the new stage of our national development, we should cherish the valuable experience gained in the Olympic medical and health services. It should encourage us to emphasize the human factor, highlight public health services, deepen the reforms of systems and mechanisms, and intensify the construction of grass-roots medical and health institutions. By popularizing health knowledge as we have done, by participating more in health activities, providing improved health security and further extending healthy life, we shall offer better health services to the people.

Mr Liu Qi
Politburo member,
Secretary of the CPC Beijing Municipal Committee,
BOCOG President,
Beijing, China



Preface

The Beijing Olympic Games have been widely praised for the spectacular sporting facilities and venues, the impressive application of information technology, the large number of Olympic and world records broken, and the enthusiastic support that the Games received from the population in the host cities and throughout China.

But the Beijing Games also have significance for the international public health community, because they were accompanied by some innovative measures to protect the health of visitors and the local population. From the very start, these Games were promoted as the "Green Olympics". The holding of this mass event in seven Chinese cities also generated important policy decisions and actions to address key public health issues, including surveillance and response to health emergencies, tobacco control and food safety.

At the invitation of China's Ministry of Health, the Beijing Organizing Committee for the Games and the Beijing Municipal and Health authorities, WHO was pleased to support these efforts to promote health and safeguard public health during the Olympics.

We are also honoured to be able to participate in the preparation of this volume that highlights the positive medium-and longer-term effects of the public health initiatives inspired by the Games. In documenting this public health legacy, WHO worked in partnership with the International Olympic Committee and with scientists, academics and programme managers from a variety of Chinese and international agencies associated with public health and the Olympic movement.

The findings recorded in this book provide an encouraging but balanced assessment of a critical question. This is: will the momentum sparked by the numerous initiatives and projects for health services, transportation, environment and health promotion be sustained, and continue to yield benefits in the future?

We believe that this publication can serve as an instructive example of how mass events can be organized to promote health in a value-added way, bringing both immediate and longer-term benefits for the health of many.

Dr Margaret Chan
Director-General, World Health Organization
Geneva, Switzerland

Preface

The Beijing Olympic and Paralympic Games captured the attention of the world. With the two Games of equal splendour, China fulfilled its commitment to the international community, and has added what we believe is a successful new chapter to the annals of the Olympic history.

Olympic-related health-care operations, sustained by the entire public health sector, particularly the devoted personnel working in Beijing and the co-host cities, went smoothly with great efficiency and effectiveness, guaranteeing high-quality events to the satisfaction of the athletes, the people of China and the wider world.

Such health-care initiatives have benefited health in general in Beijing and the co-host cities. In the process, new concepts of hosting large-scale sports events have been encouraged and invaluable experience has been gained.

The Chinese government organized a well-co-ordinated, dedicated panel of experts for the preparation and staging of the Games.

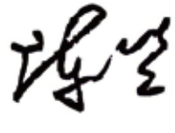
The public heath sector worked closely with relevant authorities concerning public security, transport, and other health-related issues. We collaborated effectively with the World Health Organization and other international health institutions.

Guided by the standards and practices implemented by the IOC Medical Commission, and in line with China's health-care development programmes, the public health sector fully assisted BOCOG in enacting and improving procedures for Olympic-related health-care operations, including management, communications, disease prevention and control and an emergency action plan.

The comprehensive health-care operation that took shape will, we hope, be a model that will benefit the hosts of large-scale social events in the future.

We firmly believe this book will become a major health legacy left by the Beijing 2008 Olympic and Paralympic Games to China and to the world.

Dr Chen Zhu
Minister of Health of the People's Republic of China
Beijing, China



Preface

Hosting the Olympic Games had been a long dream of the Chinese nation. The preparations that spanned seven years before 2008 proved to be a successful rehearsal and practice of the scientific approach to development and left us all feeling enriched both materially and spiritually.

Every minute of the Beijing Olympics was so unforgettable, so exciting and so gratifying. All those moments would come together and further enhance our sense of mission in inheriting the Olympic legacy, carrying forward the Olympic spirit and accelerating the building of Beijing into a modern world metropolis.

The medical and health services offered to the Games were exceptional. The management system, the operating mechanism, the working plan and the public health monitoring, alerting and emergency systems not only effectively ensured the success of the Olympic and Paralympic Games. They also promoted the development of Beijing's medical and health roles and responsibilities.

The authors of this book all participated in the Games and all made positive contributions in one way or another. Their valuable experiences and reflections are truly inspiring to the readers and can serve as a useful guidance in offering medical and health support for major international sports and other events in the future.

The reform and development of medical and health services are important to the people's physical health and represent a major task in ensuring better and faster economic and social development. By further inheriting, consolidating and developing the successful Olympic experience, we shall steadily push forward our system reforms and widely implement the "Health for Beijing People Programme", a 10-year initiative. This is designed to promote the physical health and overall wellbeing of the citizens, and in turn it will help transform Beijing into a healthy city.

Mr Guo Jinlong
Mayor of Beijing
Beijing,China

When as Deputy Director of the Beijing Municipal Health Bureau, I submitted the section on medical services in our bid for the 2008 Olympic Games,we embarked on a journey to prepare for and hold a “high-level” Olympic Games, from the historic moment when Athens passed the Olympic torch to Beijing in 2004.

History now shows that Beijing’s 180,000 medical and health care professional did an excellent job. They fully ensured the public health safety of the host city and made sure that all sick and injured people could enjoy timely, safe and effective emergency medical treatment and medical care services. They displayed the highest standards of emergency medical treatment from beginning to end and I was deeply impressed by their dedication and efficiency.

I will always remember that the IOC President, Dr Jacques Rogge sent a letter to our Bureau , in which he said: “The medical services provided during these Games are the best in my Olympic career.”

The Politburo member, Secretary of the CPC Beijing Municipal Committee BOCOG President Mr Liu Qi also wrote to say: “I extend my thanks and high respects to the comrades on the hygiene front.”

The specific requirements on medical and health care security for the Olympic Games put forward by Mr. Ding Xiangyang, the leader in charge of health care for the Beijing Olympic Games and Vice Mayor of the Beijing Municipal People’s Government, were fully implemented, and I acknowledge everything he did personally. I also applaud the idea of “Healthy Beijing, Healthy Olympics” and the in-depth implementation of health activities such as the smoke-free Olympics and the HIV prevention during the Games. I can barely describe in simple words the heroic spirit and wisdom shown by our people who worked so hard to ensure medical care and hygiene safety and health. Their consummate skills and teamwork, as well as the abilities and standards they manifested were completely in accordance with the spirit that is advocated by the Olympic movement, and should be promoted.

After the Games, in Stockholm in November 2008, I delivered a speech entitled “Medical services for the 2008 Beijing Olympic Games” at the IOC Medical Committee and International Sports Federation medical chairmen’s meeting. My respected immediate superior, chairman of the IOC Medical Commission, Professor Arne Ljungqvist, said later: “The medical services during the Beijing Olympic Games were the best among all the Olympics I have experienced. I deeply admire your opinion that Beijing’s residents should benefit from this experience and success. This will be an example for future organizers of Olympic Games and other large-scale sports events. At the same time I urge the IOC and you to pay close attention to the ‘Olympic Health Legacy’ project. We look forward to the publication of new books with great interest.”

Professor Arne Ljungqvist and Dr Jin Dapeng

These achievements and good fortune belong not only to Beijing and all members of the Olympic family, but also to our great motherland and to people all over the world.

Dr Jin Dapeng

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Part one

Overview and background to the Beijing Olympic Games

Chapter 1

Towards a healthier city with an Olympic health legacy

Hans Troedsson [1], Arne Ljungqvist [2], Wang Wei[3], Jin Dapeng[4]

The Legacy concept - past and present

More people around the world watched the 2008 Beijing Olympic Games on television than any previous event. An estimated 4.7 billion viewers, including some 680 million in China, followed the Games, from the spectacular opening ceremony in the Bird's Nest Stadium to the equally impressive closing ceremony two weeks later. They will have abiding memories not just of the stunning fireworks, special effects and displays of patriotic pride. They will also recall the dazzling performances of the athletes. More than 10,500 from over 200 countries competed, many of them shattering world and Olympic records again and again.

These are some of the enduring images of China in August 2008. Yet there is another legacy that may endure as long, if not longer. For the Beijing Olympics were a unique, ambitious attempt to connect the Games with lasting improvements in public health, in China and beyond. This book is a chronicle of how that ambition began, how it developed, the enormous efforts that were devoted to it, and the surprising extent to which it was accomplished.

Every Olympic host city dreams of accomplishing at least three things. First, to provide the best possible conditions for the competing athletes, thereby making the Games the experience of their lifetime. Second, is to stage a top standard Olympics with distinctive features that create memorable impressions of the host city and its culture that will reverberate throughout the world. Third, to bequeath a legacy to the host community and country that will benefit their inhabitants for many years to come [1]. There is no question that the Beijing Olympics accomplished the first two goals - the purpose of this book is to examine the third goal, most of all from a public health perspective.

Among the legacies of a prestigious, international, sporting event such as the Olympics, the most readily recognizable impacts include those related to urban planning, architecture, city marketing, sports infrastructure, economy and tourism [2]. However, unique to the Beijing Games, the plan from the earliest stages was also to leave a public health legacy.

In the Olympic Charter, the International Olympic Committee (IOC) clearly defines its role (i) to encourage and support measures protecting the health of athletes, (ii) to encourage and support a responsible concern for environmental issues, (iii) to promote sustainable development in sport and require that the Olympic Games are held accordingly; (iv) to encourage and support the development of sport for all; (v) to lead the fight against doping in sport; (vi) to encourage and support initiatives blending sport with culture and education, and most importantly, to promote a positive legacy from the Olympic Games for future host cities and host countries.

In recent years, the IOC Medical Commission has reoriented its work from a major focus on anti-doping issues, which recently have largely been taken over by the World Anti-Doping Agency, to focusing more on the health protection of current and future athletes and the health of the host city population. Hence, in planning the Beijing Olympic Games, substantial emphasis was given to the health and well being of not only all the athletes and those visiting Beijing and China for the Olympics, but also to the host city population itself. In fact, in the Report of the International Olympic Committee (IOC) Evaluation Commission on the five candidate cities issued on May 15, 2001, it was clearly stated that if Beijing were to be awarded the 2008 Olympic Games, it should leave a "unique" legacy to China, to sport, and to other areas [3]. Part of this effort included a big focus on improving the health and well being of Beijings and Chinas citizens.

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 [4].

Following the SARS epidemic in 2003, the importance of good public health was increasingly recognized by the host city's health authorities and city government. Thus, considerable effort was directed towards improving not only Beijing's medical and hospital services, but also, many of its public health services and programmes. Among the many different actions taken were improvements to the living environment in Beijing, advocacy for a healthier lifestyle, development and release of new policies related to public health, and the launching of new health promotion initiatives [5].

These efforts to leave a great health legacy to Beijing and other co-host cities were supported by the International Olympics Committee (IOC), the World Health Organization (WHO), and many other organizations. While the IOC has long been actively integrating sports with culture and education, the use of the Olympic Games as a platform to connect sports with health became the focus of the WHO China Office [6]. Technical support was given to the Chinese counterparts based on the challenges that Beijing and other co-host cities faced. WHO also introduced Games- related programmes, led by non-governmental organizations (NGOs) to the host cities. Two of these successful programmes were the tobacco control programme supported by the Bloomberg Initiative, and the UNAIDS anti-stigma HIV/AIDS campaign.

Encouraged by the initiative of the organizers of the Athens Olympic Games to address aspects of health legacy in their post-games report, the Beijing Organizing Committee for

1.World Health Organization
2.International Olympic Committee Medical Commission
3.Beijing Organizing Committee for the Games of the XXIX Olympiad
4.Beijing Municipal Health Bureau

the Olympic Games (BOCOG) and the Beijing Municipal Health Bureau jointly established a five-year programme (2004-2009) aimed at evaluating the health legacy of the Beijing Olympics. The project included pilot studies such as follow-up surveys of health awareness and healthy behaviour among residents in selected communities in Beijing in the years leading up to 2009, and a longitudinal study on residents' satisfaction of living conditions. Results and conclusions from these studies will help measure the health impacts of the 2008 Games. The IOC formally agreed to these plans and strongly supported this programme as a sub-project of the Olympic Games Global Impact project (OGGI). The programme also received strong technical support from the WHO China Office, particularly in information exchange and assistance with the evaluation of the long-term health legacy of the Olympic Games.

While some of these outcomes and impacts were summarized and reported by the IOC, Beijing Health Bureau, BOCOG and WHO at the most recent International Convention on Science, Education and Medicine in Sport just before the Beijing Olympics, a more comprehensive evaluation effort was still required. Therefore, it was decided that WHO, IOC, BOCOG, and the Beijing Municipal Health Bureau would jointly evaluate the health legacy of the Beijing Olympics. This evaluation project will summarize experiences and provide lessons learned to cities and countries hosting future large mass events such as Winter and Summer Olympics and the World Football Cup. The conclusions of this project are envisaged as being particularly relevant to developing countries where large sports events and mass gatherings can be exploited to improve the health and well-being of their citizens.

The health legacy of the Beijing Games

The health legacy is multifaceted, with many potential long term impacts. These fall broadly into the following categories: 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.

Like previous cities hosting the Olympic Games, Beijing was also successful in providing high quality medical services. These included "athlete-friendly" health care in the polyclinics and venues, an intricate hospital network and reliable pre-hospital emergency health services, strengthened anti-doping systems in an attempt to assure a drug-free Games, and a new research project on sports injury prevention and treatment. These and many other initiatives have not only left the host city with improved health infrastructures and advanced technologies, but also an impressive resource of trained health professionals of great benefit to the host city long after the ending of the Games.

Another pillar of the health legacy is strengthened public health preparedness to respond to and manage quickly health risks associated with mass gatherings. These Games created new records in many ways [7]. An estimated six million tickets were sold and hundreds of thousands overseas visitors attended . As discussed in Chapter 8, the increased population and population density 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 diarrhoea 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 of public health risk management.

A unique aspect of the Beijing health legacy is an impressive improvement of living environments for residents of the host cities. With the Games came a renewed attention to environmental sustainability, an improved urban infrastructure and an educational programme that brought Olympic values to 400 million school children across the country [7]. 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 [8]. The results were profound. 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. The 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.

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 in smoking and second-hand smoke, an anti-doping exhibition, and preventing HIV/AIDS stigmatization. The impacts, due to the coverage of mass media, reached beyond the athletes, visitors, and host city residents to people all over China.

Conclusion

Beijing successfully executed all aspects of the required medical service components for the duration of the Games. Most importantly, the world learned a lot about China and China learned about the world. In this way, the Beijing Games showed what is possible when the world unites as a single community [7]. Nevertheless, if hosting of the Olympic Games is to be viewed as a massive public health undertaking or intervention, then the evidence of its success means that there are tangible, lasting benefits to the host community far after the closing ceremony and after all of the guests have left.

This publication, "The Health Legacy of the 2008 Beijing Olympics" aims to serve as a post-Olympic, public health evaluation report. It was compiled through a partnership

involving BOCOG, the Ministry of Health, the Beijing Municipal Health Bureau, the World Health Organization and the IOC. The documentation of the health legacy involves (i) analyzing the process of formulating the policy actions, (ii) assessing the sustainability of improvements in health services, surveillance systems, living and neighborhood environments, and (iii) examining any shifts in health knowledge and behaviour of the Beijing population.

The public health improvements undertaken by China for the 2008 Olympics should not be seen as either temporary or unsustainable. They should be seen as part of a larger picture of the progress and development that has been well under way in China for the past 30 years, since the country's policy of reforms and opening up was launched. The resources and efforts poured into hosting the Games were truly exceptional. But in the aftermath, the international community, as well as China's own citizens can reasonably ask: what now? The purpose of the "Health Legacy of the 2008 Beijing Olympics" is to provide some of the answers. It explores and assesses what lasting benefits remain of those two remarkable weeks in August 2008 in terms of the future health of the citizens of Beijing and the rest of China. This publication hopes to inspire the hosts of future Olympics to use the Games as China did: as a vehicle for advancing the health of their populations.

The following chapters examine in detail how the work for a health legacy of the Games was pursued, and the degree to which it could be deemed successful.

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Chapter 2

Overview of health-care services for the Games

Jin Dapeng[1], Zhu Xiaowan[1], Cris Tunon[2]

As the largest international sports event ever held in China, and one of the biggest Olympics of all time – as Chapter 1 has indicated – the 2008 Games posed awesome new challenges to Beijing in its overall healthcare capacity and in public health, emergency medical care and public health emergency response.

It was an opportunity, too, for Beijing's health services to become better known to the rest of the world.

The capital city was fully confident of providing services to the standards set by the International Olympic Committee. Such confidence came from the growing overall strength of the country, the overwhelming 94.9% support rate of Beijing citizens for the Olympic Games, and the rich health resources and accumulated experiences gathered from previous large international mass gatherings.

Meanwhile, Beijing was also looking forward to harvesting generous health legacies from hosting the 2008 Games.

Socioeconomic development and health resources in Beijing

Beijing exceeded the national average in socioeconomic development indicators when it won its bid for the Games. In 2001, Beijing's GDP reached 281.76 billion Yuan with per capita GDP of US$ 3,060 at the exchange rate of that year. In contrast, the national per capita GDP was only US$ 912 in that year .

Beijing was in the leading position in health resources in China. In 2001, the city had 5,969 health care facilities with 73,000 beds and 116,000 health professionals. This included 52,100 licensed doctors and 40,537 registered nurses. On average, there were 6.1 beds, 4.64 doctors and 3.61 nurses per thousand of the population .

In 2001, the incidence rate of communicable diseases in Beijing was 301/100,000; the maternal mortality rate was 11.7/100,000 and the neonatal mortality rate 3.7/1,000. The average life expectancy in Beijing was 75.85 years (73.89 for males and 77.90 for females) .

1.Beijing Municipal Health Bureau

2.World Health Organization

Challenges faced by healthcare services

Beijing previously hosted many mass gatherings and international sports events. However, the preparation for the Olympic Games was on an altogether different scale, lasting as it did for seven years. To fulfill the commitment made in the bidding process, to pursue the ideal of "Green Olympics, Culture-enriched Olympics and Technology-empowered Olympics", and to practice the strategic thinking of "New Beijing, Great Olympic Games", Beijing and other co-host cities not only had an enormous amount of work to do in infrastructure construction such as venues, roads, transportation, telecommunication, environmental protection, and air pollution management, but were also faced with countless challenges in public health security and healthcare services.

The most significant challenges related to public health, including disease control and prevention, food and drinking water hygiene and safety, and public health emergency response.

Historically, all of Beijing's 600 or so hospitals were managed by national, military, municipal and district authorities. For mass-gathering events, such an arrangement did not make it easy to mobilize and deploy health resources across the city in a unified and coordinated manner to provide medical care support or respond to a public health emergency. Nor was it easy to make a health information development plan for the city as a whole.

The increased population density with the city development had put greater pressure on the pre-hospital emergency care system which had already suffered from insufficient ambulances and stations as well as low efficiency in services. Updates on international health standards and guidelines, adaptations and revisions needed to be implemented promptly to improve national standards and relevant policies.

The above-mentioned challenges were confirmed in the spring of 2003 when Beijing was hit unexpectedly by the SARS outbreak, one of the most serious public health crises of recent times, for China in particular, but potentially for other countries, too. This disaster revealed the consequences of the insufficent government investment in public health while focusing on economic development. It highlighted the weak links between the medical service system and the public health system, and revealed limitations in the health emergency response system. This would definitely be a major risk to the hosting of an event such as the Olympic Games.

Goals and plans

In July 2002, the Beijing Municipal Government issued the "Beijing Olympic Action Plan", which put forward a guideline of "having socioeconomic development to boost the Olympic Games, and the Olympic Games to promote development", combining the seven-year preparatory plan for the Games with the city's socioeconomic development plan. This was also the main goal of healthcare services for the Olympic Games.

In December, 2004, the Beijing Municipal Government issued "Views on Strengthening Beijing Public Health Development", clearly stating the objectives for improving the public health system. These objectives included establishing public health emergency response mechanisms; improving disease prevention, surveillance and control; advancing medical care services; strengthening health inspection and enforcement; and enhancing the public health information system. This plan was intended to build a public health safeguard for the city, and to maintain and improve the health as well as the security of Beijing residents. The Beijing Municipal People's Congress Standing Committee submitted a proposal on strengthening the public health system, and from 2005, the Congress supervised and assessed every year the Government's performance in achieving the objectives .

Based on the "Beijing Olympic Games Action Plan" and the "City Operational Outline for Beijing 2008 Olympic Games" promulgated by the Beijing Municipal Government, the Beijing Health Bureau developed in July 2005 the "City Operational Outline for Beijing 2008 Olympic Games: Safeguarding Public Health Security" and the "City Operational Outline for Beijing 2008 Olympic Games: Emergency Medical Rescue and Medical Services". All related healthcare facilities also developed their matching action plans.

Actions

Improving public health emergency responses

The Beijing Municipal Public Health Emergency Response Headquarters was staffed. with representives from the government, military, police, entry-exit inspection and quarantine bureau, railway, civil aviation, and the Red Cross Federation. This office was responsible for commanding and making decisions during public health emergencies.

Rescue cooperation was strengthened with the Chinese Centre for Disease Control, the Academy of Military Medical Sciences, the railway authorities, and the Entry-Exit Inspection and Quarantine Bureau. Communication about major outbreaks was also strengthened with the sectors of agriculture, pharmacy inspection, industry, commerce, transportation and education. A series of plans such as the Beijing Pandemic Flu Preparedness Plan and Contingency Plan and the Beijing Public Health Emergencies Contingency Plan were developed. A further ten public health emergency response contingency plans and eight prevention and control work plans were also launched. These targeted major communicable diseases such as SARS, human highly-pathogenic avian influenza, plague and cholera. These plans were completely reinforced and revised before the Games. The capacity of the emergency response team was also comprehensively enhanced.

Strengthening disease control and prevention

A complete public health surveillance network was established in line with WHO technical guidelines. This included a large number of sentinel sites for communicable diseases (335 for intestinal communicable diseases, 67 for influenza, 36 for avian flu among high-risk people, and seven for plague). In addition, there were also public health monitoring sites including 18 for drinking water contaminants and 8 for food contaminants. Vector

monitoring was carried out through 54 mosquito density monitoring sites, 90 fly density monitoring sites, 108 cockroach density monitoring sites and 108 rodent density monitoring sites (see Chapter 8, 10, 11, 12 and 13). Between 2006 and 2008 the number of vector monitoring sites increased ten fold.

Capacities in communicable disease diagnosis, differentiation and early warning, and the biosafety level of laboratories, were upgraded. Beijing set up a network with a laboratory diagnostic capacity that covered all 35 notified communicable diseases existing in the city. All 660 healthcare facilities above primary level were able to make 100% online reporting. This greatly reduced the average reporting time for these communicable diseases from seven days to just ten hours. The city CDC and district/county CDCs monitored provided 24 hours,continuous citywide,nation wide,global epidemic surveillance coverage. The total number of staff of Beijing CDC increased by 11.8% between 2005 and 2008. In 2000, there was only one PhD graduate in Beijing CDC; however, by 2007, there were 32 such graduates and three post-doctoral degree holders.

Enforcing health inspections

The health inspection workforce continued to grow with 492 new health inspectors joining the team between 2004 and 2007. The number of health inspection vehicles increased by 39%. Over 200 rapid tests could be performed in the field, having largely met the daily needs in emergency response and inspection. There were 210,000 facilities under inspection. A three-tier health inspection network composed of city, district/county health inspection agencies and their outreaches was formed that covered the whole city and unified urban and rural areas.

Building the public health information system

A Beijing Municipal Public Health Information Centre was established to serve as a health information platform to collect information about outbreaks of communicable diseases, health inspection and enforcement, blood collection and supply and provide information for policy makers.

Public financial support

During the preparatory years for the Games, China witnessed rapid economic growth. In 2008, the fiscal revenue was 3.3 times more than that in 2001, ensuring increasing support from public finance for health development. From 2005 to 2007, the Municipal Government invested 4,411,000,000 Yuan into fixed assets for constructions in health development.

Improving healthcare services

While measures were taken to speed up public health system development, all efforts were made to improve software and hardware components of healthcare services for the Games. According to the provisions in the Medical Technical Manual of International Olympic Committee and the commitment made in the Bidding Report, 24 hospitals became Olympic Games designated hospitals and signed the "Service Contract of Olympic Designated Hospitals" with BOCOG. Medical volunteers for the Games had been recruited from health facilities in Beijing since 2007 to assist BOCOG with setting up venue-based medical teams. The medical volunteers completed their training before the Games.

From 2006, the "Healthy Games and Healthy Beijing" initiative was widely implemented for health education and promotion .

The Municipal Government distributed free of charge 5,000,000 copies of "Manuals on Infectious Diseases Prevention for Beijing Residents" and "Guidance on Healthy Diets for Beijing Residents" to all households. Campaigns to reduce salt and oil intake were conducted, with 6.5 million salt spoons distributed free to residents, and in addition, 5,100,000 measurable oil cups distributed free of charge in 2008.

A "Smoke-free Olympic Games" health promotion campaign was carried out across Beijing. Information materials to promote "smoke-free catering businesses in Beijing" were sent to 40,000 restaurants in the city. From October 2007, all 66,000 taxi cabs carried "no smoking" signs.

A healthy walking campaign named "Ten thousand steps per day keeps you healthy for life" was advocated, and Beijing newspapers, television and radio channels carried special "Healthy Olympic Games, Healthy Beijing" articles or programmes.

Achievements and legacies

The seven-year preparatory efforts for providing healthcare services to the 2008 Games promoted the public health development of the city, and improved the health status of the residents. In addition, these efforts achieved the goal of preventing any major outbreaks of communicable diseases in Beijing during the Games. They also ensured that the performance would satisfy the requirements of the international community, the athletes from different countries, and the people of China.

Discussion

The successes in healthcare services for the 2008 Games should become part of routine guidelines and practice for the future. These successes are significant in two particular aspects:

First, as stated above, the preparatory efforts helped to improve public health and upgrade public health services to the benefit of the citizens of Beijing. The public health emergency response mechanisms that were developed will help to safeguard the city's public health

security for a long time to come. There are several examples. The city and inter-province joint action by blood collection and supply centres, the joint action by first-aid and transportation departments, the joint action regarding emergency care information, the tripartite police call service with foreign languages, have all improved the capacity of the city to respond to emergencies. Improvement in the public health environment, including improvement in air quality as well as food and drinking water safety, also upgraded the quality of life for Beijing residents.

Second, the preparation for the Games was used as an opportunity for health promotion and education. Numerous educational activities for three successive years targeted residents as well as participants in the Games. Health education activities had an unprecedented large coverage and provided an example of using large-scale sports events to promote the health of the city and its residents.

Much more in-depth discussion about the health legacies of the Games can be found in the following chapters of this book. These useful experiences and models in healthcare services will be carried forward as valuable legacies to promote a comprehensive and sustainable post-Olympic development in healthcare services in Beijing and to benefit the health of its people.

Chapter 3

Assessing the public health impact of the Olympic Games

Liang Wannian[1], Liu Min[2], Zhao Dong[3], Fu Hongpeng[4], Chen Bowen[5], Brian Oldenburg[6], Gauden Galea[7], Zhen Xiaozhen[8]

The Olympic Games is the world's biggest competitive sports event. It arouses world-wide attention and it has impacts on the host city and country that go far beyond the sports field. In order to preserve and improve the Olympic legacy, the International Olympic Committee (IOC) proposed that the host country make a systematic and comprehensive assessment of the impacts of the Olympic Games [1].

From the start of its bid for the Games, China believed that by staging them successfully, it would be able to promote the health and well-being of the people of the host city and even the host country, as result of the profound effects of such a mass event [2]. China is a developing country with a rapidly developing economy and many other rapid changes that have also placed strains on its health and medical services as well as its public health security capabilities.

A review of the assessment of these kinds of impacts from past Olympic Games shows that so far no scientific system has yet been established to assess and evaluate the impact of a mass event such as an Olympic Games on the health and well-being of the host population. For the first time in the history of the Olympics, the concept of an "Olympic Health Legacy" was put forward by BOCOG at the International Symposium on Legacy of the Olympic Games held in November, 2002, and it was defined as the lasting impacts that the Olympic Games have on the health of the people living in the host city and the host country. This proposal won strong support from IOC officials with the suggestion that

1.Ministry of Health of the People's Republic of China
2.Peking University Health Science Centre
3.Beijing Anzhen Hospital
4.China Health Economics Institute
5.Capital Institute of Pediatrics
6.Monash University, Australia
7.World Health Organization
8.Beijing Organizing Committee for the Games of the XXIX Olympiad

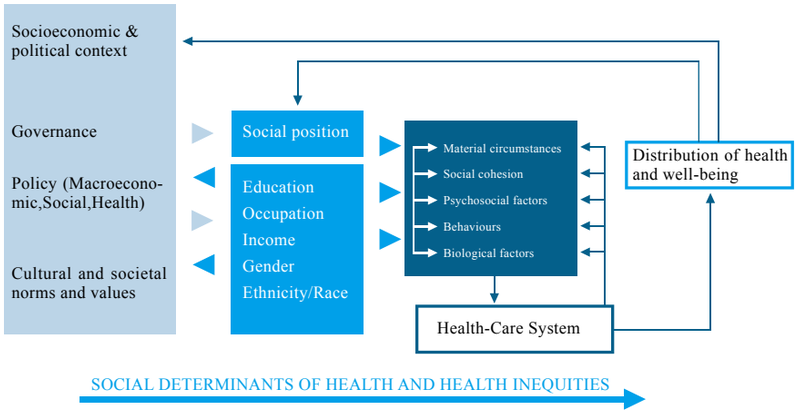
a number of health indicators should be included in the formal assessment of the Olympic Games Global Impact (OGGI). In September 2003, this proposal gained further support from the IOC Medical Department and the IOC encouraged BOCOG to consider how the health legacy of the Olympic Games could be achieved while making preparations for the medical services for the Olympic Games. In November 2003, a BOCOG speech at the International Symposium on the Olympic Games and Public Health on "Health Legacy" drew more attention to this idea.

A study on the "Establishment of the Evaluation System for the 2008 Olympic Healthy Legacy" was launched to evaluate the public health impact of the Olympic Games on the environmental and population health of Beijing and China.

Conceptual analysis and basic theoretic research

The study aimed to operationalize the "Olympic Health Legacy" concept and to develop indicators for measuring the different components at different levels as indicated in the following diagram (Figure 1).

Figure 1. Conceptual framework



Source:Amended from Solar & Irwin,2007

This study was concerned with developing a second-level index system by means of level analysis, consultation and interview; collecting optional index by means of enumeration methods and developing a third-level index system by means of the Delphi method and consulting 50 experts.

Applying and adjusting the assessment index system

The system of indices was further developed and evaluated by collecting data from official sources according to the indices that were developed and also, by obtaining other data by means of a survey questionnaires. The data on the various indices were then used to describe the impact of the Olympic Games on the health of Beijing citizens from the time of bidding for the Games until the hosting of the Games.

Proving the assessment index system

The index system was validated by using exploratory factor analysis, confirmatory factor analysis and structural equation modeling and also be comparing the indices with other previously validated indices.

Research results and achievements

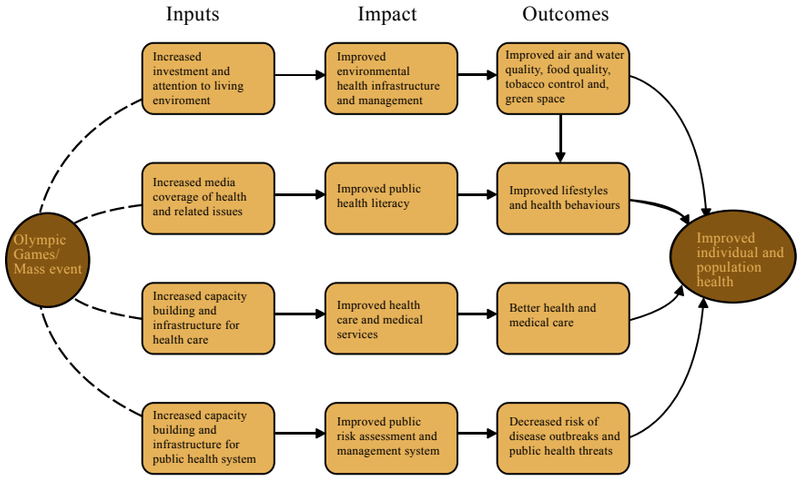
The "Olympic Health Legacy" refers to the lasting impacts the Games will have on the health of the host city and possibly the host country through improvements in health policy, health environment and health services in and on the idea, behavior and status of public health. The IOC approved the concept in 2004.

Healthcare is a fundamental human right and a core objective of social development. With changes over time and the development of medical models, people's understanding of health has improved. In 1948, the Charter of the World Health Organization defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". The major factors, which influence health, are genetic, behavioral, socioeconomic status, environmental, institutional and social.

At least three factors mostly likely contributed to the "Olympic Health Legacy". First, the promotion and publicity for the Olympics has helped to popularize modern health concepts. Second, as illustrated in other chapters in this monograph, the public health capabilities and systems of Beijing and other host cities improved significantly in the years leading up to the Olympic Games and particularly following the advent of SARS. Third, the external health environment, including natural environment (reducing health hazards through urban environment improvement), economic circumstances (improving economic conditions) and

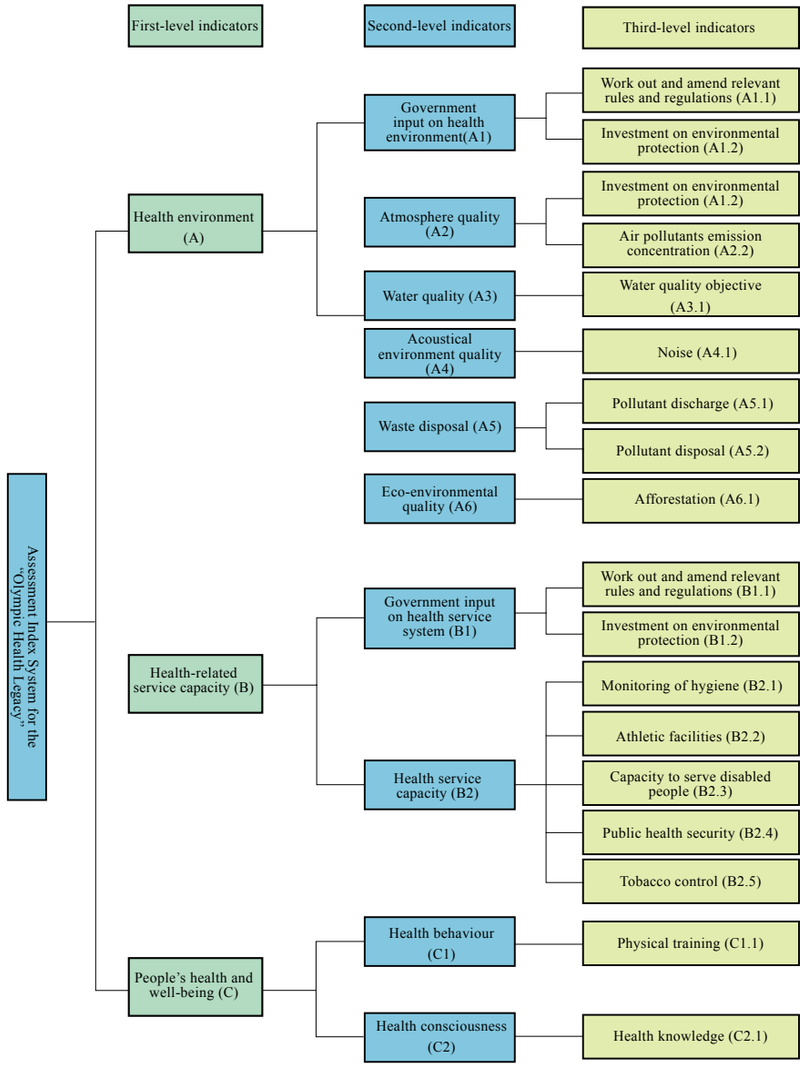
policy environment (government's reaffirmation of health services and the development of the social security system) improved. Therefore, the three major components of the "Olympic Health Legacy" are: (a) the impact on individuals, for example, the change and upgrading of people's health ideas and the popularity of health behaviours; (b) the impact on the public health services and medical service system, for example, improvements in the quality of air, water and sanitation services that also includes the relevant policies; (c) the impact on external hygienic environment, for example, improvements in the natural, environmental and political environment, and in socio-cultural environment [4-5]. (Figure 2)

Figure 2. Impacts of "Olympic Health Legacy"



Components of the index system

The indicator system is composed of indices at three levels, of which there are three first-level indicators, namely "health environment", "health-related service capacity" and "people's health and well-being". There are also ten second-level indicators, namely"government input on health environment"; "atmosphere quality"; "water quality"; "a coustical environment quality"; "waste disposal"; "eco-environmental qualtiy"; "government input on health service system";"health service capacity";"health behavior" and "health consciousness" and 17 third-grade indicators [6] (Figure 3).



Assessing the Beijing health environment and people's health status

Using the index system, an evaluation of the Beijing health environment and people's health status shows that from 2001 to 2007, 143.76 billion Yuan were spent on environmental improvement [7], which was far more than the US$ 12.2 billion promised in the bidding reports.

From 2002-2007, the annual GDP growth rate in Beijing was 12.4% [8] and the annual growth rate of investment for environmental protection was 13.1%, which was 0.7% higher because of the preparation for the Olympic Games. The city environmental quality of Beijing was improved because of rules and regulations put into effect and measures taken in the course of bidding, preparing and hosting the Olympic Games.

Since 2001, many more public fitness facilities were built in the city. By 2007, such facilities were 3.45 times more common than in 1995. The building area of comprehensive service installations for physically disabled people was almost ten times more than in 1999. Moreover, a greater effort was made to improve medical services. Medical staffs were trained in dealing with communicable diseases and outbreaks of public health incidents in order to deal with a public health emergency to meet the requirements of hosting the Games.

Health services in Beijing were greatly enhanced in preparation for the Games and this will have lasting benefits. The number of people who participate in physical activities has risen since 2003, while the smoking rate has dropped from 34.5% in 1995 to 23% in 2007.

Hosting the Games has improved both people's health behaviour and their health status, and the health environment in general.

Discussion

The assessment index system established in this research is important in the history of the Olympics Games. If can be used to the health impacts of the Games on the city and its citizens, as well related policies and measures. The index system has been endorsed through consultations with interested parties. It can be used as a descriptive method and provides a measurable index, which in turn makes the concept of the "Olympic Health Legacy" more operational and an overall assessment of the Games possible.

The system also enables decision-makers to choose health-oriented policies from a range of options, and it can therefore able be used as a planning tool.

Lessons and suggestions

Few health indexes appeared in the assessments of previous Olympic Games because most of them focused mainly on society, culture, economy, environment and tourist-related measures. How do the Olympic Games impact people's health and how can the impacts be assessed?

These two questions have been partly answered in the analysis of the impacts of the 2008 Games and relevant sports on people's physical well-being. Furthermore, this index system will provide guidance to the assessment of the health impacts of major mass events in the future. The concept of the "Olympic Health Legacy" helped focus attention on health related activities which continue today, and clearly shows that the Games greatly benefited physical well-being and changed the attitudes of many people towards health from passive to active.

Viewed from this perspective, the "Olympic Health Legacy" will surely takes its place in Olympic history, and provide future host cities with valuable guidance.

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Chapter 4

Ensuring health security

Liang Dongming[1], Li Zhengmao[1]

Ensuring high standards of health and medical care for large mass events such as the Olympics was a complex arrangement of inter-linking mechanisms involving state and regional health management institutions and many others. Successfully meeting the high standards required has had the added benefit of helping improve health and medical services across the country.

During the Games, the constant movement of masses of people across cities, provinces and borders heightened risks in regards to the spread and proliferation of communicable diseases, including some that might be imported from other countries. The dietary and other lifestyle habits of foreign athletes and visitors and their health needs imposed new demands on the existing health services. Global threats of terrorism had also to be recognized.

Health and medical services varied unevenly across Beijing and the six co-host cities, namely Hong Kong, Qingdao, Qinhuangdao, Shanghai, Shenyang and Tianjin, as did the available resources and competencies. Thus a system of medical and health guarantees, referred to in this chapter as “Olympic Health Guarantee Work” was set up to achieve a high standard of communication and coordination between departments, regions and nations at large, and readiness to provide the Olympic venue cities with medical and health service and emergency treatment through a proper allocation of the national medical and health resources and forces when necessary.

This was the first time that the Ministry of Health had set up such a system of work and developed an operational plan for health security related to such a large event. In early 2008, the Ministry established an Olympic Medical and Health Guarantee leadership team, which was headed by the Health Minister, Chen Zhu. It specified the responsibilities and duties of the internal departments, bureaus and sections that had to be involved and brought in and established information management and coordination mechanisms.

1.Ministry of Health of the People's Republic of China

Meeting once or twice a month, the team discussed such issues as prevention and control of infectious diseases, security on food and drinking water, handling public emergencies, medical services and first aid, “Smoke-free Olympic”, medical care at the opening and closing ceremonies, and international exchange and cooperation, among others. During the Games, the team had the task of ensuring further improvements to the Olympic Health Guarantee, and identifying and solving problems. In order to respond efficiently to any serious public accidents that might occur during the Games, the Ministry mapped out a contingency plan for emergencies.

The Ministry adopted a working principle of giving complete support, effective direction, and over-all coordination and close cooperation in the area of health security, working with BOCOG and the health departments of the venue cities. In 2006 the Ministry wrote formally to BOCOG, and as a result a coordination mechanism was set up with them, the Ministry itself, and the Beijing Municipal Government in 2007. From early 2008 to the opening of the Games, a series of seven coordination meetings were held with the Olympic co-cities and the local provincial health administrative departments to carry out the major preparations for the Olympic Medical and Health Guarantee. From May to September 2008 the Ministry published and distributed a weekly Briefing on the Olympic Medical and Health Guarantee Work to the relevant departments and other interested parties. During the Games, the Ministry assigned liaison teams to the all Olympic venue cities except for Hong Kong. A closer relationship was formed with the World Health Organization to facilitate information exchange and technical cooperation.

The Ministry worked closely with other ministries, including agriculture, railways, industry and information technology. Other government institutions were also involved, such as the Food and Drug Administration, and those responsible for inspection and quarantine, and anti-terrorism. Among the aims were the prevention of human cases of avian influenza and the travel-related transmission of other communicable diseases, stronger public health security at coastal ports, measures against doping, and very importantly, anti-terrorism precautions. During the Games the Ministry was in regular and frequent contact with WHO concerning any issues related to communicable disease or public emergencies. Technical support was provided by WHO in a variety of ways, such as emergency diagnostic technology for laboratories. In this area, experts from the Canadian National Microbiological Laboratory also came to China and provided laboratory assistance during the Games.

The entire national health system was involved in contributing human resources and other forms of support to ensure health security. The Ministry sent over 400 health supervisors from more than 10 provinces to Beijing for public health security work both in the venues

and the city at large. Six health emergency teams were created to deal with potential biological incidents, chemical incidents, nuclear and radiation incidents, mass deaths and injuries, and blood supply emergencies.

Hospitals in the areas neighbouring the Olympic venues were designated to be ready for any emergency, with enough patient beds reserved and sufficient personnel, technologies and medical resources. Rehearsals were conducted in pre-warnings in the event of communicable disease outbreaks or epidemics, and many other measures were established and improved. All these actions served to ensure that work on the Olympic Health Guarantee was carried out in a scientific and orderly way, nationally and locally.

The Ministry's priority concerns were disease prevention, food health and security, health emergency measures against unexpected incidents, medical treatment and the management on food or drugs containing dope. All venue cities were provided with an array of related procedures and guidelines. At the end of June 2008, three deputy ministers of health and their teams visited the six mainland Olympic venues to supervise and examine the Olympic Medical and Health Guarantee activities. They directed and supported the health department of each venue city to conduct more rehearsals, and improve contingency plans. During the Games, the Health Minister, his deputy and other senior health officials visited and inspected the venues and Olympic villages and were present at the opening and closing ceremonies to direct and coordinate responses in any case of medical and health security.

Before and during the Paralympic Games, the Ministry closely communicated with BOCOG and the China Disabled Persons' Federation in order to understand the Paralympic Medical and Health Guarantee work and then to encourage the health departments of venue cities to focus on related medical treatment and rehabilitation. Careful consideration was given to the special needs of the Paralympic participants and visitors. It was not sufficient to satisfy their basic needs in medical and health terms, but to provide them in addition with a humane and sensitive approach that was an embodiment of the spirit of the "People's Olympics".

Results and achievements

With the joint efforts of the national medical system, especially the health departments and medical and health staff of venue cities, the Medical and Health Guarantee work was efficiently and effectively carried out. There were no serious health-related incidents of any kind during the Games, and this contributed greatly to their overall success.

In this way, the goals of "making the world athletes, the global society and Chinese people equally well satisfied" and "Two Games, Equal Splendour" were achieved. The countless mechanisms established for the Guarantee were most useful not just during the Games themselves, but also served as valuable experiences for future events on a similar scale. Indeed, they formed an important chapter in the history of health security and a lasting contribution to the health legacy of the Beijing Olympics. As a result of the years of preparation towards this end, Chinese health departments improved their standards in disease prevention, control and monitoring; food safety, microbiological laboratory techniques, and contingency planning for acts of nuclear, biological or chemicals terrorism, as well as other unexpected health incidents.

Discussion and suggestions

Given the massive scale of events like the Beijing Olympics, and the huge numbers of people attending, the Medical and Health Guarantee activities must be effectively coordinated through management integration. When more than one city is involved, information exchange, cooperation and experience-sharing are essential.

Holding such a great international sporting event requires adherence to internationally-recognized working values and ethics, regulations and standards. Full respect must be given towards the cultural values, religious habits, lifestyles and health needs of foreign participants and visitors. At the same time, the possible risks of imported disease transmission need to be recognized in accordance with the requirements of the international health regulations and other international agreements. Only through these steps can China ensure that its Medical and Health Guarantee work is compatible with international conventions and thereby win the approval and satisfaction of not just foreign participants, but international society as a whole.

The Medical and Health Guarantee work on such large-scale activities requires systematic and complex programming on many levels. The state Ministry of Health should adhere to the principle of specified responsibilities. It should act as a general manager to facilitate and enhance the coordination and cooperation between regions and central health systems. It should effectively integrate the health resources; make sure that information is exchanged in a timely fashion and that the activities are smoothly coordinated and completed. Enhanced communication and coordination with the countries of the world is necessary when holding such an international event.

Part two

Procedures and achievements

Chapter 5

Medical emergency services and blood supply

Deng Xiaohong[1], Zhang Yongli[2], Liu Jiang[3], Chen Jing[1], Zhang Jinjun[2], Chen Fengping[3]

Emergency transfers and safe blood supplies save patients' lives. They are fundamental clinical practices in all societies and at all times, and are the responsibility of the public health authorities. Both these practices were of particular importance during the Beijing Games, and a crucial element of the overall medical services provided for the Games.

Medical emergency services

As a key component in medical services, emergency transfers play an essential role primarily in protecting people's lives but also in ensuring the success of major social events [1-3]. In 2001, when Beijing was awarded the Games, the Beijing Emergency Medical Centre (also known as Beijing 120), then the only medical institute of its kind in the capital, was designated to undertake the venue emergency transfer operations during the events.

At that time, stations and also provided inpatient services. However, despite the experiences gained in successfully guaranteeing large-scale events such as the 11th Asian Games in 1990 and the 21st Universidad in 2001, Beijing 120 did not have adequate emergency medical care resources (service stations, vehicles, equipment and personnel), nor did it have enough capacity for emergency medical services, as was required by the International Olympic Committee (IOC) of the Olympic host city.

The reality was that it could not satisfy simultaneously the needs for emergency medical service in the city's everyday operations and during the Games. Furthermore, pre-hospital emergency care personnel were not experienced in dealing with casualty incidence and staff in the front line was not proficient in foreign languages. These all posed great challenges to the emergency medical services [4-5].

In preparing for the Games, the Municipal Government made plans based on newly enacted laws and regulations such as Beijing City Master Plan, Plan for Improving the Emergency Medical Operations in Beijing, and the Candidature File. From 2001 onwards, efforts were intensified to improve the city's emergency medical services, including the emergency service network, operation mechanism, emergency vehicles and medical equipment, emergency care personnel.

1.Beijing Municipal Health Bureau
2.Beijing Emergency Medical Center
3.Beijing Red Cross Blood Center

Independent pre-hospital emergency care centres

Freed from its inpatient medical duties, Beijing 120 became specialized in pre-hospital emergency care. In September 2001, the Red Cross Society of China Beijing Branch Medical Centre (Beijing 999) was also established and hence became another major pre-hospital emergency care provider.

Emergency medical service stations

A rapid expansion of emergency medical facilities in Beijing took place in the years leading up to the Games. Between 2001 and 2005, the ten suburban districts and counties in Beijing each set up its own emergency medical sub-centre, with 48 emergency medical service stations. In 2006, another 14 emergency medical service stations were added to the list in the scenic spots of these districts and counties. In July 2008, a further 65 stations were established all over the capital. Altogether, 165 stations were in operation in Beijing 120's emergency medical service network. By 2008, the Red Cross Beijing 999 centre had also included 68 stations in its emergency medical service network.

Emergency vehicles and first aid kits

From 2004, onwards, emergency vehicles and first aid kits were gradually introduced in the newly established service stations. Eighty-two new ambulances were purchased, bringing the total serving the Beijing network to 465. Beijing 999's ambulance fleet grew from 102 to 152. The overall ambulance strength for medical emergencies in the city during the Games was 617, a 15-fold increase since the Games were awarded in 2001. All the vehicles used for venue medical service operations were fully equipped with first-aid kits, electrocardiogram monitors, defibrillators, cardiopulmonary resuscitators and oral and intravenous medicines, as well as radios and global positioning systems (GPS), thus meeting international standards [6].

Emergency medical service management

Beijing 120's Command Management System was updated three times. Emergency calls could be handled within 10 seconds. An international language reception desk was installed during the Games to deal with the emergency service to assist international visitors.

Recruiting emergency medical personnel

During the Olympic Games, medical workers were transferred from various medical institutions in the capital. With professional training, they became a major force in pre-hospital emergency care. In addition, 746 experienced doctors and nurses were chosen from the Olympic designated hospitals to become medical volunteers at the Olympic venues.

Training and exercises

Training sessions were offered to all the selected medical personnel, the best of whom also took part in language courses and domestic and international conferences in Hong Kong, France, Israel and the United Kingdom, among others. All these were put in place to prepare staff for unexpected medical incidents and to enrich their practical experience.

Test events and the earthquake in Sichuan Province

Between 2006 and 2008, the medical volunteers chosen for venue emergency medical service participated in the 42 "Good Luck Beijing" test events. In 2008, when the earthquake struck Wenchuan in China's Sichuan Province, 297 of the personnel went immediately to the area for emergency transfer operations. As a result, they gained vital experience and were better prepared for the Games.

Improved capacity for pre-hospital emergency care in Beijing

By 2008, a comprehensive network for urban pre-hospital emergency care service had taken shape, covering every corner of Beijing. By the time the Games opened, 233 emergency medical service stations, with 617 ambulances and 2,105 pre-hospital medical personnel, were in operation. (Table 1)

Table 1. Improved capacity for pre-hospital emergency care in Beijing

Items	2001	2008
Service stations	28	233
Vehicles	40	617
Personnel	370	2,105
Time of response	30 minutes	10 minutes
Number of emergency calls	90,000	360,000
Satisfaction	70%	99.1%

*Data source: Beijing 120 emergency centre.

Operations during the Games

During the Games, Beijing 120 and Beijing 999 received 93,000 emergency calls and dispatched ambulances 18,000 times. Among the recipients of the emergency medical service were 40 Olympic accredited staff and 150 non-accredited international visitors (see Table-2 for disease categories).

Credit: BODA, IOC

Table 2. Disease categories of pre-hospital emergency care

Disease categories	Percentage
Cardio and cerebrovascular	36.78
Injury	16.69
Respiratory	4.47
Digestive	4.38
Tumour	3.18
Endocrinological and metabolical	2.69
Obstetrical and gynecological	2.29
Neurological	1.46
Urological	1.09
Others	26.07

Blood Supplies

Beijing has four agencies responsible for the collection of blood donations and supplying them to clinics and hospitals. In 2001, the estimated total clinical need was 360,000 units each of 200 mililitres, with volunteer donations representing just 34% of the whole blood supply. By the time of the Games, the total need had risen at an average of 10% per year to 613,000 units.

The Beijing Blood Centres faced four major challenges for the Games: (i) to motivate more volunteers to donate blood regularly because August would be the off season for blood donation; (ii) to store sufficient blood to cope with casualty incidence during the Games, with millions of extra visitors; (iii) to recruit more donors of RHD negative type blood in case of need among foreign athletes and visitors, 15% of the general global population have RHD negative blood type as compared to 0.3% of the Chinese population; (iv) to improve blood safety techniques to screen for disease or contamination. A strategic plan was therefore developed to deal with these challenges.

Based on the principle of high blood storage and balanced blood type, the blood storage objective from 2005-2007 is shown in Table 3.

Table 3. Objective of storage

Blood categories	Blood varieties	Objective of storage	Guarantee capacity in 2007
Common blood	Red cell components	16,000 unites	160,000 units
	Blood plasma	10,000 unites	20,000 units
	A.Pheresis Platelets	200 unites	200 units
Rare blood	RHD negative red cell components	800 unites	1,500 units
	RHD negative blood plasma	1,600	2,100 units

Recommended initiatives to recruiting more blood donors

A range of methods of encouraging more blood donations should be considered. These include television and other mass media public appeals, organized theme activities on World Red-Cross Day, World Blood Donor Day, and the anniversary of Blood Donation Law of the People's Republic of China. Furthermore, the Invitations were sent to celebrities to serve as blood donation ambassadors. The comprehensive publicity materials were distributed to inform people in government offices, schools, enterprises and villages.

There were 40 mobile blood donation stations in downtown areas, responsible for almost equal to 94% of all blood donations that year. Founded a registration system of voluntary blood donors to meet demands in a mass emergency. As earlier mentioned, Sichuan Province was stricken by a major earthquake three months before the Olympic Games. Large numbers of blood donors came forward to assist the victims. They were invited to keep appointments for donating blood during the Games, and almost 50,000 of them did so.

Expanded RHD donators screening coverage

From 2001 onwards, all family members with RHD negative blood type were registered as voluntary donors. In 2006, a new policy of screening RHD was implemented and became part of regular health care checks for all Beijing residents. It was also used to identify and motivate potential RHD negative donors among army recruits. In 2008, the RHD negative blood donation was 3,228 units, much more than enough to meet average annual clinic needs of 800 units.

Advanced blood safety equipment

Special equipment should be increasingly used in addition to standard detection tests to kill viruses and ensure safe blood transfusion [1].

Blood management information systems for emergency needs

In April 2008 the Beijing Blood Managing Information network was established. It consisted of four blood centres, 37 mobile blood-collecting vehicles and 125 hospitals. This produced a database of donors that all the institutions shared. During the Sichuan earthquake, 6,000 units of blood were transferred immediately to the earthquake city. Beijing residents donated an unprecedented average of 6,700 units per day. The blood supply information network coped with this extraordinary surge in donations, showing its ability to withstand an emergency.

Emergency plans for blood supplies

All told, 31 emergency plans and related documents have been made for Beijing during the Games, and staff have been trained accordingly.

Results and legacy

There was plentiful blood storage and supply for the clinics during the Olympic year in Beijing. During the Games, Beijing met the intended target, which was to guarantee a sound blood supply. An emergency blood collection team of 170,000 registrants and a regular donor team of 60,000 registrants were set up. There are 680 RHD-negative registered donors and a further 274 RHD-negative soldiers located in Beijing. Blood donations of all types in August, 2008 was 2.1% more than in the previous August, with more than blood collected everyday. This guaranteed a high level of all types stored in Beijing blood centers. During the Games, 6.51 million of bloods were transferred to hospitals in Beijing with no case of disease transmission reported.

The rate of voluntary donations increased significantly between the successful bid for the Games in 2001 (31%) and the Games themselves, and had reached 100% by 2005. In March, 2009, a survey of 2,000 employees from 300 units showed that 94% had a thorough understanding of blood donation and 65.9% donors wanted to donate again.

The introduction of advanced equipment and NAT (nucleic acid detection technology) has further minimized the risk of disease transmission through blood and greatly improved the safety of blood transfusions.

All the emergency responses, network models, and blood donation motivational programmes employed for the Games have been maintained. These have led to new blood donation administrative procedures for the city being introduced in November 2009.

Lessons

The best blood comes from volunteer donors. No blood transfusion accident occurred in the Olympic Games because all types of blood were collected from volunteers [5].

In Beijing, the first ever blood management information system was set up along with the successful implementation of the new Emergency Plan for Blood Supply. This has guaranteed a quick and effective response in time of emergency [6].

The best detection methods meeting international standards have guaranteed blood quality and safety. In preparation for the Olympic Games, NAT (nucleic acid detection technology), leukoreduce and virus-killing technology were used to guarantee blood use safety in clinics.

Hosting the Olympic Games has helped accelerate the improvement of the pre-hospital emergency transfer mechanism in Beijing. Feasible planning for, and sound distribution of, the city's pre-hospital medical resources have laid a solid foundation for protecting citizens' lives.

The smooth emergency transfer operations during the Games indicate that with adequate training, medical staff will be competent in first aid operations. This opens up a new

channel for mobilizing human resources within the pre-hospital emergency care mechanism of the capital.

Carefully planned training and exercises were essential for the successful emergency transfer operations during the Games. Valuable activities such as these should become incorporated into ongoing operational routines used for improving the capacity of emergency transfers.

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Chapter 6

Medical services in the city

Deng Xiaohong[1], Qiu Dalong[1], Chen Jing[1], Xu li[2]

The previous chapters of this book have helped demonstrate that the Olympics are an international event from which the host country and local citizens will greatly benefit [1,2]. This chapter discusses how hosting the Games conferred an unprecedented opportunity for Beijing to develop its medical and health services.

The capital of China has an abundance of quality medical resources and can provide medical treatment not only to its citizens but also to seriously ill patients throughout the country. By the end of 2007, Beijing had over 150 large hospitals, more than 90,000 sickbeds, almost 150,000 health care technicians including 55,000 executive doctors and 51,000 licensed nurses. That means 5.13 beds and 3.37 doctors are accessible to every one thousand people.

Table 1. Medical resources per 1,000 people, Beijing, 2007

Index	Beijing	Hong Kong	U.S.A	France	U.K	Denmark
Beds/1,000	5.13	5	3.6	3.7	4.2	4.5
Executive doctors/1,000	3.37	1.7	4	3.4	3.4	4.4
Licensed nurses/1,000	3.12	7.9	7.9	7.7	9.1	7.7

Data Source: OECD Health Data 2007, Hong Kong Statistics (2007)
Beijing Public Health Information Center

In the last two decades, Beijing accumulated a great deal of practical experience in providing medical services for large international sports events such as the 11th Asian Games in 1990, the 6th Far East and South Pacific Games for the Disabled in 1994, the 21st Universidad in 2001 and the 11th World Junior Championships in 2006. It also used the valuable lessons learned from the previous host cities [3-7] in its pre-Games preparations.

Some large hospitals in Beijing already had advanced medical technology that met national and international standards, but they still lagged far behind in regards to the presence of barrier-free facilities, accessibility of bankcard payment systems (for foreign currencies), and second language proficiencies of medical staff. They also lacked first-aid experience in treating mass casualty incidents. This, with a deficit of comprehensive and systematic training meant they would be confronted with a huge challenge during the Games.

1.Beijing Municipal Health Bureau
2.Beijing Chaoyang Hospital

Clinical area designated for the Olympic Games

The Olympic-designated hospitals were mainly in charge of organizing doctors and nurses in certain venues or competition events to provide medical services and hospitalization treatment of spectators and staff if necessary. Among them, three hospitals were responsible for treating athletes, Olympic families, foreign media representatives and patients transferred from other designated hospitals.

The local Health Bureau designated 10 hospitals in Beijing in 2001, and the number increased gradually to a total 24 in 2008. Each of these hospitals set up Olympics offices and reception areas to supervise and manage medical services before and during the Games.

Selection and training of medical volunteers

Many medical service volunteers were needed. Recruitment, training and deployment were important steps, each likely to impact overall integration. All volunteers had to receive special training in medical skills, relevant laws and regulations, knowledge of the Olympics, anti-doping measures, and other aspects. The aim was also to create a sense of group identity reflecting various cultural concepts as the cornerstone of medical services at the venues.

Providing internationalized services

To deal with a lack of language proficiency among local medical staff, the health bureau compiled and published 10,000 Handbooks of Foreign Languages on Medical Health Services which included 1,257 clinical terms and over 2,000 medical expressions. The bureau also launched a series of training courses in advanced English and French, mainly in the designated hospitals.

In addition, it selected about 300 medical workers with high foreign language skills, covering ten languages in all, and organized them into a talent pool to provide language service during the Games.

Working with the tourism bureau, the health bureau compiled and published about 100,000 Guidebooks on Beijing Medical Emergency in English, Japanese, French, German, Russian, Korean, Spanish and Arabic, with Chinese translation. Copies were handed out at each reception area of the competition venues, airports, hotels and non-competition venues, ambulances and the emergency rooms of each designated hospital. The designated hospitals installed bankcard transaction equipment to make the overall service more convenient for foreign guests.

Assessing medical services at the designated hospitals

A thorough assessment was carried out at the designated hospitals 500 days before the opening of the Games by a team of experts and scholars. The assessment consisted of three general evaluations, six special inspections and several drills and practice sessions. The team also examined the medical laboratories of each hospital in Beijing. In total, 19 medical laboratories in 18 designated hospitals were certified as capable of providing standardized and normative services in accordance with international standards.

Facilities for the disabled and elderly

To comply with instructions issued by the health bureau to assist the disabled and elderly, each designated hospital installed barrier-free facilities in parking lots, ramps at entrances to the outpatient and emergency buildings, special toilet facilities and other measures.

Emergency medical network

The health bureau established a three-level emergency medical network across the city. It was based on five types of unexpected public emergencies: burns, trauma, nuclear pollution, poisoning (including chemical pollution), and infectious disease outbreaks. The network spanned 18 specialized hospitals responsible for these five categories, 54 second-level general hospitals, and 37 third-level general hospitals. Together they could collaborate in response to emergencies, provide first-aid, ambulance transfers and in-hospital treatment.

The hospitals reserved a total 5,880 beds and sufficient medicines and materials for any possible emergency. In addition there were 115 emergency teams with a total of almost 1,000 personnel available to respond to mass casualty incidents.

The health bureau and hospitals made plans to handle emergencies of different types and scales. First-aid training was held among medical staff. About 2,000 doctors and 4,000 nurses at emergency departments from all the second- and third-level hospitals of the city received training in emergency care such as cardio-pulmonary resuscitation, ventilation therapy, deep venepuncture, and the four skills of “homeostasis, bandaging, fixing and referral”.

A Textbook of Training Emergency Specialized Doctors (including CD discs), and a Guidebook on Clinical Skills for Specialized Doctors in Case of Emergency were used as teaching materials trainees and received further information from local emergency departments and emergency centres.

Working with the China Military Medical Institute, the health bureau compiled a Textbook of Nuclear Bio-chemistry and Anti-terrorism Medical Training for Beijing Olympic and Paralympic Games, a Guidebook on the Medical Disposal of Nuclear Bio-chemistry and Terrorist Threats, and held three-day training courses on nuclear biochemistry and anti-terrorism for a total of 3,200 doctors and nurses from 160 hospitals.

Training courses in infectious disease prevention and control were given to specialized medical staff from designated hospitals. These courses included various drills, and used a combination of theoretical guidance and practical rehearsal, in order to establish a continuous movement of emergency patients all the way from on-the-scene first aid to hospital treatment.

An exercise to simulate a stampede among crowds was conducted to test communication and cooperation between medical teams and policemen, transportation teams, security guards, volunteers and other groups in venue.

Outcome and legacy

60,000 person-time were hospitalized. The amount of work was almost the same compared with that of 2007, which meet the need of medical service of the city during the Games.

During the Games, the Olympics-designated hospitals received altogether 3,567 people related to the Games of whom 128 were hospitalized.

Apart from the designated hospitals, 46 other hospitals successfully received 314 foreign patients that collectively spoke more than 70 different languages. Nevertheless, there were no patient complaints related to linguistic barriers.

Figures 1 and 2 show the categories of patients and health related problems.

Figure 1 shows that among the patients, working staff represented the highest percentage (44%) to the total number, followed by media workers (27%). This was probably because both groups were working under considerable stress for extensive periods. It is likely that the combination of high on-the-job pressure and fatigue was a factor in the increased incidence of health problems among these groups.

Figure 1. The category of patients received by the Olympic designated hospitals

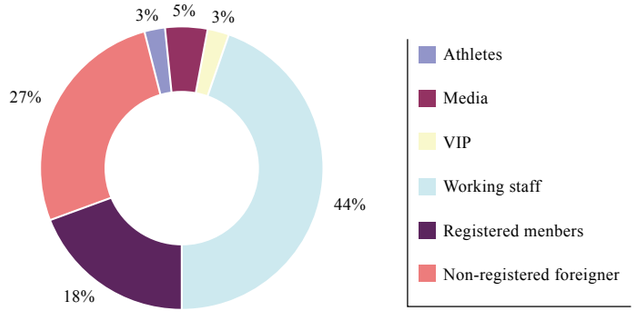
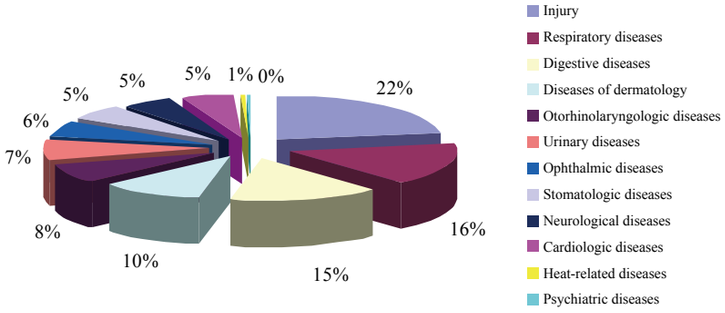


Figure 2. Categories of health problems diagnosed in the Olympic designated hospitals



From the above data, it was found that such diseases as injuries, respiratory diseases, digestive diseases, and diseases of dermatology were the most common and frequent diseases during the Games, with injuries numbering the highest.

Successful first-aid

There was no mass casualty event during the Games, due largely to effective precautionary measures. There were many serious individual emergencies, however, and these individuals were rapidly taken to hospital and treated. For example, two foreign tourists were attacked during the Games. One was killed and the other seriously wounded. An ambulance arrived three minutes after the emergency call and took the wounded tourist to hospital. After emergency treatment, she survived.

In another example, a foreign coach suffered a cardiac arrest during the mountain-bike cycling competition. After prompt first-aid and hospital treatment, he was revived. In another case, an Olympics staff member suffered an acute myocardial infarction when climbing the Badaling Great Wall. He was quickly sent to the nearest suburban hospital and underwent successful cardiac intervention surgery. The patients in these three cases, and other foreign visitors, praised the standard of treatment that they had received.

The Olympic Legacy

Seven years of preparation by Beijing's health service system went into the 17 days of the Beijing Olympics. The capital health service system integrated the preparations with medical developments, modernizing and improving services to internationally recognized levels, thus leaving Beijing with an abundant health legacy.

Through their experience, Olympic medical teams became the backbone of the medical system in the capital city. During the Games, over 2,000 medical workers passed an examination based on BETS(Beijing English Testing System).

Although Olympic medical volunteers returned to their own work places after the Games and some first-aid equipment at the venues was stored away, the talents and medical resources can be quickly summoned again and reassembled into an efficient, professional, and proactive team in large-scale activities for the future. The importance of their role in civil medical care cannot be overstated.

The emergency network, medication, medical equipments, and other medical sources built up in preparation for the Games will continue to play a long-term role in protecting the lives and health of local citizens. The planning and practical rehearsals for different kinds of emergency have become an important part of training courses at local hospitals. The successful use of English-language information signs and the barrier-free facilities to assist the disabled during the Games will see an extension of their use in public places in the future and their incorporation in health administration policies.

Experiences and lessons

This chapter has not been able systematically to cover the improvements to the medical services. It is suggested that the organizers of the host cities of future Olympic Games work out in advance the assessment index system and systematically collect data to lay a solid foundation for the scientific assessment.

Medical inventory is indispensable in dealing with emergencies, but the quantity and method of procurement should be effectively planned and schematically calculated to avoid surpluses.

For future large-scale international events, the importance of minority language skills among medical volunteers should be emphasized and prepared for through strengthened inventories of linguistically qualified individuals.

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Chapter 7

Medical services for athletes

Per Renström[1], Guo Jiyong[2], Dai Jianping[3], Ma Sui[3], Ma Jun[3], Sun Xingming[3]

Introduction

When he became the IOC president in 2001, Jacques Rogge stated that "the main goal of the IOC Medical Commission is the protection of the athlete's health". The IOC Medical Commission Games Group mandate is therefore not only to oversee doping control but also to secure the health of the athletes by supporting the local organizers to provide the best medical services.

The goals for the health and medical services set by the organizers for the 2008 Games were "to ensure no major infectious disease outbreaks, to provide optimal medical services and emergency treatment as well as absolute safety of the food." This chapter includes a discussion of the medical services provided at the Polyclinic, the venues and for the NOCs, and a brief discussion of the research, seminars and workshops that were organized. Some recommendations are given at the end of the chapter.

In terms of the organization of medical services, it is clear that planning before the Olympic Games is important.

The goal of the IOC Medical Commission Games group was to secure a medical service of continuous high quality by supervising and supporting all aspects and logistics of the medical service. Early interaction with local organizers of medical services before and during the Games was of fundamental importance. In cooperation with the IOC and the International Sports Federations, a medical care guide was produced to document the medical requirements for each sport.

1.International Olympic Committee Medical Commission
2.Beijing Municipal Health Bureau
3.Beijing Organizing Committee for the Games of the XXIX Olympiad

IOC Medical Commission Games Group

Medical services

Health care personnel included in total 3,223 in Beijing and 2,061 in co-host cities. There were 157 venue medical stations in Beijing and 71 in co-host cities. There were 191 ambulances available in Beijing. The Polyclinic had a well-organized team of 596 health professionals including 155 physicians, 360 physical therapists and 81 dentists. In addition, there were many young and enthusiastic volunteers.

The Polyclinic was well-structured with services such as acute care, orthopaedics, and dermatology located on the first floor. The major clinical specialties, X-ray, ultrasonography and MRI, as well as rehabilitation, were on the same floor, with the pharmacy and the IOC office located by its entrance. The second floor was mainly devoted to dentistry and ophthalmology. The Polyclinic was well-equipped with some of the latest medical and diagnostic equipment, and had the following specialties: traumatology, emergency care, dental care, optometry, and physical therapy. In addition, there was primary outpatient care such as internal medicine, surgery, dermatology, ophthalmology, ENT, gynecology, clinical psychology, medical imaging, a medical laboratory and pharmacy.

The authors, Professor Per Renström, of the IOC Medical Commission, and Dr Ma Sui, Head of the Polyclinic, met daily with the leadership team to discuss relevant issues, be alert to potential problems and to ensure smooth functional service.

Medical services at venues

During the Games, 227 medical stations were established in competition, training and non-competition venues, 109 of which were for athletes. In competition venues, 29 physical therapy rooms were available for athletes.

Medical encounter forms used during the Games have traditionally been worked out by the organizers and then approved by the IOC Medical Director. This form is becoming an increasingly important instrument and it was agreed with the head medical officers of the forthcoming Vancouver and London Games that the "Calgary system" should be the basis

for the 2008 Games. An internal workshop is planned for the Vancouver Games in 2010 to work out a medical encounter form that can be transferred and used from one Games to another.

Results and outcomes

Medical encounters

There were in 22,137 medical encounters during the Games. Details are shown in Figures 2 and 3, and Tables 2 and 3.

Figure 1. The peak of 417 cases occurred on August 18

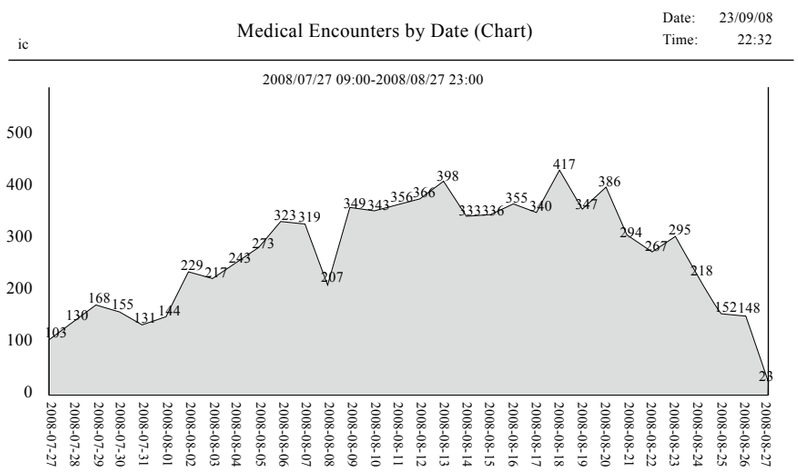


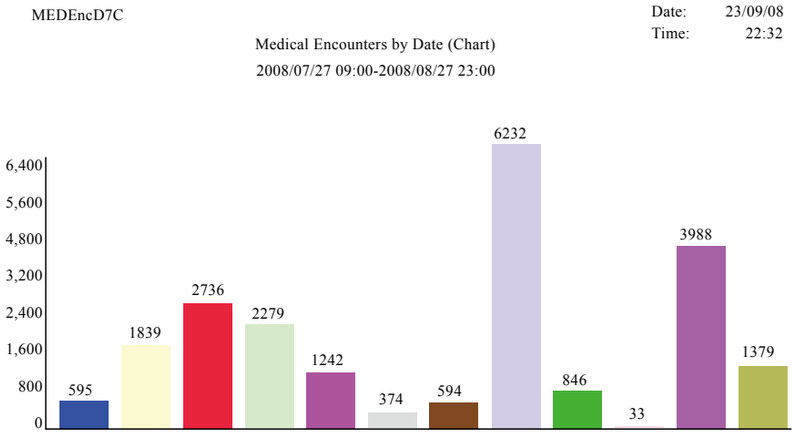
Table 1. Medical encounters at the Polyclinic by Accreditation Category

Accreditation Category	Number of Cases	Percentage
Non-Accredited	2,876	13.5 %
Athlete	3,243	15.3 %
WorkForce	9,442	44.5 %
Media	550	2.6 %
Other	4,096	19.2 %
VIP	1,033	4.9 %
Total	21,240	100%

Table 2. Medical Encounters by Diagnosis Category

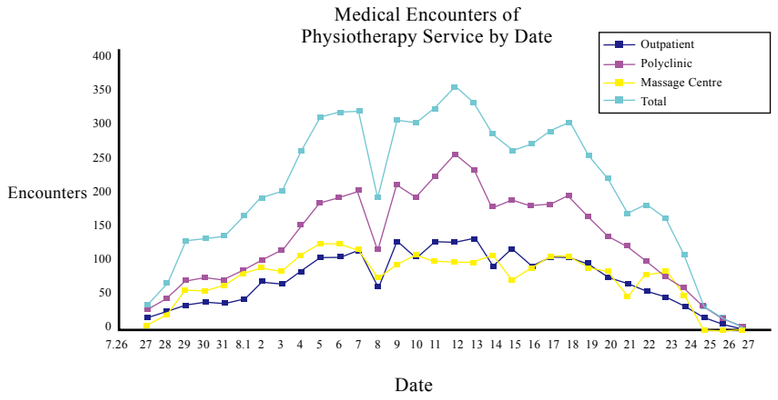
Diagnosis Category	Number of Cases	Percentage
Cardiovascular	595	2.7 %
Dental	1,839	8.3 %
Digestive	2,736	12.4 %
ENT	2,279	10.3 %
Eye	1,242	5.6 %
Genito-urinary	374	1.7 %
Heat-related	594	2.7 %
Nervous-sensory	846	3.9 %
Psychiatry	33	0.1 %
Injury type/ symptoms	6,232	28.1 %
Respiratory	3,988	18.0 %
Skin	1,379	6.2 %
Total	22,137	100%

Figure 2. Medical encounters by diagnosis category



(FROM LEFT TO RIGHT:CARDIOVASCULAR DENTAL DIGESTIVE ENT EYE GENITO-URINARY HEAT RELATED INJURY TYPE/SYMPTOMS NERVOUS-SENSORY PSYCHIATRY RESPIRATORY SKIN)

Figure 3. Medical encounters of physical therapy services, by date



Orthopaedics and sports medicine accounted for about half of all the visits, most of whom were athletes. Services were provided 15 hours per day by two teams of three orthopaedic specialists. In view of the workload experienced, more orthopaedic staff may be required for future Games.

Infections accounted for seven cases, including four of malaria, two of chickenpox and one of Dengue fever. Diagnoses were quickly confirmed and the patients were isolated immediately.

Ophthalmology diagnoses included conjunctivitis, glaucoma and retina disorders. More than 750 pairs of spectacles were fitted and provided free of charge.

Dermatology accounted for about 1,100 encounters, including 467 at the Polyclinic, Athletes represented a minority of the most common cases – allergies, fungal infections, and rashes.

Radiology and medical imaging at the Polyclinic involved up to 450 visitors for X-rays, up to 320 for ultrasound, and up to 440 for magnetic resonance imaging (MRI), which usually was provided on the same day.

There were about 1,600 dental encounters, involving two shifts of six dentists. Treatments included almost 300 endodontic, over 300 each of restorative or soft tissue, almost 200 mouth guards. About 60 patients had treatment for dental trauma, 25 others had extractions, and a total of 124 mouth guards were made.

The range of physical therapy treatments included cryotherapy, microwave, shortwave, hydrotherapy, diadynamic therapy, laser therapy, ultrasound, shock wave, interference electrical therapy, TENS, traction, massage, acupuncture, and psychology for relaxation. Registered therapists from the NOCs had access to the facilities.

Through the Games, local organizers aimed to improve international understanding of the impact of Chinese Traditional Medicine (TCM) on athletes' hygiene and rehabilitation. Activities included a weekly Chinese medicine cultural publication before the Games began, the establishment of the Beijing "Digital Museum of Chinese Medicine" and the staging of several exhibitions.

The TCM services were provided by 263 volunteers of the Beijing Olympic Chinese medicine services. They were the most popular medical services, receiving 6,172 people at the acupuncture and massage services, and 8,633 people for consultation and visits. Two of the Chinese medicine hospitals at the Games provided fixed-point services for 409 visitors from more than 30 countries.

Polyclinic

Medical services at the venues

Each venue had a medical room set up for the athletes and another room for spectators. Ambulances were present at all times. All teams in the field were equipped with defibrillators and the necessary resuscitative materials for all emergencies.

The warm-up and preparation areas in all the indoor venues were excellent and allowed adequate mental and physical preparation for the events. Most of the rooms had apparatus for strengthening and cardiovascular fitness.

Encounter rate of athletes

Among six categories (non-registered workers, athletes, workers, media, others, and VIPs) of personnel in Beijing Olympic Games, the number of medical encounters with athletes was 3,363, ranking them third after workers and others.

Athletes' diseases

Twelve health problems categories were analyzed. Most athletes had injuries (62%), with dental

diseases (19.6%) and eye diseases (4%) ranked second and third. Heat-related diseases and cardiovascular diseases each represented about 0.25% and were ranked tenth and eleventh. (Table 3).

Table 3. Categories of athletes' diseases in Olympic venues and related service sites

Diagnosis Category	Number	Percentage (%)
Cardiovascular	8	0.24
Dental	658	19.57
Digestive	63	1.87
ENT	118	3.51
Eye	135	4.01
Genito-urinary	47	1.40
Heat-related	9	0.27
Nervous-sensory	38	1.13
Psychiatry	10	0.30
Injury type	2,090	62.15
Respiratory	87	2.59
Skin	100	2.97
Total	3,363	100

Figure 4. Categories of athletes' diseases in Olympic venues and related service sites

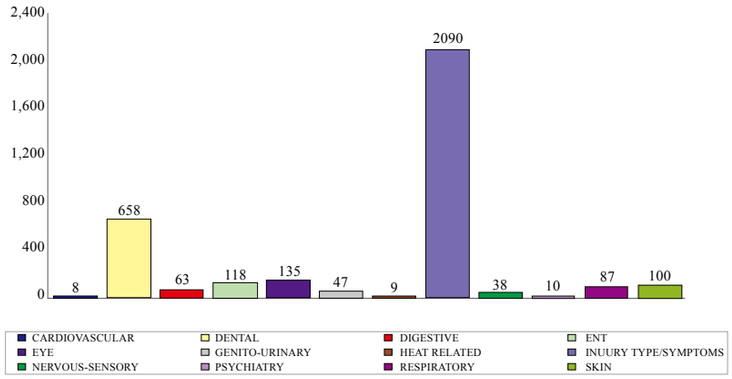


Table 4. Diagnosis for orthopedics and sports medicine (by August 21)

Tendon strain	1,155
Muscle lesion	615
Ligament injury –sprain	569
Arthritis	517
Open trauma	169
Other (without diagnosis in encounter)	822

Apart from the Beijing venues, Qingdao had six medical stations, 70 health care personnel and volunteers, three ambulances, and five rescue boats for medical emergencies. Hong Kong had 20 medical stations, 2,017 health care personnel and volunteers and about 20 ambulances.

There was a well-developed network of 24 dedicated hospitals. During the Games there were 17 inpatients in the athletes' hospital and 14 inpatients in IOC family hospital.

National Olympic Committees (NOCs) Medical teams

The NOC health care professional team consisted of 834 doctors and 91 physiotherapist. The goal of the IOC Medical Commission Games group was to give them assistance on all medical aspects and basic doping matters. Through visits and discussions, the IOC Medical Commission wanted to ensure that the NOCs had the logistics to give optimal medical service to their athletes.

A common complaint among the NOC medical teams was that they were given too few accreditations. Some physicians had to support several teams at different locations during the same day. For example, the Canadian medical team had over 50 members but only 40 accreditations, and had to adjust within this framework. The extent of this problem should be analyzed.

Athletes and coaches and others from over 200 countries participated in the Games, and there were some cultural differences in how people reacted to the services offered. Below are some examples.

Suture material. Conventional sutures are frequently required so occasionally there was a need to reuse instruments. Sterilization of suture materials for use on non-Chinese patients is however against Chinese law on grounds of legal liability. Staples as an alternative were not available for general use in China. The provision of one-time suture kits solved the problem.

Protection for nose fracture. A Norwegian football player sustained a nose fracture. The team doctor wanted a protective orthotic device made, but the Chinese dentists did not feel comfortable in doing this. An IOC dentist managed to produce a device to everyone's satisfaction and the patient did well.

Condoms: A UNAIDS safe sex education programme was popular. It included distribution of 400,000 free condoms and 250,000 "Stop HIV" booklets to all rooms of 119 designated hotels and all other hotels in Beijing.This action has been praised by the international community. Education leaflets were also distributed free at the Polyclinic together with 100,000 condoms. A complaint that there was only one condom size available was received and discussed, and will be taken into account for the next Games.

IOC Medical Commission office at the Polyclinic

The IOC Medical Commission had an important advisory function and the members supported and advised Polyclinic personnel on matters such as managing difficult cases, disagreement over treatment, and the overuse or misuse of services. The office had visitors

from all over the world and dealt with many questions The NOCs appreciated this contact area very much as a useful resource. .

Evaluation of the medical service given by the IOC

An evaluation form was sent to all the head physicians of the NOCs and the response was generally very favourable. Some of the comments are given below.

- "Everything was superb such as the attitude of staff, the promptness of service, and the quality of service. Well done".
- "The medical care in the venues was by most considered excellent. The venue medical staff seemed to have less sport experience, but were always cooperative and helpful".
- "Questionable levels of "on field/sport specific" experience of venue medical teams. Some language difficulties".
- "Electrically adjustable tables to adjust height would be ideal".

IOC research –The IOC Injury Prevention study

IOC and the International Sports Federations continuously needed to be aware of the injury risks for the athletes, in order that prevention strategies can be developed. Because of this, the IOC MC decided 10 years ago to initiate some pilot studies.

An injury prevention pilot study in all individual sports was conducted during the Sydney Olympics in 2000, the Winter Olympics in Salt Lake City 2002, and the Athens Olympics in 2004. Several valuable experiences were learned, such as how to not impose on the athlete and not interfere with the sports activities. It was also learned that it is vital to involve physicians from the NOCs for success and that the compliance must be monitored.

At about the same time an IOC team injury study was conducted in cooperation with FIFA (F-MARC) and IHF in Sydney and with all the team sports in Athens as well as with the IIHF in ice hockey at the Winter Olympics in Turin in 2006, using a medical form developed and tested by FIFA. More than 500 injuries were reported with 90% compliance. This study resulted in a publication.

After the Turin Games all these experiences were discussed and a working plan was established for a well-designed injury surveillance study with the overall aim of recording and analyzing injuries in all sports incurred in competitions and/or in training during the 2008 Games. A successful pilot study was carried out at the 11th IAAF World Championships in Athletics in Osaka August, 2007.

The study in Beijing included:

Injury surveillance. The response rate in Beijing was 88%. A total of 1,055 injuries were reported, with no significant differences between men and women regarding location, type and severity of injury but for cause of injury. On average, 9.6% of the registered athletes were injured during the Beijing Olympics; approximately 5% incurred a time-loss injury.

In a compliance study, eight of the NOC teams in Beijing 2008 agreed to use the forms and check them with their own data base. Films from competition injuries have been collected and will be analyzed.

It is recommended that the group increase the scope to involve medical issues. The International Sports Federations should be involved as much as possible to catalyze specific sports injury prevention issues.

Education during the Games

Education during the Games included seminars and workshops on popular sports medicine topics. The seminars included:

- Patellar tendinopathy taught by some experts that have published in the area.
- Traditional Chinese Medicine. Over 70 physicians participated in the Academic Exchange Seminar in the Olympic village about "Preventive applications of Traditional Chinese Medicine".
- A special programme: "Get an idea of the Chinese medicine culture, experience the longevity preservation of the Chinese medicine—cultural exhibition of traditional Chinese medicine", attracted about 100 hundred media representatives from 18 countries and regions.

The workshops included sessions on shock wave, examination techniques and taping.

Participants appreciated the programme and there was interest for its expansion. It was suggested that structured, short courses could be introduced during future Games.

Discussion

First, the recruitment and integration of human resources including volunteers were key factors for success. Integrating different cultural concepts and cultivating the identity of team members were fundamental to the success of the Olympic medical service.

Second, the influence of human resources integration of Olympic medical services into the Beijing medical system was important. After long preparation, planning and implementation, the core team members had strong capabilities in coordination, command and crisis treatment.

Third, the establishment of medical stations should meet the demand of the medical service. Though there were different venue structures and events, the main operating principle of the athletes' medical stations were the same.

Fourth, an analysis of athletes' medical demands showed that at each venue, injury was the most common (62.15%), while dental and eye problems ranked second and third respectively. This suggests that more orthopaedic specialists should be working at venues.

Furthermore, post-Games activities should be fully planned during the preparatory phase

in order for smooth implementation after the Games. The Beijing Municipal Health Bureau and BOCOG discussed this problem both before and after the Games.

The 2008 Games were generally regarded as a great success and everyone was very satisfied with the performance of the Beijing medical team. The goal is to transfer these experiences well before the Winter Olympics in Vancouver in 2010, so that organizers can be as well prepared as possible.

Lessons and recommendations

- The medical experiences from each Olympic Games should be transferred to the next one.
- Medical encounter forms should be based on diagnosis. The IOC must develop a robust template for use in future games.
- More orthopaedic specialists are needed, at least during the Summer Olympics.
- The comprehensive dental service provided to athletes was very popular. Mouth guard programmes should be maintained and promoted.
- Language skills are important in general and a good command of English in particular is required at medical stations and in ambulances. The need for less—common languages should be respected in the medical services.
- All those involved must respect traditions and be sensitive towards culture differences.
- There may be a need to discuss a recommended number of medical persons that should be included in the NOCs teams to ascertain optimal medical service and proper accreditations.
- Medical service personnel and ambulances must have the ability to gain timely access to all areas including high-security ones.
- The educational program should be expanded and planning it should start early. The IOC injury surveillance study should also involve medical issues and study some specific important issues.

Chapter 8

Prevention and control of communicable diseases

Zhao Chunhui[1], Zhao Tao[1], Deng Ying[2], Huang Ruogang[2], Wang Quanyi[2], Luo Peilin[1]

Communicable disease prevention and control is an important component of the national health system, protecting the health of the citizens and offering support for large scale mass gatherings in the city. During the 2008 Games, large influxes of spectators and tourists carried the risk of increasing the possibility of communicable disease transmission.

Beijing has a relatively good public health and disease control system, with one city-level CDC and 18 district-/county-level CDCs responsible for the prevention and control of communicable diseases. However, for a huge city densely populated with 16.33 million residents, communicable diseases remained one of the great challenges for hosting the Games. The Games were held in summer, the peak time for intestinal disease outbreaks; incidences of dysentery and infectious diarrhoea annually have ranked second and third among communicable diseases of Classes B and C[1] each year. The Games therefore were at risk both of outbreaks or transmission of local communicable diseases, and of imported diseases.

The goal was to make sure that during the Games there would be no major outbreaks or transmission of communicable diseases in Beijing; sporadic and imported cases would be controlled promptly, to prevent secondary infections. It was also intended that the capacity and management level of the host cities and venues to prevent and control communicable diseases be comprehensively upgraded.

Measures and actions

In July 2005, the Beijing Olympic Games Disease Control Office was set up within Beijing CDC. One of its main responsibilities was to strengthen disease control information sharing. This included sharing information with the CDCs of other co-host cities such as Shanghai, Qingdao and Hong Kong; exchanging information with the CDCs of Beijing's

1.Beijing Municipal Health Bureau
2.Beijing Centers for Disease Control and Prevention

neighbouring provinces and cities about the types, number of cases, and epidemic patterns of diseases; and regularly seeking information about findings of disease screening activities from the entry-exit quarantine, railway and transportation authorities. In addition, a disease control information platform was established with the support of the Ministry of Health and the World Health Organization (see Chapter 14). The frequency of exchanging information increased as the Games approached, from weekly to daily and then to instant communication, by means of fax, email, teleconference and daily videoconference.

Risk assessment of communicable diseases was completed one year before the Games, with 20 types of risks identified (Table 1) as having the potential to occur during the Games. Contingency plans were made based on the assessment, and efforts were made to minimize the risks (see Chapter 15) .

Table 1.Types of risk

Risk level	Types of events
High (14 types)	1. Highly pathogenic avian influenza; 2. Anthrax; 3. Ebola haemorrhagic fever; 4. SARS; 5. Bacterial dysentery; 6. Acute haemorrhagic conjunctivitis; 7. Sexually transmitted infections (including gonorrhea, syphilis, genital herpes, chlamydia infection); 8. Hepatitis A; 9. HIV; 10. Influenza; 11. Legionellosis; 12. Haemorrhagic fever with renal syndrome; 13. Measles; 14. Epidemic cerebrospinal meningitis.
Moderate (5 types)	15. West Nile fever; 16. Poliomyelitis; 17. Human rabies; 18. Yellow fever; 19. Dengue fever.
Low (1 type)	20. Brucellosis

Communicable disease surveillance

Surveillance of communicable diseases in Beijing was usually achieved through the communicable diseases reporting network that covered over 600 healthcare facilities across the city[2]. The 19 CDCs at city and district/county levels were responsible for implementing communicable disease prevention and control activities. Surveillance in Beijing routinely covered 38 notifiable diseases. In addition, from April to September every year, diarrhoea clinics were opened in 335 healthcare facilities in the city for intestinal communicable disease surveillance during the summer months.

Surveillance of communicable diseases was continuously strengthened and improved after 2001, with all 667 healthcare facilities at and above primary level in Beijing eventually using a computerized online reporting system.

Focusing on the need for communicable disease surveillance at mass gatherings, surveillance during the Games ranged from routine surveillance to city-wide enhanced surveillance and special surveillance in the venues (Table 2).

Table 2. Communicable disease surveillance systems during the Games

	Surveillance/monitoring
Routine surveillance	Notifiable communicable disease surveillance; early warning surveillance in diarrhoea clinics
City-wide enhanced surveillance	Syndromic surveillance for communicable diseases; primary and middle school student absenteeism surveillance; vector and disinfection effectiveness monitoring network; food safety and food borne disease surveillance; drinking water inspection; air quality and centralized air conditioning hygienic monitoring; public reporting telephone monitoring for communicable diseases; monitoring communicable disease outbreaks in neighboring cities; communicable diseases surveillance in the entry-exit quarantine, civil aviation, railway and long distance bus service sectors
Intra-venue surveillance	Health patrol and syndromic surveillance for communicable diseases in Olympic Games venues

During the Sydney Olympic Games in 2000, there were more reported cases of communicable diseases (1,740 cases) than in 1999 (1,479 cases), and there were more imported cases as well. To ensure that local and imported cases of communicable diseases could be promptly identified during the 2008 Games, Beijing CDC developed a syndromic surveillance system for communicable diseases. This used the 157 medical stations in the venues to detect any potential outbreaks from patients presenting with fever, diarrhoea, conjunctiva redness, rashes and jaundice at the clinic, and used another 125 healthcare facilities at and above secondary level in the city for surveillance of patients with the above symptoms.

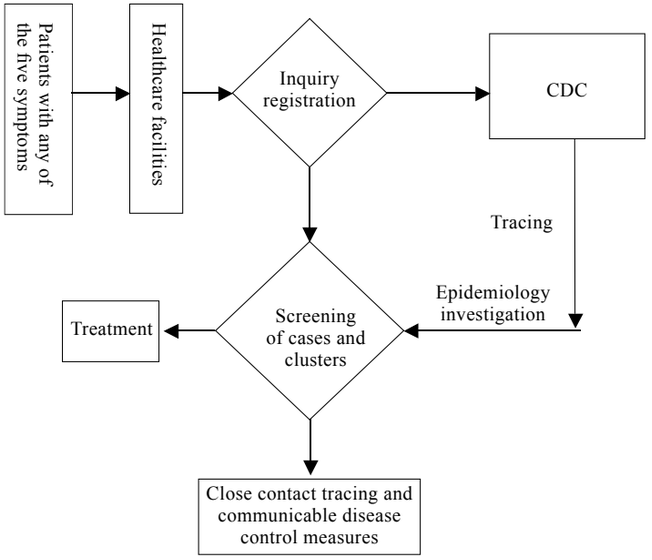
Basic steps for surveillance and screening (to exclude cases of communicable diseases) were followed. Public health workers registered the patient with any of the symptoms and carried out epidemiological investigations. If other cases were found to be associated with this patient, an assessment was made on whether they represented a cluster of cases, to enable early detection and control. Standard computerized reporting software was used for surveillance and reporting through an internet-based reporting network.

Table 3. Symptoms under syndromic surveillance during the Games

Symptoms	Reporting criteria
Fever	Olympic Games pass holders* or 3 close contacts of the pass holder had similar symptoms within 3 days
Diarrhea	Olympic Games pass holders or 3 close contacts of the pass holder had similar symptoms within 3 days
Rashes	Olympic Games pass holders or 2 close contacts of the pass holder had similar symptoms within 3 days
Conjunctiva redness	Olympic Games pass holders or 3 close contacts of the pass holder had similar symptoms within 3 days
Jaundice	Olympic Games pass holders or 2 close contacts of the pass holder had similar symptoms within 3 days

* Olympic Games pass holders: include Olympic Games athletes, coaches, media workers, intra-venue staff and Olympic Games volunteers.

Figure 1. Syndromatic surveillance system for communicable diseases



Preventive vaccination

As most of the migrant workers and their children among the floating population in Beijing were from the countryside of China and lived in substandard conditions, they had always been the key groups for disease prevention and control efforts in Beijing. Since the health of the catering business employees working in Olympic Games venues and restaurants were closely related to the health of the Olympic Games participants, Beijing CDC provided vaccination services to the above-mentioned key groups for preventive purposes. In March 2008, the migrant workers and their children in Beijing who had not been previously vaccinated or missed vaccinations that were included in the national expanded program immunization(EPI), were able to receive such vaccinations; in addition, 45,044 catering business employees working in Olympic Games venues and contracted restaurants were vaccinated against hepatitis A.

Emergency stockpiles

In early 2008, Beijing CDC organized 53 laboratory testing institutions in Beijing to form the Beijing Laboratory Network for Communicable Diseases, and invited experts from China CDC and other research institutes to form the Expert Group on Public Health Support for the Olympic Games.

Beijing also developed a Communicable Disease Emergency Response Material Stockpile Plan, and stocked up on eight routine vaccines such as oral polio vaccine and meales-mumps-rubella (MMR) vaccine, drugs such as Tamiflu, as well as rapid test reagents for communicable diseases.

During the Games, a food safety laboratory of Biosafety Level 2 (BSL-2), covering an area of 120 square meters, was set up in the Athletes Village, providing everyday testing services for key food items and food processing environment in the Village to ensure food safety and effective real-time monitoring in the venue.

Human resource arrangements

During the Games, while efforts were made to maintain the routine functions of communicable disease control system, 421 public health professionals from different CDCs were redeployed to undertake disease control tasks, which included health patrol and inspection, epidemiological investigation, and so on.

For visitors, Beijing CDC produced 1.53 million items of posters, fliers, fans, fridge magnets and disposable cups carrying health educational information about how to prevent intestinal communicable diseases and food poisoning. It also made use of various channels such as television, radio, newspaper and text messages to disseminate knowledge and information to the general public about how to prevent communicable diseases in summer time.

Cover pages of "Olympic Health Handbook" (Chinese and English versions)

Results

Data from the reporting network show that there were no major outbreaks or transmission of communicable diseases during the Games in Beijing; sporadic and imported cases were well controlled without any secondary infection. Seven imported cases were reported in Beijing including four cases of malaria, two of chickenpox and one of dengue fever, all effectively controlled without any secondary cases. These results thus contributed to achieving the goal of communicable disease control set forth in the "City Operational Outline for Beijing 2008 Olympic Games and Paralympic Games".

The number of cases of Classes A, B and C notifiable communicable diseases reported by 18 districts/counties of Beijing during August 8-24, 2008, decreased by 40.6%, compared with that during the same period in 2007. The number of reported cases of intestinal communicable diseases fell by 46.9% in Beijing compared with that of the same period the previous year.1 Several main reasons account for this. First, the coverage of communicable disease surveillance network was wider. In particular, the syndromic surveillance network established in 2008 covering 125 hospitals in the city contributed greatly to the effective control of communicable diseases. Second, the threshold for initiating an epidemiological investigation was readjusted so as to trigger an epidemiological investigation whenever three or more cases with similar symptoms were reported through the syndromic surveillance system. Third, as the health inspection of catering services was strengthened and the hygienic levels of restaurants were reclassified, all restaurants of Level D in Beijing were closed. This also significantly contributed to the effective control of outbreaks of intestinal communicable diseases.

Figure 2. Reported cases of Class B communicable diseases during the Games (July 20-September 20, 2008)

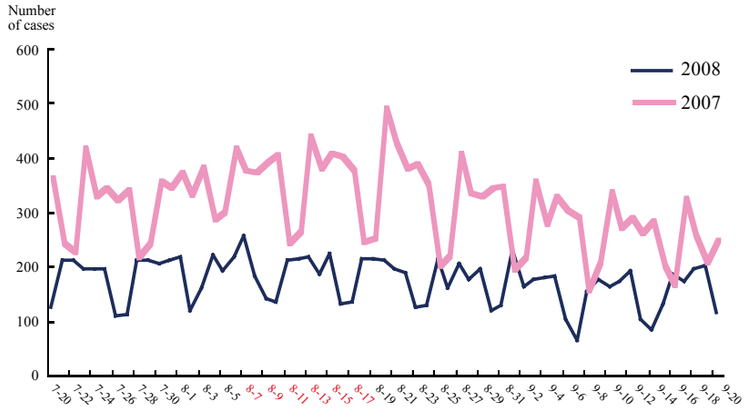


Figure 3. Reported cases of Class C communicable diseases during the Games (July 20-September 20, 2008)

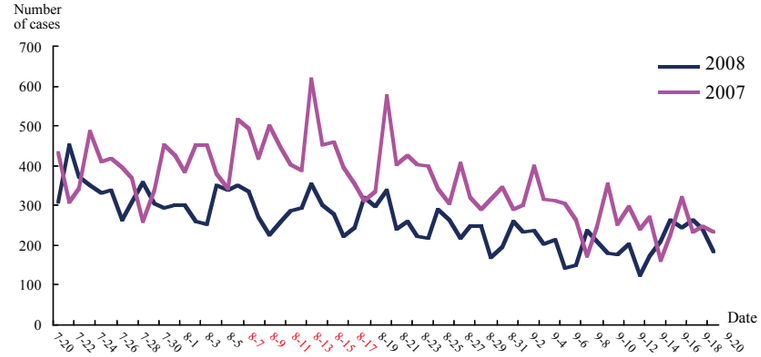
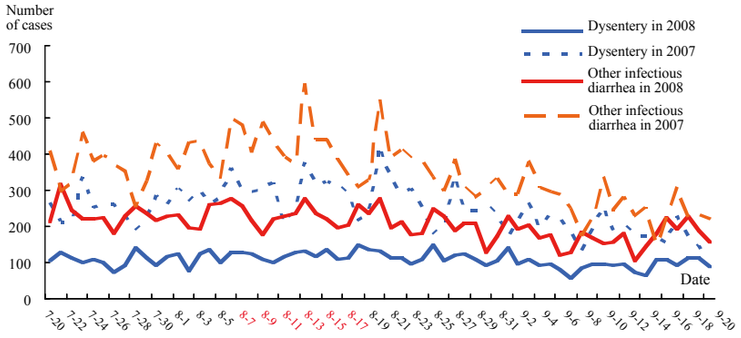


Figure 4. Reported cases of intestinal communicable diseases during the Games (July 20-September 20, 2008)



Through the syndromic surveillance system, 83 events of suspected association were reported by hospitals at and above the secondary level in Beijing during the Games, involving 377 people. Of these events, 64 were of diarrhea, 11 were of fever, five of rashes and three of conjunctiva redness. Of the 83 events, 67 were confirmed with clear association by epidemiological investigations, and the others were confirmed sporadic events. The 67 events of association were mainly of diarrhoea caused by contaminated food. Because immediate measures (such as tracing, isolation and treatment of cases and their close-contacts) were taken after reporting, the diseases were well controlled and no spread and outbreaks occurred.

The syndromic surveillance system for communicable disease was readjusted and retained after the Games, becoming part of the routine surveillance in Beijing and a legacy of the Games for regarding disease prevention and control. In the prevention and control of the A/H1N1 pandemic in 2009, febrile case surveillance was used in Beijing as a tool for early detection of clusters of A/H1N1 influenza cases.

Discussion

The incidence of communicable diseases, and intestinal communicable diseases in particular, declined during the Games, compared with that in 2007, because of the food safety management measures (See Chapter 12 on food safety for details). The decline can also be attributed to the efforts made by the Beijing Municipal Government to regulate the catering business and the improved lifestyle of Beijing citizens through health education.

During the Games, strict tracing, investigation and control measures were taken in Beijing for cases of communicable disease. In particular, healthcare facilities registered, in detail, patients with five kinds of symptoms: fever, diarrhoea, conjunctiva redness, rashes or jaundice, followed by tracing and epidemiological investigation by the CDC staff. Although these measures increased the workload of the CDC workers, and some patients complained about having to undergo epidemiological investigation for simply mild symptoms, these measures were necessary in the context of such large-scale mass gatherings and high public health risks such as the Games. The drop in the incidence of intestinal communicable diseases also proved such strict measures were effective in blocking the transmission.

References

1. The Monthly Report of Notifiable Communicable Diseases in China: August 2007 published by the Ministry of Health. In August, 2007 (from 00:00 August 1 to 24:00 August 31, 2007), the top five notifiable communicable diseases of Classes A and B reported in China (excluding Taiwan, Hong Kong and Macao) were tuberculosis, hepatitis B, dysentery, syphilis and gonorrhea; and the reported top three communicable diseases of Class C were other infectious diarrhoeal diseases, mumps and acute hemorrhagic conjunctivitis. http://www.bjcdc.org/news.php?id=33853

2. 2008 Statistical Yearbook of Beijing, Chapter 3, Section 10, Population http://www.bjstats.gov.cn/tjnj/2008-tjnj/content/mV33_0301.htm

Chapter 9

Public health preparation for potential nuclear, biological, chemical, and explosive terrorist attacks

Gao Xing[1], Cao Wuchun[2], Jiang Hezuo[3], He Yuezong[2], Lee Chin Kei[4], Barbeschi Maurizio[4], Lv Yiping[1]

Introduction and background

Mass gatherings are on occasion targets of terrorist action, as in the cases of the 1972 hostage-taking and subsequent murder of Israeli athletes at the Munich Olympic Games, and the Atlanta bombing of 1996. MGs can be very high visibility events, such as the Olympic Games and the Football World Cup; with the eyes of the world on an event, the attraction is great for terrorist groups wanting to carry out violent activities to bring attention to their cause or plight.

In recent years, the potential mechanisms through which these groups may attain their desired effect have changed. The perceived threat in some countries has evolved towards increasingly nonconventional means. The gassing of the Tokyo metro system in 1996 with Sarin gas, which killed 12 people, and the posting in the USA of letters containing anthrax in October 2001, killing 5, indicate that terrorist groups have both the intention and the capability to take technological steps forward. The terror associated with reaction to the use of a chemical, biological or nuclear weapon during an MG could have enormous social and economic consequences, and could impose a severe public health burden, pushing fragile and possibly already stressed public health systems to surge capacity and beyond. This problem is compounded by the fact that, as well as considering these new threats, attention cannot be removed from more conventional, yet equally terrifying, terrorism using explosive weapons.

Regardless of the threat assessment conducted by any event organizer and its results, the fact a threat exists warrants building capacity in risk management: the social, economic and political consequences of any terrorist action would be too great to justify failing to institute such capacity. Building capacity in this field is intrinsically an exercise in interdisciplinary collaboration, for which responsibility is shared between public health and medical actors, emergency and disaster services, law enforcement authorities, relevant government ministries, and so on. Often, these actors are not used to collaboration; sometimes they do not speak the same technical language and do not share the same objectives. The real challenge, therefore, is achieving fluid interdisciplinary communication and resultant confidence in partners. This can only be achieved by starting work early on the organization of an event, and by establishing normalized platforms (committees) within which partners can share.

This chapter outlines the process by which the necessary medical capabilities were built to prepare for potential terrorism activity, of nuclear, biological, chemical or explosive nature, during the 2008 summer Olympic Games in China.

1.Beijing Municipal Health Bureau
2.Academy of Military Medical Sciences
3.General Hospital of PLA Second Artillery Corps
4.World Health Organization

Security threat and intent assessment

This section provides a short description of the theoretical background to Chinese security risk assessments in the run up to the 2008 Olympics, and which underpinned the medical preparations for the event.

Security threat assessment is vital for managing the health risks of the deliberate use of biological, chemical or radiological agents. Scenarios resulting from security threat assessment serve as a basis for risk assessment and planning by the health sector. Health personnel should be aware of the processes used by the security sector to assess security threats, as they have a range of possible contributions for the process of security threat assessment. The health sector needs to build effective relationships with the security sector to ensure that the health sector has the necessary information on which to develop plans and capacity to manage the health risks of the deliberate use of biological, chemical or radiological agents.

Security threats are analysed as a function of three factors: the vulnerability of potential target populations or systems, the capability of a person or group to obtain and deploy a weapon, and the intent of the perpetrator to carry out such an act. Threat analysis provides a measure of the likelihood of an attack.

Intent is a combination of factors, including motivation and opportunity, that are specific to certain actors, and is the most difficult element to analyse and counteract. Traditionally, the goal of terrorism has been to make a political statement or to influence an audience through an act of violence. A more recent phenomenon, however, has been the evolution of what is called post-modern terrorism or super-terrorism. The goal of this type of terrorism is essentially maximizing the political message by maximizing the number of casualties. Any effective assessment of intent needs to focus on the set of threats that may realistically be expected.

Some groups may not use biological, chemical or radiological agents, either because the use of such agents is not commensurate with their goals and plans or because they

are unable to access and to use them. Others may try to obtain biological, chemical or radiological agents more or less randomly, and yet others may systematically seek to use them. Restrictions on access are likely to discourage the first type of group, but the second type will be more determined and less easily discouraged.

Capability assessment

Capability is not defined solely in terms of the possession of relevant agents or material, but also measures the technical ability of an individual or group to acquire, produce, weaponize and disseminate an agent or material, and to select suitable targets. Source assessment analyses the availability of agents and relevant technologies in each specific case; and exposure assessment includes consideration of the types of weaponization of agents that can be expected, and the expected attempted methods of delivery. Effective and efficient dissemination or delivery of such agents and material is generally considered to be more difficult than their production or acquisition. The technical problems associated with dispersing large quantities are complex and require highly developed professional and organizational capability.

Assessment of the vulnerability of the potential targets or systems

The vulnerability of potential targets or systems is the measure of the ability of a country to prevent, reduce or counter an attack against a potential target. It is generally recognized that preventing or countering the deliberate use of biological, chemical or radiological agents is extremely difficult, and that without specific and widespread preparation, the current infrastructure – including health care facilities – of most countries is ill-prepared to prevent widespread suffering in the event of such use. Vulnerability assessment considers likely targets, their nature and their vulnerability, as well as mitigating strategies, plans for management of potential crises, and potential public health impacts.

Assessing risks from security-related threats

Credible scenarios of security threats may be developed by combining the products of the analysis derived from the assessments of intent, capability and vulnerability of target populations or systems. Assessing the health risks involves analysing the likelihood and the effects of the type of events described in these scenarios. Conclusions may be then drawn on the actions required to manage these risks. This, in turn, can guide any preparedness activity in a more structured manner and can assist in assessing how preparedness will affect possible deliberate acts, and vice versa.

Risk is the chance of something happening that will have an impact and is a function of likelihood (threat) and effects (harm). Unlike industrial risk assessment approaches, the likelihood of security threats may be impossible to define quantitatively and only parametric or qualitative analysis can usually therefore be performed, with a ranked order across incident types.

Security threat assessment of the deliberate use of biological, chemical or radiological agents, and the resulting risk assessment are, by their very nature, country-specific. The outputs of the security threat assessments are usually scenarios combining a description of the possible use of these agents and their possible target populations or systems. Based on these assessments, the potential attacks may be classified based on the specific type of group action and its probable impact on the societal system. Such a classification may be used to structure possible scenarios, such as those presented in the table below, which characterizes effects as having sudden (shock) or indirect influences, defined as follows:

- Shock: subjecting the system of society to such a sudden and violent impact that it ceases to function as a whole, at least for a significant period of time.
- Indirect influence: causing problems for a societal system by attacking and disabling one part, the proper functioning of which is essential for other societal functions.
- Abrasion: wearing away the resistance of a societal system by repeated attacks.
- Rule change: ensuring that the aims and rules that operate in a given societal system change.

Each scenario may be developed at any given level of detail, providing the basis for discussions on assessing risks (likelihood and effects) and determining the possible strategies required to manage them.

Table 1. An example of a structured approach for classifying scenarios

Impact/Action	Shock	Indirect influence	Abrasion	Rule change
Specific action	Releasing a nonpersistent rapidly acting chemical agent in an enclosed public space	Releasing a perceptible persistent agent to deny the use of an area	Initiating a contagious livestock disease	Initiating a transmissible disease
Symbolic action	Releasing a nonpersistent rapidly acting chemical agent in a symbolic place	Contaminating water supply	Hindering response or relief organizations with readily accessible chemicals	Using biological, chemical or radiological agents to cause massive numbers of casualties (genocide)
Opportunistic action	Releasing readily accessible chemicals	Contaminating food or feed	Generally not applicable	Generally not applicable

The China context

The build-up to the 2008 Olympics took place at a time when China was emerging onto the global scene as a major player. The organization of the Olympic Games was an important test and demonstration of this role.

Big cities are densely populated, especially the major metropolises such as – in China – Beijing, Shanghai, Tianjin, and Hong Kong, where numerous international organizations and overseas business institutions are based. These cities often hold large-scale international MGs, and thus face the potential threat of terrorist attacks.

Terrorist attacks are characterized by unexpectedness, unpredictability, and complexity, and are difficult to cope with. As a result, onsite emergency response and management capability tends to be weak.

During the Olympic Games, large crowds of people gather, and frequent, well-publicised major activities increase the risk of violent terrorist attacks. It is therefore necessary to be well prepared for such attacks, whether they are of nuclear, biological, chemical (NBC) or explosive origin.

Description and evaluation approach

Work objective

This project was intended to evaluate and analyze the potential risk of terrorist attacks; to study and formulate priority control management measures; to summarize the experiences and lessons of the host countries and cities where MG activities had previously been held; and to offer ideas and models as references for other countries and cities planning MG events like the Olympic Games. The capabilities thus built were intended to ensure that once a mass casualty incident (MCI) occurred, an efficient medical rescue system could be launched, with the capability of handling emergencies.

Although the health sector is not traditionally involved in assessing security threats, it can contribute knowledge of relevant health aspects to such an assessment, including the health effects of biological, chemical or radiological agents, effective risk communication strategies, health system capacity, and identification of unusual disease patterns requiring investigation. In return, the health sector requires information on security threat assessment for assessing and managing health risks, including many of its functions in prevention, preparedness, response and recovery.

The health sector will be able to optimize its planning, capacity development and response to the health effects of emergencies involving the deliberate use of biological, chemical or radiological agents only if it has effective relationships with the security sector and access to information on security threats.

Evaluation approach

According to public health reports about responding to terrorist acts (from China, the USA, other countries which have held games, and WHO [1]), there are two commonly used evaluation indices for responses. The first is known as the system-building evaluation index, and is constituted of such factors as command and control, medical emergency responses, medical treatment (emergency, ICU, etc.), NBC laboratory safety networks, medical rescue teams, laws, and emergency preparedness and response plans. The second is known as the capability-building evaluation index, and contains such factors as organizing and coordinating medical and health resources, risk assessment, epidemiology investigation, laboratory tests, site response and management, medical rescue, monitoring and warning, information reporting and releasing, medical and health emergency material reserves, group linkages and joint control, international cooperation, social mobilization, and so on.

In China, the NOC and IOC organized experts to assess these indices in the Chinese context and conduct a subsequent final evaluation through training and exercising, as well as during “Good Luck Beijing” test events and Olympic Games security drills. The results of these exercises were combined with department evaluations, analyses of media commentary, and the work of the national anti-terrorism coordination group.

Action and measures

Risk evaluation of medical rescue for terrorist attacks

Evaluation was made on the basis of the risks of severity, probability, and preparedness. First, bioterrorism agents, toxic chemicals, nuclear material and radioactive substances were classified, assessed, and managed at different levels (see Tables 1 and 2[2.3.4.5]). Next, moments of vulnerability, key regions, important places, and possible terrorist scenarios were evaluated. The comprehensive risk evaluation was then combined with the analysis of medical rescue systems, capacity building, and risk control management [1].

Building anti-terrorism medical rescue systems; establishing anti-terrorist medical rescue systems nationally and within game regions and venues

After the Olympic games were awarded to Beijing, the Chinese government mobilized people all around the country to ensure the safety of the local communities and the participants. The national anti-terrorism coordination group was formed in 2006, and was composed of representatives from the Ministry of Public Security, the Ministry of State Security, the Ministry of Health, and other relevant ministries and commissions under the State Council. The group was in charge of national command and control, site emergency response and management, international cooperation, the security of MGs such as the Olympic Games, and emergency management of incidents such as terrorist attacks. Its office was within the Ministry of Public Security.

Provincial and city anti-terrorism coordination groups were also set up in the provinces and cities where the Games were to be held (with direct jurisdiction given to cities and municipalities), to assist the government in emergency response and management work. These offices were set within provincial departments of national and city public security bureaus.

The Chinese anti-terrorism medical rescue system is composed of Public Health Administrative Departments and medical institutions, and is in charge of handling terrorist attacks and other security incidents. During the Olympic Games, the national and regional anti-terrorist coordination groups were in charge of the emergency response and management of terrorist attacks and other security incidents, command, communication and management.

The medical and health care teams of the Ministry of Health were responsible for the organization and coordination of national anti-terrorist medical rescue. Seven liaison groups were accredited to the game regions to achieve overall coordination. WHO's representative office in China cooperated with the Ministry of Health and the National Centres for Disease Control in taking charge of surveillance and alert systems, and instructing and assisting in identifying and assessing national laboratory capabilities. During the Olympic Games, the Beijing Olympic security protection command centre was sent to coordinate security in venues, and to put into effect an integrated system of regional emergency medical and health management and Olympic venue security protection.

Table 2. Main characteristics of biological, chemical and radiological agents

	Biological agents	Chemical agents	Radiological agents
Agent or material	Living organisms (such as bacteria, viruses, Rickettsia or fungi) or toxins of biological origin that can infect or poison humans or other organisms	Toxic chemicals, in gas, liquid or solid form that, through its chemical action on life processes, can cause death, temporary incapacity or permanent harm to humans or other organisms	Radioactive substances that cause excessive radiation exposure among humans and other organisms and affect the environment
Characteristics	Disease symptoms among people exposed to pathogen or toxin May spread from person to person or by vectors Incubation period may delay symptoms and diagnosis for days or weeks	Chemical contamination localized Not contagious Substances moved by wind, water, explosion or cross-contamination Rapid onset of symptoms linked to dosage, exposure and toxicity Potential long-term health effects, such as carcinogenic, mutagenic and transgenerational effects	Symptoms of general or local radiation overexposure in a localized area of radioactivity or explosion site Spread by wind, water and explosion Symptoms are linked to radiation exposure and delayed for hours and days Potential long-term mutagenic and transgenerational effects
Routes of exposure	Inhalation, contact and ingestion	Skin contact, inhalation and ingestion	Indirect exposure from a short distance, contamination of the skin and ingestion or inhalation of radiological agents
Characterizing functions for managing risk (Many common functions apply to managing risks of biological, chemical and radiological agents, such as risk communication, mass casualty management, mental health and community)	Health surveillance, early warning, quarantine, sampling and analysis, vaccination and prophylaxis, epidemiological investigation, infection control, and biosafety in laboratories and health facilities	First response, environmental detection, decontamination, incident site management, environmental health, long-term issues and chemical safety	First response, environmental detection, facility design, decontamination, environmental health and long-term issues
Detection and analysis	Rapid diagnostic tests exist for specific agents. Laboratory confirmation may take days (such as molecular methods or immunoassays)	Can be rapidly detected and analyzed (such as spectrometry or chromatography)	Can be directly and immediately detected (such as geiger counters or dosimeters)

Table 3. Potential special terrorist materials and devices that could be used by terrorist organizations

Types of special terrorist attacks	Classification of Special terrorist materials and devices
Bioterrorism	Class A: Bacillus anthracis ,Yersinia pestis, Variola virus strains, etc. Class B: foodborne pathogens(Salmonella typhimurium, Escherichia coli, etc.), psittacosis, viral encephalitis(eastern equine encephalitis, etc.), staphylococcal enterotoxin
Chemical terrorism	Nerve agents, vesicant agents, choking agents, etc. Cyanides and other highly toxic chemicals
Nuclear Terrorism	Dirty bomb (DU) Simple nuclear explosion devices 239 uranium and other smuggled nuclear materials
Explosive Terrorism	Bombs Explosives and explosive devices

The establishment of a committee of anti-terrorist medical rescue

National and regional committees for anti-terrorism medical rescue were set up, divided into comprehensive management groups and risk groups. Different groups were mandated to provide scientific consultation services concerning bioterrorism, chemical terrorism, nuclear terrorism, and explosive terrorism, and to provide assistance with evaluation, analysis of surveillance and alert capacity, and instruction in medical rescue work.

The establishment of anti-terrorism medical rescue bases and emergency teams on site

The anti-terrorism medical rescue bases and emergency teams had the responsibility for anti-terrorism medical rescue work via national medical bases for infectious diseases, intoxication, and radiation sickness. Olympic Games regions appointed medical institutions with specializations in infectious disease, chemical intoxication, radiation sickness, trauma, and burns as anti-terrorist medical rescue bases. National and Regional Centres for Disease Control were responsible for handling bioterrorism on-site. National, regional, and venue medical rescue teams for nuclear, biological, chemical, and explosive terrorist attacks were established and were placed in a state of combat readiness throughout the entire Games period.

The establishment of an NBC safety laboratory network

Centres for Disease Control and anti-terrorism medical rescue bases were put in contact with NBC safety sentinel and reference laboratories, in order to be able to detect nuclear, biological, and chemical material promptly and effectively. The National Laboratory was founded in NCDC and MCDC, to take charge of the verification and identification of biological agents such as smallpox, yersinia pestis, anthrax, ricin, botulinum toxin, and chemical and radioactive materials. WHO offered the use of equipment and experts from international public health laboratories to identify and analyze biochemical factors, as well as standard positive pathogen detection kits to facilitate the detection of ebola, marburg, rift valley fever, and other virulent pathogens.

The establishment of anti-terrorist medical rescue system

According to the requirements of the national anti-terrorist medical rescue emergency preplan, the anti-terrorist medical rescue surveillance and alert system was established for the first time using the WHO public health emergency guidelines for NBC terrorist attack [1.7]. The system included preparation for the following events: (1) a threat assessment of a bioterrorist event (e.g. smallpox reports and rumours); (2) outbreaks of public health events; (3) human morbidity and deaths following a serious animal epidemic; and (4) foreign reports of suspected, premeditated, or deliberate incidents.

A number of detection systems were tested and professionals trained in their proper use. These included environmental biological particle detectors; dangerous liquid detectors; colloidal gold rapid test kits; fixed and mobile spectrum analyzers; and other rapid spot detection technologies.

These systems were tested. In May 2008, three months prior to the Beijing Olympic Games, five foreign embassies in China received letters containing white powder. The embassies at once reported to regional CDC and Beijing anti-terrorist offices, and the prevention and control team moved quickly to the relevant sites and carried out spot detection in accordance with the preset routine. The powder was immediately sent to the National Laboratory for identification. After analysis, the city anti-terrorist office excluded the possibility of terrorist attack. See Figure 1 for information on specific handling procedure during this incident.

Implementation process

During the Olympic Games, the Health Department exchanged information with the Departments of Public Security, Environmental Protection, Railroads, Entry-Exit Inspection and Quarantine, Civil Aviation, Transportation, and other relevant departments, and sent specialists to take part in security protection capacity building. NCDC monitored intelligence on terrorist activity at home and abroad 24 hours a day. Likewise, health workers in regional health emergency offices and Olympic venues continuously collected and analyzed anti-terrorist medical rescue information and reported on a daily basis up the chain of command and to partner organizations. The WHO representative office in China reported relevant international surveillance information to the Ministry of Health through daily telephone conferences and weekly consultations. In return, the Ministry of Health notified WHO of relevant home and venue disease activity.

The central government, military forces, armed police forces, and local finance departments divided responsibilities according to their different capabilities and tasks, and put funds into national and regional government reserves and medical rescue base equipment, material preparation for medical rescue, and formulation of a dynamic system for allocating the necessary resources.

Public health preparedness according to relevant international and national norms

Capacity to mitigate the public health consequences of an NBC weapon was built according to the 1925 Geneva Protocol, the Biological and Toxin Weapons Convention, the Chemical Weapons Convention, and relevant national laws. These included the Emergency Response Law of the People's Republic of China (or 'Response Law' for short), promulgated in 2007, and The Beijing Municipality Regulation for Implementation of Response Law, promulgated in 2008. Both were aimed at improving China's risk prevention and control of emergencies.

The government developed a diagnosis and treatment plan, as well as guidelines for injured people at the scene of an attack or in hospitals, and applied categorized treatment to the materials and devices that could be used for terrorist attacks, in order facilitate anti-terrorist medical rescue. This was done with reference to WHO biochemical weapon medical

emergency guidelines, nuclear and radiation medical rescue guidelines, and the health surveillance, case treatment, protection standards of European and American countries[1.6.8], drawing on the experience of national diagnostic criteria for infectious diseases, diagnostic criteria for occupational acute chemicals poisoning, and diagnostic criteria for radiation diseases.

Establishment of the framework for anti-terrorist medical rescue preplan

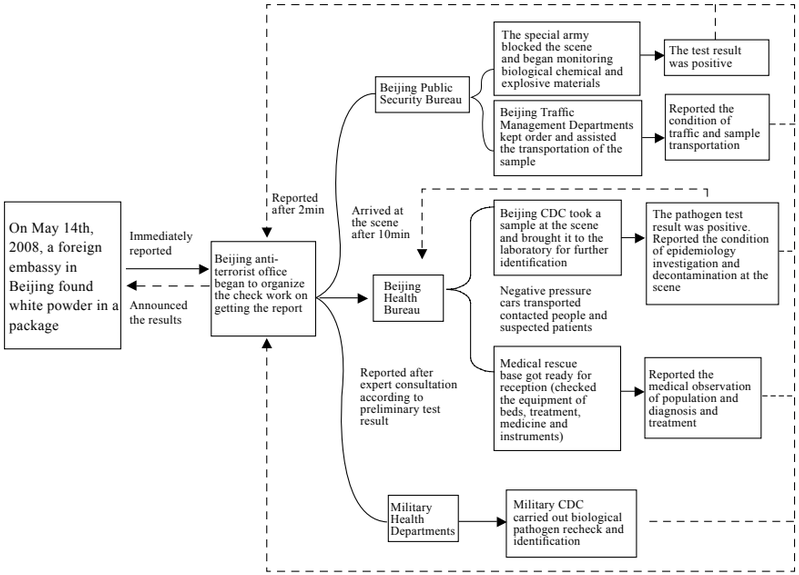
The organization and formulation of a national anti-terrorist medical rescue preplan, medical rescue work plans and a hidden trouble check plan for NCB and explosive terrorist attacks in game regions and important venues in accordance with the results of terrorist risk identification and evaluation was necessary for capacity building and effective action. According to the preplan, the Beijing Olympic Operations and Command Department, the NOC and the and IOC were required to check implementation in game regions and venues, and anti-terrorist medical rescue preparedness was organized and carried out on the basis of these plans.

Organization of training and emergency drills

The organization of training classes for advanced management of bioterrorism medical rescue, and Beijing Olympic terrorist medical rescue, as a part of routine training for health care professionals was essential. At the same time, in game regions, leaders of the health departments at all levels, and supervisors of different medical and health institutions, were also trained in order to develop their basic knowledge and skill set in this area. For instance, national and regional CDC laboratory personnel greatly benefited from the training sessions on bioterrorist response, that were organized by the WHO, and led by international experts.

Public health drill for bioterrorism

Figure 1. Process of handling the white powder incident in a foreign embassy by Beijing anti-terrorist office and public health emergency office before the Beijing Olympic Games



The country and games regions held comprehensive drills, focusing on chemical and explosive terrorism response and rescue, as well as national, regional, and venue cooperation. Hong Kong held chemical, biological, and nuclear drills, focusing on joint anti-terrorist response and rescue capability and cooperation mechanisms. Moreover, all game regions carried out further specialized drills – those related to large-scale incidents such as: the collapse of spectator stands, food poisoning, and the contamination of drinking water supply – in order to verify response system' capability, identify problems, and achieve further improvements.

Prompt handing of potential biological, chemical and explosive terrorist attacks

Five months before the Olympic Games, eight potential biological, chemical and explosive terrorist attacks were decisively obviated. These included the white powder incident in a

foreign embassy in China, the rumoured plot of a metro explosion, an incident of a plane at the International Airport carrying explosives, and acts of bioterrorism targeting Olympic venues outside of china.

Results

Defined the overall risk of terrorist attacks; put forward the priority strategy of controlling risks

During the Beijing Olympic preparation and organization stages, the overall risk of routine terrorist attacks, and of special terrorist attacks using NBC and/or hi-tech means, was defined. The six months before the Olympic Games and the period during the Games were defined as a high-risk period; the International Airport and train stations were defined as key places; and food and drinking water were defined as major pathways that could be utilized by terrorists.

Health departments were found to be lacking in anti-terrorism medical rescue systems, mechanisms, and spot handing experience. According to experts, the Beijing Olympic Games faced an extremely high risk of terrorist attacks; but the occurrence probability was lowered by the preparations taken, and the improvements made to the preparedness and response system.

The comprehensive evaluation results were high risk. On this basis, priority control strategies and measures were put forward; these were to apply emergency preparedness and response management to high risks; to identify and assess risks according to localized prevention strategies; and to organize experts for assessment. Five months before the Olympic Games, eight potential NBC and explosive terrorist attacks were decisively obviated. Biological safety laboratories and poisonous fungi pools had effective control; all enterprises for the production, transportation and trade of highly toxic industrial chemicals were under supervision; and dangerous chemicals such as highly toxic and narcotic drugs, radioactive materials, and nuclear reactors were all under safety protection management. In all important regions and places, NBC detection devices were set up for 24-hour dynamic surveillance to monitor changes in terrorist risks over time. The national anti-terrorism work coordination group, the NOC, and the IOC organized experts to carry out comprehensive inspection, assessment, and evaluation of all preparedness work, in order to ensure that the necessary security requirements were met. International anti-terrorist organizations spoke highly of the Beijing Olympic anti-terrorist work, praising for its efficient command, rigourous organization, careful planning, and stringent measures. Ultimately, all risks were under control, and the games passed without terrorist attack.

Established the national anti-terrorist medical rescue system, and successfully improved emergency handling capability

Relevant national committees, bureaus, and offices, and medical rescue resources in game regions, were comprehensively integrated; an integrated medical rescue command system for game regions and the Games was established; NBC safety laboratory networks were improved; and surveillance and alert systems for terrorism medical rescue, comprehensive information platforms, and an anti-terrorist medical rescue stockpile were all set up. Systems were set up allowing the departments of public health, national security, public health, environmental protection, work safety supervision, civil aviation, railway, fire protection, and other relevant departments to share anti-terrorist information with one another. Relevant information concerning emergency medical treatment, health surveillance, disease control, blood collection and supply, and psychological crisis intervention was likewise networked; and, for the first time, national and local finance departments were given assistance in procuring the necessary storage of diagnostic kits, effective vaccines, antidotes, toxic, anti-radiation drugs, medical equipment, personal protective equipment, and disinfection devices.

Regional government and medical rescue base equipment was acquired. During the “Good Luck Beijing” Test Events and the Olympic Games themselves, for the first time, national and local terrorist response and rescue departments unified procedures for reporting, warning, and circulation of information. During the national anti-terrorist comprehensive drills, the national anti-terrorism work coordination group took part in self-inspection and expert assessment. Great improvements were achieved in regards to the national and local medical rescue systems, the legal system, and emergency preparedness and response plans. Similar improvements were made to emergency response capability and management of medical rescue services, epidemiological investigation capabilities, contaminated area control capacity, medical emergency and emergency services, ICU and other disciplines in hospitals, blood collection and supply guarantees, and psychological crisis intervention.

Improved relevant laws and the emergency preparedness and response plan system for medical rescue after terrorist attacks: adoption in long-term management mechanisms

As part of the Beijing Olympic anti-terrorism preparatory work, various laws such as the national anti-terrorist laws, the national emergency response law and municipal policies were enacted, amended, and/or promulgated, thus becoming better aligned with international terrorist laws. Additionally, emergency preparedness and response plan systems were set up to carry out scientific classification and graded responses, and to bring medical rescue into long-term management mechanisms for governance of public security.

Discussion

Improve the understanding of the overall risks and threat of potential terrorist attacks, and implement the idea of anti-terrorism medical rescue

Modern terrorist organizations are complicated, diverse, and have international sources. They can cause very great damage to societies, economies, politics, and public security in a short time. It is therefore necessary to strengthen government leadership, unify command systems, overall coordination, and the capability to react to risk in order that terrorist attack risks can be comprehensively defended against and effectively controlled.

Establish and improve national anti-terrorism medical rescue systems, and make them a normal management model

Terrorist attacks are violent activities initiated by terrorist organizations using different kinds of materials or devices, which are premeditated, planned, organized, with political aims, and often targeting MGs and crowded places. They often cause large-scale damage to infrastructure, severe economic losses, deaths, psychological panic, and social turmoil. It is therefore necessary to establish a unified, authorized, and highly efficient national anti-terrorism medical rescue system.

To do this, organization and leadership must be enhanced; cooperation between armed forces and local governments must be promoted, resources must be integrated; and long-term mechanisms of regional management must be implemented. The facts have shown that improvement of the anti-terrorism medical rescue system, promotion of medical rescue capability and strengthening the management of these services are important measures for the control and reduction of terrorist attacks, and important bases from which to guarantee successful MGs.

Thoroughly improve standards and technical specifications, and consistently enhance the capability and management level of anti-terrorism medical rescue

Until now, the Chinese government has not promulgated anti-terrorism medical rescue work standards and diagnosis standards and treatment principles for those immediately impacted by terrorist attacks. Spot rapid testing and emergency response capability still need further improvement. Relevant WHO technology guidelines and national treatment standards should be familiarized and considered, especially in the formulation of national anti-terrorism medical rescue standards and specifications. In this way, comprehensive improvements can be made to the capability and management of anti-terrorism medical rescue.

Promote international cooperation, establish and improve three networks, and establish the new mechanisms for linkage and joint control of groups

Terrorist attacks are international, with global knock-on effects, therefore international anti-terrorist organizations should be allowed to work unimpeded. All nations should promptly summarize their experiences and lessons of terrorism medical rescue, promote international cooperation and the free exchange of this information, and speed up the improvement of international, national, and regional surveillance and alert networks while building further medical rescue and laboratory networks. In this way, new mechanisms for linkage and joint control of anti-terrorism and medical rescue groups can be continually improved.

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Chapter 10

Vector control

Zeng Xiaopeng[1], Liu Zejun[2], Zhang Yong[1], Ma Yan[1], Yu Chuanjiang[2]

Outbreaks of infectious disease that are spread by insect vectors such as mosquitoes, and rodents, pose a serious public health threat wherever these vectors exist, and in particular in the circumstances of mass public events like the Olympic Games, where very large numbers of people are in close proximity. Accordingly, prevention of such vector-borne outbreaks was a key consideration for the Beijing Games.

The most common insect vectors in China are mosquitoes, fleas, flies, cockroaches, bugs, lice, midges, blackflies, gadflies, sandflies, tick and mites [1].

According to Ministry of Health statistics in 2007, the top three causes of vector-borne diseases were malaria, hemorrhagic fever with renal syndrome (HFRS) and Japanese encephalitis (JE) [2]. Others among 37 officially notifiable diseases in China include dengue fever, kala-azar (black fever), plague, epidemic and local typhus and West Nile Virus (WNV).

Rodents, mosquitoes, flies and cockroaches are most active in the summer, a season that provides conditions for the spread of infectious diseases. The influx of people and goods from endemic areas of the world also adds to the risk of outbreaks. Mosquito bites could affect the athletes', affecting their performances during events. Rodents such as mice bite power cables and damage electricity supplies, thus may impact the functioning of electrical equipment at the Games seriously affecting the Games.

Vector control measures were established in Beijing for the 2008 Games with the aim of reducing disease risks throughout the whole event, keeping the density of vectors at the lowest possible levels, and avoiding negative impacts people's health. In the implementation of the vector control programme, it was also necessary to improve the infrastructure, organize a professional team, and build a scientific, standardized and normalized vector risk analysis system. The creation of a highly efficient surveillance system in Beijing would also improve vector control capacity after the Games.

Standards and approaches

The International Health Regulations revised and published by the World Health Organization in 2007 include regulations about vectors. Industrial health standards have been listed in "Infectious Disease Prevention Act of People's Republic of China" and other national laws and regulations, including "Anti-rodent, Mosquitoes, Flies, Cockroaches Standards". Other stronger measures were included in the Guideline for Controlling of Vectors in Olympic Venues, enacted by the Beijing Health Bureau. All the measures proposed were in the special context of the Games: and considered factors such as world-wide attention, dense population and the high mobility of people.

1.Beijing Centers for Disease Control and Prevention
2.Beijing Patriotic Health Campaign Committee Office

Surveillance methods

A range of surveillance methods were employed for rodents and insects, including density and pathogen surveillance, the latter related in particular at transmission of West Nile Virus [3-6], for which two new detection methods were introduced [7,8]. Drug resistance surveillance was used to detect the resistance of cockroaches and houseflies to commonly used insecticides in Beijing.

Control Approaches

Approaches to vector control varied among different Olympic venues and regions. In Beijing, the chosen approach was to eliminate breeding grounds of mosquitoes and flies. Furthermore, chemical measures were employed, and other methods such as protective nets and window screens were also installed in certain parts of the Olympic stadium.

Work crews spraying pesticides for mosqutio larvae around the Bird's Nest

Plans and Actions

Some lessons have been drawn from the study of the vectors prevention measures taken in Sydney and Athens during the previous Olympic Games. In the 2000 Sydney Olympic Games, a brochure on the comprehensive measures against the prevention of pests was published [9]. At the 2004 Athens Olympics Games, great importance was attached to mosquito surveillance and control [10].

Together with the Beijing Municipal Patriotic Health Campaign Committee and Beijing Centers for Diseases Control and Prevention, the Beijing Health Bureau introduced some measures at a very early stage. In 2005, it published "Plans of the control of vectors for the purpose of a healthy Olympics" which became the vector control guidelines for 2008 Games.

The objectives of the action plan were to effectively lower the density of the vectors in high priority places, and to guarantee that the vector density in the Olympic stadium, Olympic village and the surrounding areas met the proposed standards for the Games.

The two main desired outcomes are: first, that the health of the athletes, and their performance would not be affected; second, that the health and safety of other participants, foreign visitors and local citizens could be guaranteed.

Organization

The Service Department of the 2008 Beijing Olympic Games Organizing Committee, the Beijing Health Bureau and the Beijing Municipal Patriotic Health Campaign Committee published in May 2008 "Guidelines of Vectors control in the Olympic Stadia" (Service Department of 2008 Beijing Olympic Games Organizing Committee [2008], No.133) which also clearly detailed the responsibilities of the various partners.

Firstly, the 2008 Beijing Olympic Games Organization Committee had the leadership role, the Beijing Municipal Patriotic Health Campaign Committee was responsible for program implementation, and the Beijing Centre for Disease Control and Prevention was responsible for density surveillance in the seven Olympic stadiums.

The document also clarified the responsibilities of other important partners such as the regional patriotic health campaign committees, CDCs, and the stadium owners.

Action and training

In order to cope with and respond to sudden outbreak of vector-borne diseases and increases in vector density, the Beijing Government organized a team with 150 specialists. Similar teams were also organized by the MPHCC and the CDC.

Professional vector control teams were set up, requiring many staff and much financial support due to the various aspects and wide range of areas involved. Guidelines were published in March 2008, and all the team members in the programme were given intensive training leading to certification.

Between May 2007 and March 2008, more than 1,500 people took part in over ten vector control training courses. Special training on vector surveillance, control and assessment was offered in Olympic host cities. Knowledge on vectors and health education was promoted among key tourist cities, stadium owners and volunteers.

Choice of pesticides

The programme of "The Application, Appraisal and Other Regulations on the Vector Control in the Olympics" was launched by the Centers for Disease Control and Prevention in February 2007. It aimed to study safe, highly efficient chemical pesticides that could quickly and extensively control relevant vectors in and around the Olympic venues. Pesticides had to meet the following requirements: the ingredients must be recommended by WHO [11]; they must be registered in China and could be bought in bulk; and be environmentally friendly.

Unified controls

Unified control over mice was undertaken in the spring of 2008 by Beijing Municipal Patriotic Health Campaign Committee, and unified control over mosquitoes and flies was undertaken monthly from May to July of 2008.

Supervision and checks

Vector control checks were carried out twice by specialists in all Olympic venues in May and June 2008.

Findings

Apart from standard daily vector surveillance from 2006 to 2008, additional surveillance was conducted which focused on the Olympic venues. The number of surveillance points expanded to 3,005, with 1,032 for mosquitoes, 1,022 for flies, 487 for cockroaches and 464 for rodents. These surveillance points were located in the 88 Olympic venues, 118 hotels serving the Games, 20 designated hospitals, and 18 counties.

Surveillance for mosquito density around the Bird's Nest using carbon dioxide traps

Surveillance results

Seven species of mosquitoes were found in the venues, 97% of which were *Culex pipiens pallens*. Eight species of flies were found, with Sarcophagidae most common (46%). Three species of rodents were found, with the *Mus musculus* domestic mouse most common (63%). Most cockroaches were *Blattella germanica*. (Figures 1-4). The density of the mosquitoes, flies, cockroaches and rodents were comparatively low in 2008 (Figure 5). The proportion of the vectors in the Olympic venues and the changes in density were well known throughout the surveillance period [12].

Pathogen surveillance

A total of 360 surveillance points to collect mosquitoes were set up in 30 Olympic venues, 15 non-competition venues and 43 training halls. Between 2006 and 2008, 6,118 mosquitoes were found in venues and 16,157 mosquitoes were found in non-competition venues and training halls. All results were negative.

Drug resistance surveillance

Chemical prevention was the major means of vector control, and laboratory tests were used to monitor pesticide resistance among flies and cockroaches. All flies in the area of the venues were found to have developed some levels of resistance. However, resistance was found in only a small number of cockroaches.

Control

The Integrated Pest Management (IPM) strategy was adopted for control [13, 14], with methods differing from region to region.

Controlling mosquitoes and flies by car-mounted ultra low volume pesticide spray

Research on prevention methods

The Recommended List of Medicines and Equipment for the 2008 Beijing Olympics Vector Control was released in 2008 on the basis of field experiments. The applicability of the pesticides and rodenticides was assessed and then combined with the results of the drug resistance assessments. A total of 49 pesticides and rodenticides are listed.

The Guidelines for the comprehensive prevention of vectors for 2008 Beijing Olympics gives detailed descriptions of the goals, methods for controlling of mosquitoes, flies, cockroaches and rodents, and also of the proper and safe usage of the equipment. In addition, "Vector prevention plans for the 2008 Beijing Olympics" and the "Vector preliminary prevention measures in emergency Situations for 2008 Beijing Olympics" were published.

Results

The average density of rodents in the 88 Olympic stadiums dropped from 0.15% to 0.06%, 60% lower than that in the same period in 2007. The average of cockroaches was 0.002%, 99.92% lower than that in the same period in 2007. The density of mosquitoes dropped from 9.79 to 2.79, 87.55% lower than that in the same period in 2007. The density of flies dropped from 25.73 to 7.69, 87.03% lower than that in the same period in 2007.

Figure 1. Mosquito density

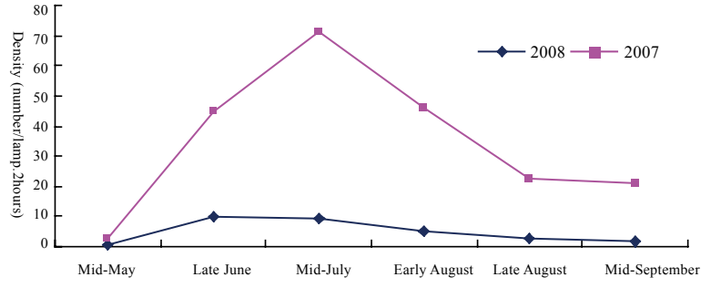


Figure 2. Fly density

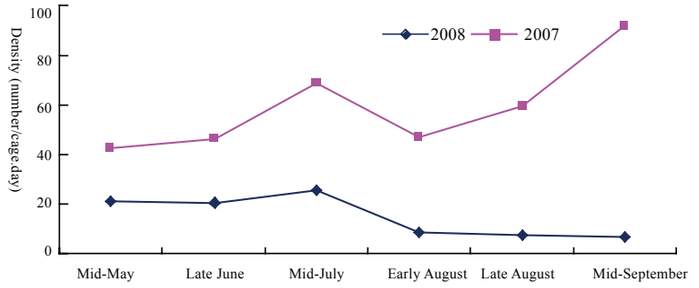


Figure 3. Rodent density

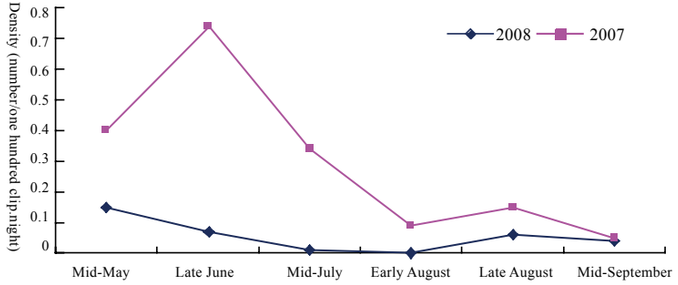
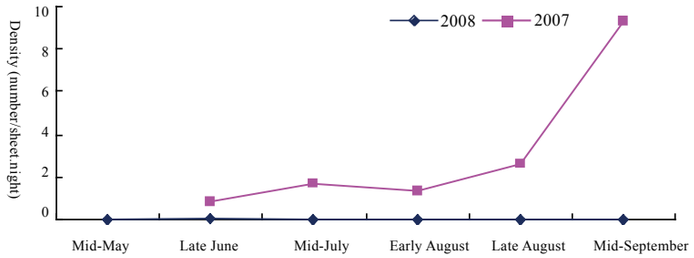


Figure 4. Cockroach density



During the period of the Games, the density of mosquitoes, flies, cockroaches and rodents were maintained at a very low level [15]. (Figures 5-8)

Figure 5. Mosquito density, Olympic Central Area (2007-2008)

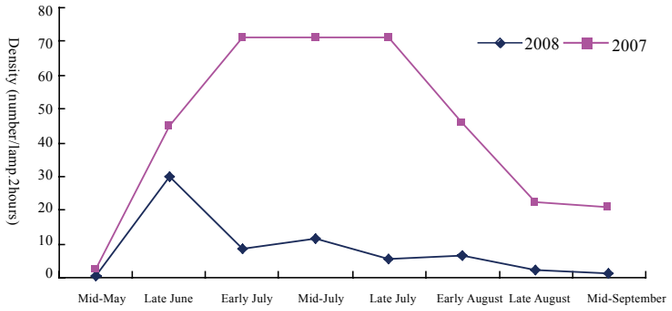


Figure 6. Fly density, Olympic Central Area (2007-2008)

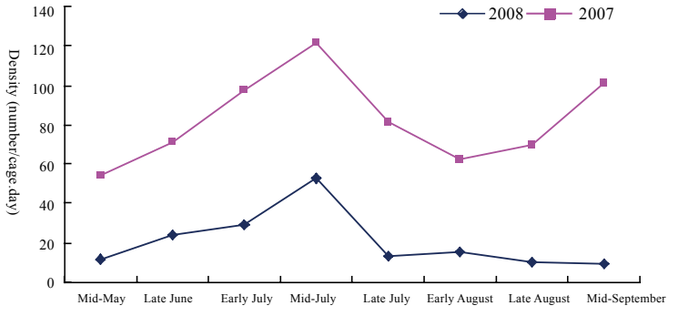


Figure 7. Rodent density, Olympic Central Area (2007-2008)

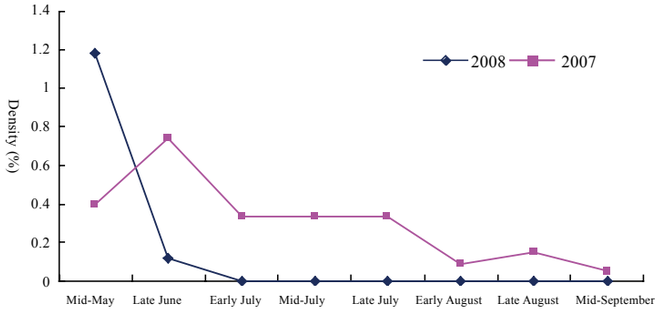
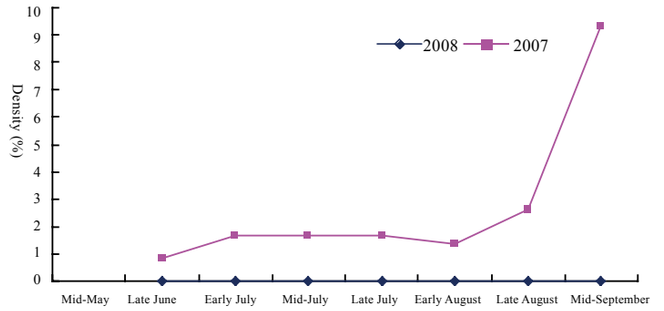


Figure 8. Cockroach density, Olympic Central Area (2007-2008)

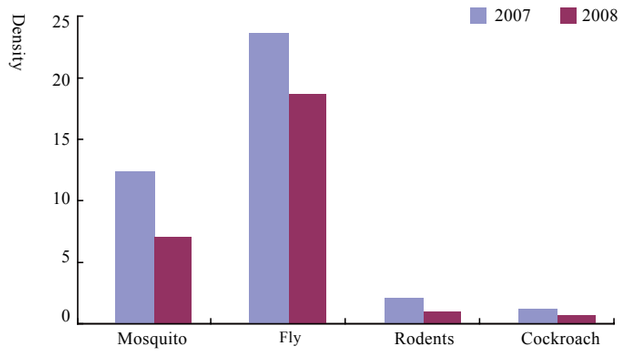


Opening and closing ceremonies

A questionnaire survey was conducted among 220 spectators, both foreign visitors and locals, as well as staff. No traces of rodents and flies were found and the detection rate of mosquitoes was 0% [16].

Within a two-kilometer radius of the stadium the density of rodents, mosquitoes, flies and cockroaches were all found to have dropped.

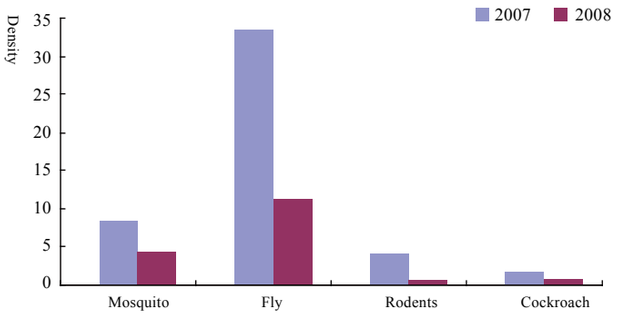
Figure 9. Density of vectors two kilometers around stadium (2007-2008)



Vector density in Beijing

Density of vectors within the city dropped sharply compared with that in 2007. Density of the mosquitoes was 42.40% lower; of flies, 20.81% lower, of cockroaches, 41.46% lower, of rodents, 19.56% lower. The density of particular species of rodents was 57.82% lower.

Figure 10. Vectors density for whole of Beijing (2007-2008)



Evaluation

An analysis was conducted on the decrease in densities of relevant vectors (see Control of the result). At the same time, a questionnaire survey among 2,992 residents in the districts of Changping, Shunyi, Shijingshan, Dongcheng, Xicheng, Haidian and Chaoyang was distributed.

In a random survey of 366 athletes, spectators, volunteers and others in seven venues, none of the respondents that they ever saw mice or cockroaches inside their rooms.

A total of 92.27% claimed never or only seldom to have seen a fly or mosquito and none complained about them. The survey results were in line with those from the prevention study, indicating that great progress had been made in controlling the vectors in the key venues. Spectators, athletes and volunteers thought highly of the efforts.

As for the 2, 992 questionnaires carried out among city residents 55.28% thought that there were few mosquitoes or flies in their houses, and 37.03% said believed they had never seen a mosquito. Most residents (67.11%) felt that there were few mosquitoes outside their houses. Only, 3.38% thought there were many mosquitoes.

Discussion and conclusion

No outbreak involving vector-borne diseases took place during the Beijing Olympic Games. Sporadic and imported cases of vector-borne disease came under timely control; there were no follow-up occurrences. Related data showed that, compared with the figures of 2007, major vector-borne disease occurrences dropped by different percentages during the Olympics, of which occurrences of hemorrhagic fever fell by 34.16%, Japanese encephalitis fell by 100%, dengue fever fell by 51.78% and malaria fell by 5.77% [17]. Vector density was controlled effectively in Beijing, especially in areas involved in the Olympic events, and no serious impacts on the game were attributed to vector-related problems.

Vector control for the Beijing Olympic Games involved a new operational scheme that required organization by government, coordination between departments, guidance from the CDC, implementation by the PCO and participation of the citizens. PCO is highly specialized. Introducing PCO as the main operating body of vectors control in big events such as the Beijing Olympic Games not only improved the efficiency of prevention and control by a large margin, but also helped to relieve the organizing party's shortage of human resources and technical equipment. However, in the implementation of the PCO, appropriate attention should be given to the standardization of training and quality control.

Some new detection and surveillance methods were introduced and GPS-GIS surveillance systems continue to be used for detection and surveillance of harmful vectors in Beijing. The vector risk assessment used for the Olympic Games helped to establish the framework of China's vector risk assessment system and the development of relevant standards. Therefore, priority should be given to technological research before holding large activities.

The Beijing municipal government also applied the above-mentioned operation scheme and detection and surveillance methods in addressing the cockroach problems among households. From December 2008 to March 2009, the government aimed to eliminate cockroaches in 1.54 million households, representing five million citizens. Surveillance results indicate that these actions lowered cockroach density in households by 91.68%, demonstrating an effective post-Olympic application of a strategy that had proved invaluable during the Olympics.

In addition, for big and influential events such as the Olympic Games, effective vector control is not the sole priority. Ensuring that the preventative and control measures are safe and environmental sound are equally important. For this reason, great emphasis was placed on the adoption of safe, effective, appropriate and environmentally sound chemicals and technologies for use in vector control. Corresponding operational norms and standards should be formulated in order to ensure that these technical measures will be successfully implemented.

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Chapter 11

Drinking water security

Wang Yi[1], Wei Xiangdong[1], Zhao Rui[1], Li Jian[1]

Water is not only an essential source of life but also a potential carrier of disease – the World Health Organization lists 27 different waterborne diseases – and other hazards. Thus, the safety of drinking water was a vital aspect of health security during the Games and had an important impact in China after they were over.

Beijing has long enjoyed good quality drinking water, drawn from both surface reservoirs and underground wells, with more than 6,000 water suppliers in the city. In China and especially in Beijing, the criteria for water quality are set by local governments to ensure it meets national standards. In its bid for the Games, Beijing pointed out that its drinking water also met the international standards set by WHO (2003 revision) [1] .

However, some difficulties did occur during preparations for the Games. The water in some areas of Beijing is particularly hard, which is potentially harmful to people's health; also tourists and athletes from western countries have different drinking habits. Furthermore, some delegations were doubtful about Beijing's water quality before the Games. In addition, millions of people were traveling to Beijing. In these circumstances, the biggest challenge was to ensure that the existing water supply system and the mode of management would guarantee water safety and people's health during the Games.

Regulations and standards

The Chinese national drinking water standards were revised, expanding the criteria and increasing the number of water quality parameters from the 35 established in 1985 to a new total of 106 among which 71 were new and 8 revised. These were published in a new edition of "Drinking Water Criteria" in 2006.

The new edition added four microbiological parameters, minimum limits for 3 types of disinfectant residuals, 59 chemical parameters, five aesthetical characteristics and physiochemical parameters. Revisions were also made to limits of total coliforms, arsenic, cadmium, lead, carbon tetrachloride, nitrate, turbidity and gross alpha activity.

The Beijing Health Bureau formulated a "Public Health Security Plan during the Beijing Olympic Games", with the following key objectives: no drinking water contamination at the Olympic venues, no severe drinking water contamination in the city, and no diarrhea or infection cases related to drinking water.

1.Beijing Municipal Health Inspection

Risk assessment

Risk factors were provided based on risk assessment and historical data with respect to pipeline contamination, bioterrorist attack, water contamination, contamination of secondary water supplies, and temporary indigestion caused by water with high levels of hardness. These risks could be prevented with safe and sanitary measures along with water treatment technology.

Sanitation and safety measures

From May 2008, the Health Bureaus of both the districts and counties were required to provide weekly drinking water quality reports on.

Online water quality monitoring and an early warning system were installed in the water line entering the Media Village and Athletes Village in order to detect water contamination and possibly prevent any terrorist attacks involving the poisoning of the water supply. Additionally, 180 continuous 24-hour monitoring sites were set in the Olympic Venues.

During the Games, Public Health Security Team members conducted daily inspections of the water supply system at the venues. An Emergency Response Team was formed to ensure drinking water safety throughout the city. The team was equipped with testing,

Water safety monitering

sampling and disinfection equipment and chemicals; were on permanent standby to respond to drinking water contamination incidents. The team took part in training programmes provided by the Beijing Health Bureau, which included a series of field exercises and desktop scenarios.

Strengthening government supervision

Before the Games began, public health departments examined the designs and construction plans of water supply facilities in the Olympic venues, non-competition venues and Olympic contracted hotels. Inspections were carried out once the construction was completed, and prior to the issuance of drinking water supply licenses. Sanitation supervision and water quality monitoring were also conducted at different levels during the sporting events.

Where and whenever contaminants were detected in the tap water coming from new constructions at the venues, cleaning and disinfection was immediately conducted. Taps were replaced where necessary. However in some cases water pipes were left exposed to the air for lengthy periods before the replacement taps were fitted. As a result, the total bacteria and coliforms were found to exceed permitted levels, and rigorous disinfections of the tap drinking system with chlorine dioxide were carried out. After further cleansing another examination was conducted to ensure microbial safety standards were met. In this manner, the safety of the drinking water system at the venues was guaranteed.

Figure 1.Online monitoring data of drinking water

Furthermore, there were no complaints in regards to drinking water quality during the Games.

Monitoring results

During the Games, 586 samples were collected from water supply facilities of 93 venues according to the established criteria. These samples underwent laboratory testing for numerous parameters including: total bacteria, total coliform group, Escherichia coli, disinfectant residual, colour, turbidity, odour, oxygen consumption, arsenic and cyanide. Also, water samples were taken from taps and tested for giardiasis and cryptosporidiosis. The laboratory qualification rate was above 90% [2].

Examinations were quickly arranged according to the water pipe distribution of the city possible changes of water quality. Compared with 5,024 samples at Athens Olympics, Beijing conducted an additional 3,847 samples. The Table 1 shows compliance rate of quick sampling reached 99.9%.

Table 1. Water quality test results at the venues during the olympic games

Items	Samples tested	Qualified items	Unqualified items	Qualified rate(%)
Colour	1,889	1,889	0	100.00
PH value	1,474	1,474	0	100.00
Total chlorine	141	141	0	100.00
Total hardness	44	44	0	100.00
Turbidity	1,478	1,477	1	99.93
Chlorine residual	1,785	1,784	1	99.94
Ammonia-nitrogen	923	922	1	99.89
Nitrite-nitrogen	160	158	2	98.75
Total				

Quality monitoring

During the Games, Beijing aimed to ensure the safety of drinking water from all sources and suppliers. The water quality of all the tap water suppliers in the city was guaranteed. The national standard for water hardness is 450 mg/L, but the water was able to limit the hardness to less than 380 mg/L. It was required that the water compliance rate of the water factory during the Olympic Games should reach 99%, but, in fact, it reached 100% based on the monitoring data acquired.

Before the Games, 267 samples of drinking water from 112 contracted hotels were collected. Altogether 1, 761 samples were taken and all of them met the standards. There were 238 pipeline bacteria testing spots and the compliance rate also reached 100% .

There were no public health emergencies related to drinking water during the Games and no reports of pipeline contamination, bioterrorist attack, water contamination, contamination of secondary water supply, or temporary indigestion caused by hard water among the working staff, volunteers and spectators. No serious water contamination was reported in the city. Patients at the clinics of the venues showed no sign of diarrhea and infections related to drinking water.

Discussion

Because most of the venues were new buildings that had been rarely used, the pipes could not be well washed and the water usually stayed in the pipes for a long time, which caused excess levels of turbidity and bacteria. Monitoring and testing of drinking water should be conducted before the Olympic Games to detect and eliminate potential risks as quickly as possible.

Based on the experiences of the Sydney Olympics in public health monitoring and the characteristics of the Beijing Olympics, a combination of laboratory testing, on-site testing and 24-hour online testing was applied which solved problems of insufficient frequency of monitoring and the lack of staff. The multi-dimensional monitoring scheme laid a foundation for the management of the online monitoring network - consisting of 50 testing locations - in Beijing to be built after the Olympic Games.

Because quality control in laboratories can affect the accuracy of water testing result, laboratory quality control must be strengthened. Before the Olympic Games, China CDC, Beijing CDC, district CDC, and the laboratory of Beijing Water Group were designated as water testing laboratories for the Games. This multi-level laboratory network undertook different tasks of water testing. All the testing equipment in the laboratories was officially approved by to make sure that data obtained were precise and reliable.

Recommendations

Drinking water security measures should start at the time the venues are being constructed. Public health departments should be involved in the design, commissioning, and signing off of the venues in order to avoid the significant financial losses and time wasted due to additional, post-commissioning, modifications that must be made in order to address potential contamination risks. In addition, increasing public awareness of water sanitation through the media has also proved to be very effective.

Through the improvements made to drinking water system infrastructure and management prior to and during the Olympics, Beijing has emerged as a leader in the country for its capacity to ensure safe, high quality, municipal drinking water. To date, no severe drinking water contamination emergencies have occurred in the city, which has been invaluably beneficial to its residents has been invaluably beneficial to its residents. The experiences gained in drinking water security during the Games have already been applied to a series of big events elsewhere in China, such as Harbin 2009 Winter Universiade, Shanghai World Expo, and Guangzhou Asian Games.

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Chapter 12

Ensuring and promoting food safety

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The previous chapter emphasized the importance of safe drinking water in general and during the 2008 Games in particular. This chapter takes a similar approach to food safety.

The safety of food is essential for any major sporting event for both athlete and spectator alike; just as it continues to be for the general public of the host country and the host city. However, the provision of safe and nutritious food during such mass gatherings poses unprecedented challenges not only for the food industry, but also for government authorities responsible for ensuring the safety of the food supply.

In preparation for the Games, to ensure food safety for athletes, spectators and the general public, existing food safety programmes were greatly strengthened and coverage was extended to all stages of the food production continuum, i.e. "from farm to table". In view of the characteristics of the food service for the 2008 Olympics, the Beijing Municipal Health Bureau adopted the concept of Hazard Analysis and Critical Control Point (HACCP) management, implementing a system of classified management in catering.

In the recent past, foodborne disease outbreaks have occurred at several major sporting events. Because of the national and international coverage that accompanies such major events, these outbreaks were widely reported in the media.

For example during the Athens Olympics test event the German rowing team had to quit the competition due to Salmonella infection. Such outbreaks are most unfortunate for the athletes themselves, but they are also disruptive to the competition and are an embarrassment for the host organization and country. Learning from these experiences, food safety is considered an essential component in the planning for any major sporting event. Capacities to rapidly investigate possible food-related disease incidents need to be strengthened, including necessary food tracing and recall systems. In addition, education and training of food handlers are important tools to promote voluntary compliance with food safety norms and are considered one of the most effective means for promoting food safety. In this regard, food safety education for the public not only improves food safety practices in the home, but also raises consumer expectations for safe food handling in restaurants and other food service establishments in the community. Therefore, major sporting events offer a golden opportunity to link the superior health status of world-class athletes with healthy food and physical activity choices by consumers.

This chapter describes the efforts to strengthen and promote food safety during the Beijing Olympics and discusses their possible impact on the health of Beijing residents in the future. Finally, the lessons and recommendations for future mass gatherings are presented.

1.Beijing Municipal Health Bureau
2.Beijing Municipal Health Inspection
3.Beijing Municipal Food Safety Office
4.World Health Organization

Description and evaluation of methods

On the basis of a food safety risk analysis the Beijing Municipal Government has long attached great importance to food safety, especially in catering and food service establishments. Beginning in 2004, Beijing began implementation of relevant Ministry of Health (MOH) regulations, focusing inspection efforts towards high-risk foods and processing establishments, including distribution systems and canteens. This was guided by the following MOH and Beijing Health Bureau advisory documents:

- Hygiene Standard for Food Enterprises and Food Delivery Units.
- Guide for Implementing HACCP in Food Enterprises.
- Provisions on Quantitative and Classified Management of the Catering Industry in Beijing.
- Evaluation Standard on Quantitative and Classified Management of the Catering Industry in Beijing.
- Provisions on Management of Hygiene Administrators in the Catering Industry in Beijing.
- Ten Key Issues on the Prevention of Food Poisoning.
- Key points of food safety proposed by WHO.
- Ministry of Health "Standard on catering and distribution systems".

In addition, the policy documents that specifically formulated for Beijing Olympics provide support on the food safety, such as:

- "Programmes on food safety in Beijing Olympic Games".
- "Programmes on urban operations public health in Beijing Olympic Games".
- "Requirements on management of public health in Beijing Olympic Games".
- "Requirements on health of distribution enterprise of service providers in Olympic Games".
- "Programmes on prevention of food poisoning in Beijing Olympic Games".

The Beijing Municipal Government made great efforts to generally strengthen the food safety programme in Beijing. Administration, inspection and laboratory services were provided with additional resources to update and expand their capabilities. For example, over 60 new food control laboratories were established throughout Beijing, including a mobile laboratory, and a food control laboratory build in the Athletes' Village. This

strengthening of basic food safety infrastructure provided a solid foundation for the Beijing Olympics.

In planning for the Olympics, policies, regulations and guidance documents were prepared to address various aspects necessary for strengthening food safety during the Games. The Beijing Municipal Government also undertook activities to help guide this planning, including convening a panel of Chinese and foreign expert advisors to provide expertise and experience on food safety relative to mass gatherings, including previous Olympic Games. Planning was coordinated with the Beijing Municipal Health Bureau in accordance with "Operation Guidelines for Beijing during the 2008 Olympics" and "Food Safety Management for Beijing during the 2008 Olympics".

A risk-based approach was used to identify key urban areas, and key catering and food service establishments for enhanced inspection and monitoring during Olympic Games. Key areas: Olympic venues (including competition venues, non-competition venues) and surroundings within a radius of around 1 kilometer, downtown district, key streets and tourist attractions. Key units: Olympic venues, official hotels, distribution enterprise, star-rated hotels, food chain enterprise, etc. Risk factors for foods were also evaluated, especially western foods, which were expected to account for 70% of the foods consumed at Olympic venues. In addition, food safety management of food delivery providers was strengthened. The following actions were taken:

- Developing a scoring system for catering and food service establishments using both quantitative assessment and letter classification of the establishment according the assessment, i.e., A for best to C for acceptable;
- Establishing an early warning system based on risk evaluation and symptom surveillance;
- Operating a comprehensive 24/7 emergency response centre;
- Training of personnel in inspection departments, and catering and food service establishments;
- Conducting multi-dimensional and real-time supervision of key processing steps at major food facilities using remote supervision and regular inspection by inspectors stationed on the spot;
- Conducting comprehensive hygiene monitoring and rapid testing covering all critical control points in catering establishments; and
- Establishing a tracing system for catering establishments based on purchase invoices for raw materials and on retention of samples of prepared foods.

By the end of July 2008, all the projected targets had been realized (Table 1). In order to communicate to the consumer the documented health level of the catering industry, health supervision institutions distributed free uniform grading signs to grade A and B catering industries, requesting such signs to be presented in a prominent position on the premises.

Table 1. Distribution of health level in Beijing catering before the Olympics

Grade	Number of catering establishments		Margin	Rate of change	Proportion in 2008
	2007	2008			(%)
A	1,687	2,590	903	53.5	7.2
B	6,486	15,396	8,910	137.4	42.8
C	19,863	17,992	-1,871	-9.4	50
D	7,445	0	-7,445	-100.0	0
Total	35,481	35, 978	497	1.4	-

Note: data collection took place in January 2007 and July 2008

The government distributed information, education, and training materials to staff involved in food preparation (chefs and cold meat chefs), and to the public, athletes, technical officers and spectators for free, to increase public knowledge on the prevention of food poisoning (Table 2).

Table 2. Distribution of free materials about food safety in Beijing

Name	Amount (per 10, 000)	Target audience
Prevention on food poisoning "ten key points"	10	Chefs,cold meat chefs
Health management guidelines in Beijing catering	5	Practitioners
Dining guidelines in A-level restaurants	2	General public
Food hygiene laws brochure	3	General public
Refrigerator magnet	2.5	General public
Health supervision publicity cartoons	3	General public
Food safety knowledge brochure	10	Athletes,technical officers,spectators
Total	35.5	

During the Games, at the Olympic core area, continuous video monitoring equipments were installed in relevant food catering establishments. A total of 30 cameras with 360-degree high definition carried out 24-hour continuous dynamic monitoring of the food preparation process. The system detected 38 behaviours that did not comply with the defined food hygiene standard.

Before the Olympics began, hygienic monitoring was carried out twice for the Olympic venues. The results showed an improvement in the compliance rate for the second round as compared to the first round monitoring. (Table 3)

Table 3. Monitoring of food samples in the Olympic venues

Monitoring time	Samples	Qualified	Pass (%)
First round monitoring(10-11 August 2008)	420	403	95.95
Second round monitoring(17-18 August 2008)	805	796	98.88
Total	1,225	1,199	97.88

Note: Samples were taken from cold meat dish, food utensils, containers and food operators' hands.

Olympic catering providers established a HACCP management system and carried out continuous monitoring of food processing at Olympic venues. The Beijing Municipal Health Bureau formulated the requirement for preserving food samples in the Olympic venues, thereby establishing a unified and standard operation system to preserve relevant food samples, to enable trace-back in case of food hygiene problems. During the Games, the public health protectors preserved a total of 27,746 food samples among all of the Olympic venues for this purpose.

Athletes' cafeteria in the Olympic Village

In addition to efforts to strengthen the food safety system in Beijing, health promotion approaches targeting consumers were also pursued. In discussions between the Beijing Food Safety Administration and the World Health Organization (WHO), it was recognized that there was a golden opportunity to launch a health promotion campaign for the general population linking the Beijing Olympics not only to food safety, but also to nutrition and physical activity. In identifying five key behaviours for each topic, "The 3 Fives" campaign was developed with the intent to promote healthy choices during the Beijing Olympic Games and beyond.

An initial printing of 1.2 millions copies of "The 3 Fives" brochures and posters in Chinese was disseminated in strategic locations, such as the airport, hotels, Olympic venues and in the community. About 200, 000 copies were printed in English. These materials were endorsed by the Beijing Organizing Committee for the Olympic Games (BOCOG) and carried the logos of the Beijing Olympics and Special Olympics. In addition, a poem version was published in Chinese to facilitate the memorization of the messages, and media, including TV, were used to promote "The 3 Fives" campaign. A Knowledge, Attitude and Practice (KAP) study to assess the long-term impact of "The 3 Fives" campaign on Beijing residents was conducted by the Beijing Food Safety Administration with support from WHO.

Related to "The 3 Fives", the Ministry of Health prepared an adaptation of the WHO brochure "Guide on Safe Food for Travelers" specifically for the Olympics. This brochure in Chinese and English was also endorsed by and included the logos of BOCOG. The brochures were distributed at the same strategic locations in Beijing, plus restaurants and certain tourist destinations. In addition to information on avoiding food borne diseases while eating out, the brochures included a hotline number to the MOH response team.

Findings, results and outcomes

The most important outcome was that no major outbreak of food borne disease occurred during the Beijing Olympics. Olympic participants appreciated the catering facilities in the Olympic Village, which provided most of their meals. The facility included a nutrition centre staffed by professional nutritionists where athletes and their coaches could obtain information on nutrition and food safety, including "The 3 Fives". Other than a few sporadic cases, the food safety controls at other catering and food service establishments throughout Beijing also performed well, which, no doubt, added to the enjoyment and good memories for Olympic spectators.

A number of direct and indirect indicators also suggest that the management of food safety during the Olympics was successful. These include:

- Distributions of classifications (A to D) for catering and food service establishments were higher;
- Work records showed less absenteeism;
- Surveys of health personnel's knowledge showed improved understanding of food safety laws and regulations;
- Surveys of public satisfaction with the management of catering and food service establishments showed a marked improvement;
- Acceptance rates of laboratory tests of food improved; and,
- Beijing ranked high in comparison of food safety indicators with other host cities.

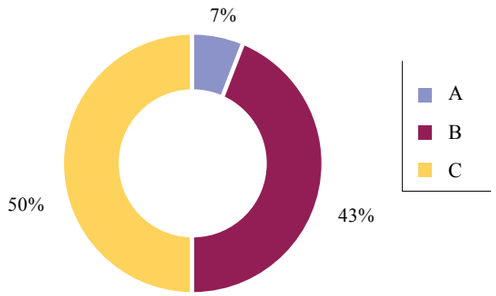
The fact that no foodborne disease outbreaks occurred suggests that food safety management at the Beijing Olympics was successful. This is also confirmed by the comparison of number of food poisoning incidents patients with the same period in 2007 in the Beijing area before and during Olympics, which showed a significant decrease. This success was the result of efforts undertaken in advance of the Games to improve the status of food safety in Beijing. For example, the number of catering and food service establishments receiving a hygiene classification of A or B increased during the time immediately before the Games. This was reinforced by greater public awareness of food safety, which was reflected in a preference by consumers to dine at grade A or B

establishments. There was also a continuous decline in the number of complaints related to food hygiene (Table 5).

Table 5. Comparison of number of food poisoning incidents and complaints during the Olympics with the same period in August 2007

Type	August 2007		August 2008	
	Incidents	People	Incidents	People
Food poisoning	12	312	2	34
Complaints	1,051	-	794	-

Figure 1.The distribution situation of health classification in 2008 Beijing catering



Regarding food safety promotion, an assessment of the effectiveness of "The 3 Fives" campaign was conducted by the Beijing Food Safety Authority and the Municipal Centers for Disease Control (CDC) with the support of WHO. A community-based study on knowledge, attitude and practice (KAP) study was undertaken from August in 2008 to February in 2009 in 8 suburban communities of Tongzhou County. This county was selected because it was not involved in the original campaign, which was run in central Beijing. The study was composed of two phases:

Phase 1 of the study (August - December 2008) was carried out to evaluate the KAP impact of brochure and poster distribution in order to simulate the large dissemination of these materials that had begun in March 2008 in central Beijing. A baseline survey instrument (a questionnaire with 49 items) for assessing "The 3 Fives" was developed.

The items of the questionnaire encompass KAP on all of the key messages described in "The 3 Fives". Among the 8 communities, 500 residents in 4 communities were randomly selected as the control group and only received a baseline survey administered by local CDC staff. Another group of 500 residents in the other 4 communities were selected as the "intervention" group and received "The 3 Fives" brochures and posters after completion of the same questionnaire. In November 2009, a follow-up survey of both groups was conducted using the same questionnaire composed of the same items.

Phase 2 of the study (February in 2009) was conducted to evaluate the effectiveness and acceptability of health education workshops given by a health promotion professional. The workshop was supplemented with a "The 3 Fives" cartoon booklet written in lay terms and containing around 15, 000 Chinese characters. About 100, 000 copies of this booklet had already been distributed elsewhere in Beijing. For this study, a group of 40 residents was selected to participate from Tongzhou County. Another group of 56 residents were selected from Changping County. All subjects were given a one and a half hour public education lecture by an experienced health promotion professional who explained the rationale of "The 3 Fives" messages and how to implement the recommended behaviours in Chinese context. One cartoon booklet was given to each subject to help them to retain the key messages. Following the education activity, a survey to assess KAP on "The 3 Fives" was undertaken by CDC staff. Results of 40 completed surveys from Tongzhou County and 58 surveys from Changping country were analyzed. Comparison of correct answers and adopted practices reported from the two surveys were used to identify the changes due to the three different levels of interventions, namely:

Control versus brochure/poster group.

Control versus education workshop/booklet group, and

Brochure/poster group versus education workshop/booklet group.

After distributing "The 3 Fives" brochures and posters, the percentage of correct responses on several questions were significantly higher in the intervention group. However, there was no significant difference observed on physical activity between the baseline control group and endpoint intervention group. This could suggest that achievement of behaviour change requires long-term intensive intervention instead of just receiving a brochure, but could also be due to a generally high level of knowledge in this area in the general population.

In Phase 2 of the study, results of "The 3 Fives" KAP study in Tongzhou county comparing surveys before and after an education workshop and booklet distribution (N=40) indicated a significantly higher correct response in post-education group.

In addition, there were higher percentages of correct response to questions in regards to recommended behaviors in food safety and health diets among the survey participants post education workshop.

Discussion

The Beijing Olympics tested the ability of the city and the country to ensure a high level of food safety. The experience accumulated will continue to play a role in ensuring food safety for urban residents in the post-Olympic period. Experiences can be summarized as follows:

1. At all levels, the government of China attaches great importance to food safety and to building the capacity of law-enforcement teams to ensure compliance with laws and regulations. This consensus provided strong support for food safety in the preparations for the Beijing Olympics.

2. A supervision model was developed to monitor and control the whole process from raw materials, storage, transportation, and processing, including final food delivery, to identify and reduce foodborne risks along the entire food continuum.

3. A quantitative and classified management system for the catering industry helped to promote industry self-regulation, phase out unqualified food establishments and improve food safety standards in the city.

4. Large-scale cold chain food deliveries helped to reduce the risk of foodborne outbreaks. Microwave technology was also used in catering service vehicles to heat food on the spot, which shortened the time before consumption and reduced food risks.

5. Training of food hygiene administrators and 100, 000 chefs as well as non-Chinese catering staff also contributed to safer food handling during the Olympics.

6. Many government departments, such as health, industry and commerce, administration, public security, tourism, agriculture, quality inspection, etc. worked together to ensure food safety. At the technical level, more stringent requirement on issuing hygiene permits were implemented. Long-range monitoring systems raised the efficiency of supervision and can be further utilized after the Games.

7. To supplement the law enforcement capacity, a large number of health supervisors from 15 other provinces (municipalities) provided efficient additional support.

8. The “3 Fives” represents a multidisciplinary consensus on key health messages. The timely development of “The 3 Fives” was the result of an extraordinary degree of cooperation and good will among all involved parties. On the Chinese side, this collaboration involved the Ministry of Health, the Beijing Food Safety Administration and BOCOG. On WHO’s side, this collaboration involved the Office of the WHO Representative in Beijing and three departments in WHO Headquarters, namely Food Safety, Zoonoses and Foodborne Diseases, Nutrition for Health and Development, and Chronic Diseases and Health Promotion. The outcome of the KAP analysis indicates that although brochures and posters appear to contribute to participants’ knowledge of food safety and diet, the results of the physical activity part of the survey are less clear.

Lessons and recommendations

1. The strengthening of basic food safety infrastructure, including administration, inspection and laboratory services, is the foundation for building capacities for assuring food safety during mass gatherings.

2. In addition, resource for food safety should be committed at an early stage to allow for planning and preparation for the events involving large numbers of people. Because there is a large number of Olympic staff and volunteers of different categories who are closely related to Olympics, the safety of their food supply should be taken into account in the planning. In this regard, the most useful documents for planning for a mass gathering are shown below:

“Work Plans for Food Safety Inspection”.

“Requirements on Olympic Food Safety Management during Olympics”.

“Training Manuals for Catering Service Providers”.

Currently these documents are only available in Chinese.

3. Regarding health promotion, “The 3 Fives” campaign or similar integrated promotion can be useful in raising awareness of specific actions that people can take to improve the safety of their food, make their diets healthier and increase their level of physical activity. Coupled with a more intense education programme, these messages can be effectively reinforced. In the best case, such health messages should be mainstreamed with the various media covering the event, including television, radio, print and Internet.

Chapter 13

Air quality and control

Ken Fitch[1], Lu Yong[2], Chen Tian[3], Ming Dengli[3], Song Qiang[3]

Air quality was regarded as a problematic issue at the 1968 Olympic Games in Mexico City, but was overshadowed by the physiological problems of altitude. Before the Los Angeles Games in 1984, air quality (abbreviated in this chapter to AQ) was of concern to some experts [1] and National Olympic Committees (NOC) but no known specific measures to improve it were undertaken. Because many residents left the city for summer holidays and traffic restrictions were imposed near Olympic venues, air quality improved significantly although only for the two week period of the competitions. During the 1996 Games in Atlanta, traffic restrictions were imposed and their impact was examined. The resultant lower peak daily ozone (O_3) concentrations correlated well with reduced childhood asthma [2].

In 2008, the city of Beijing, which covers 16,410km2, had 16.95 million residents and 3.5 million motor vehicles and was undergoing rapid economic and social development. These circumstances combined with local geographic and meteorological factors were important reasons why AQ was a major environmental issue in the Olympic city. When China was bidding to stage the Games, concerns about air quality in China and especially in Beijing were acknowledged and China's bid included assurances to the International Olympic Committee (IOC) to improve it.

After being awarded the Games in 2001, China began planning these improvements. In 2007 after adverse press publicity about air quality in Beijing and with the IOC's focus on the health of athletes, the IOC Medical Commission (IOC-MC) established an Air Quality Expert Panel to monitor data and advise the IOC. This was undertaken because inferior AQ could result in adverse consequences on the health of Olympic athletes.

Athletes who exercise vigorously breathe large volumes of air every minute and if the air is contaminated with pollutants, athletes with asthma are liable to be more severely affected than their rival non-asthmatic competitors. Through the Air Quality Expert Panel, and with co-operation from the Beijing Environmental Protection Bureau (BEPB), the IOC-MC monitored AQ data prior to and during the Games.

This chapter examines in detail why inferior air quality is harmful to exercising athletes, the measures undertaken to improve it for the Games, the outcomes of these actions during the Games, and their subsequent impact. This will include the policies established and implemented, their outcomes on the city of Beijing and neighbouring cities and provinces, AQ data during the Games with any consequences to the health of the 10, 810 athletes as well as lessons learned and legacies for the future.

1.International Olympic Committee Medical Commission
2.Lung Function Laboratory Chao-yang Hospital Beijing
3.Beijing Environmental Protection Bureau

Effects of air pollutants on athletes' health, especially asthmatic athletes

There are three reasons why exercising athletes are at risk when inhaling polluted air[1]. First, the quantity of pollutants inhaled varies in proportion to the minute ventilation (V_E). The more intense the exercise and the longer its duration, the greater the quantity of air and thus pollutants is inhaled. Second, during vigorous exercise, a greater percentage of air is inhaled through the mouth effectively bypassing the normal nasal mechanisms which allow filtration of large particles and soluble vapours. Third, the increased velocity of airflow carries pollutants deeper into the respiratory tract. Athletes with asthma will experience more severe consequences than their non-asthmatics competitors [3].

Carbon monoxide (CO), derived from the incomplete combustion of fossil fuels, is detrimental to athletic performance [4-6]. It combines with haemoglobin in preference to oxygen (O_2), resulting in less O_2 being transported and available to muscles causing reduced maximum oxygen uptake (VO_2 max) and work output. Nitrogen dioxide (NO_2) is formed during high temperature combustion especially from automobiles and can be absorbed by the mucous lining of the nasopharyngeal cavity, where it is converted to nitrous and nitric acids which can cause respiratory symptoms, such as pharyngeal irritation, cough, and dyspnoea [7].

With shorter term exposures to NO_2, asthmatics have been shown to experience significantly greater increases in airway resistance than non-asthmatics [8].

A potentially serious risk to exercising athletes is posed by O_3. Decrements in lung function result from exposure and there is evidence that athletic performance may be affected with deleterious effects occurring even at low ambient O_3 levels [9]. O_3, which is derived from the chemical interaction of hydrocarbons with nitrogen oxides (NO_X) in the presence of sunlight, is especially detrimental to the exercise performance of asthmatics [10, 11]. Sulphur dioxide (SO_2) is produced from burning fossil fuels predominately from industrial sources. Exposure to high concentrations can cause narrowing of the airways because mediator release from mast cells in the respiratory tissues is stimulated by SO_2 [3,4,12].

Asthmatics are generally ten times more sensitive to SO_2 than non-asthmatics, especially when exercising and asthma is exacerbated by SO_2 [13]. Particulate matter (PM) is divisible into larger particles, PM_{10} (less than 10 μm in diameter) which emanate from dust and the construction industry and smaller particles, $PM_{2.5}$ (less than 2.5 μm in diameter) and ultrafines (PM_1, less than 1μm) which are principally by-products of combustion from diesel and automotive engines.

In high concentrations, PM causes acute and chronic deleterious effects on the respiratory and cardiovascular systems [14]. Smaller particles are more likely to be deposited deeper in the respiratory tract and once in the alveoli, diffusive deposition increases.

The synergistic interaction between PM_{10}, SO_2, and water vapour may induce soot particles to transport sulphuric acid deep into the lungs, where the gas exchange surfaces are damaged and the capacity for oxygen exchange is decreased [15].

Official actions to improve air quality for the Games

After being awarded the Games, Beijing grasped this opportunity to improve its environment. With AQ identified as the top priority, a series of programmes to reduce air pollution were developed and implemented under the framework of the "Green Olympics". Between 2001 and 2008, and costing 140 billion Yuan, more than 160 specific programmes were implemented to control coal-burning pollution, vehicle emissions, industrial pollution, and dust.

Specific measures included reduced pollution from coal-burning with the natural gas supply usage increased from 1.4 billion m^3 in 2001 to 5.5 billion m^3 in 2008, the percentage of high quality energy rising from 48.9% in 2001 to 62% in 2008. All 16,000 small coal boilers and 44,000 coal cooking facilities in the urban area were converted to natural gas. A clean fuel heating service was provided for 94 000 families living in the old single-story houses in the central town's cultural protection zones.

To minimise vehicle emissions, the development of the public transportation system was a major priority and eight rail transit lines became operational between 2001 and 2008, with the total length of rail lines extended to 200 km by 2008. Public bus and subway fares were reduced to attract passengers.

More stringent vehicle emission standards were formulated – China IV emission standards for both light and heavy duty vehicles which are equivalent to Euro IV vehicle emission standards [16] - were implemented in Beijing in March 2008, two years ahead of the national schedule. More than 10,000 polluting old public buses and 50,000 aged taxis were replaced. All the 1,462 refilling stations, 1,387 storage tanks and 52 oil reservoirs in the city were required to adopt oil gas recovery retrofitting, and any that failed to meet this order were closed.

Industry was radically restructured to reduce industrial pollution. Between 2001 and 2008, more than 140 polluting factories were closed, transferred to other production, or relocated with technical renovation. Beijing's high polluting chemical and coking power generation plant was closed in 2006. The Environmental Impact Assessment Law [17] was strictly enforced.

No new projects which caused high levels of pollution such as the metallurgical industry, cement production or coal-fired power generation, were permitted to be established. In the urban area, building new coal-fired boilers and renovating or expanding existing coal boilers were not permitted. More than 10 local air pollution emission standards, including the boiler air pollutants emission standards, which were more stringent than national standards, were developed by the Beijing Municipal Government and implemented.

All four large-scale coal-fired power plants completed retrofits for desulphurization, dust removal and de-nitration, resulting in the emission levels of these plants achieving globally best practice. As required by the Cleaner Production Law [18], industries emitting volatile organic compounds (VOC) such as laundry, printing, furniture manufacture, automobile maintenance, and restaurants were compelled to undertake measures to reduce VOC.

Construction sites were closely supervised via an on-line monitoring system to enable the BEPB to enforce strict standards to control dust and adhere to Beijing's Environmental Standards for Construction Sites. A new road cleaning process was introduced, with suction sweeping and watering adopted in most of the urban road cleaning services. Through greening and re-forestation, an eco-shelter belt was established in the mountains, the suburbs and the urban area, which contributed to the rise of forest coverage from 44% in 2001 to 52.1% in 2008.

The air quality monitoring system was automated, extended to 27 stations and operated 24 hours a day. Real-time emission monitoring systems were installed at key sources of pollution such as power plants and major industrial furnaces to monitor the emissions. Air quality information was released daily via newspapers, websites, television and other media outlets. A large scale public communication programme with a focus on the "Green Olympics" and AQ was launched through various media to enhance public awareness of environmental issues. "Green Communities", "Green Schools", "One Less Driving Day", and other activities for public participation were organized.

With the support of the Ministry of Environment Protection, an Olympic/Paralympics Air Quality Action Plan was developed and implemented in cooperation with neighbouring Tianjin Municipality, Hebei Province, Shanxi Province, the Inner Mongolian Regional Administration, and Shandong Province to assist to provide optimal AQ for the Games.

During the period of the Olympic/Paralympic Games, tougher temporary measures were implemented in Beijing, including banning high polluting vehicles and alternate day automobile use via odd-even number plate control. Construction sites were shut down from 20 July until the close of the Paralympic Games while high polluting large chemical plants, 27 cement production plants, 140 concrete mixing plants, and 18 metallurgical and building material production plants were either temporarily shut-down or required to reduce production.

In neighbouring Tianjin city and Hebei Province, the metallurgical industry, polluting power generation plants and building material production were either shutdown temporarily or production reduced. In Shanxi province, Inner Mongolia, and Shandong province, coal-fired power plants reduced their production. Automobiles visiting Beijing were required to adhere to local rules and pre-1999 vehicles were prevented from entering the city. During the Olympic /Paralympic Games, the public was encouraged to take public transport; spectators holding competition event tickets were entitled to all day free public transportation (taxis excluded). Low emission and zero emission vehicles were used for the Games' service, including 500 electric, fuel-cell, and hybrid cars and buses.

In addition to the routine monitoring system, for enhanced awareness of Beijing's air quality situation during the Olympic/Paralympic Games period, 18 temporary monitoring stations were installed close to competition venues. A monitoring service was provided

for all major outdoor venues and along the routes of outdoor events such as the marathon. Close attention was paid to AQ forecast and assessment. A monitoring and forecast working team and an expert team were established with the participation of technical professionals and scientific experts, from various universities, meteorological and international institutions both from China and overseas. An integrated vertical monitoring network, utilizing satellite imaging and multi-level tower and remote sensing optical instruments was organized to carry out full scale monitoring on air pollutants. Different models were run to perform AQ forecasting based on monitoring data and meteorological information. This system provided a sound base for the smooth operation at the time of Olympic Games and provided technical support for decision-making in activating the air quality emergency plan.

Actions by BOCOG and Beijing Health Bureau

During the Beijing Olympic Games, 21 dedicated medical facilities provided medical services to athletes and NOC delegations from all over the world.

The medical teams on site were composed of doctors and nurses from these hospitals. Doctors were trained to deal with asthma attacks and allergic or anaphylactic reactions and to heed the guidelines of IOC-MC. A respiratory specialist was on duty in the Polyclinic in Beijing Olympic Village. The lung function laboratory at Beijing's Chao yang Hospital was designated as "dedicated pulmonary function testing laboratory for the Beijing Olympic Games" and was available to perform bronchial provocation or bronchodilator tests on athletes who may develop wheeze or asthma because of inferior air quality. In addition, this laboratory was able to test athletes who required beta 2 agonist drugs to treat asthma but who had not been tested in their NOC.

Actions by the IOC Medical Commission

The World Health Organisation's air quality standards of 2001 were updated in 2005 and were the standards considered by the IOC for the Games [19]. Accepting that China was a developing country and aware that WHO AQ Guidelines were merely for guidance and were not mandatory, the IOC's AQ Panel recommended that Interim Target-1 of the WHO AQ Guidelines for 2005 would be the most appropriate targets for the Beijing Games and should be adequate to protect athletes from major health consequences (Table 1).

Table 1. Interim target 1 with WHO 2005 air quality guidelines *in italics*

O_3 150µg/m^3 mean daily 8-hour maximum; (100µg/m^3)
NO_2 400µg/m^3 1-hour maximum; (200µg/m^3)
PM_{10} (PM< 10µm) 150µg/m^3 24 hour concentration; (50µg/m^3)
$PM_{2.5}$ (PM < 2.5µm) 75µg/ m^3 24 hour concentration; (25µg/m^3)
SO_2 125µg/ m^3 24 hour average; (20µg/ m^3)

The Air Quality Panel identified outdoor competitions involving one hour or more of continuous high-intensity endurance exercise as being those events in which athletes were most likely to experience respiratory problems and decrements of performance if AQ was unacceptably inferior. These included the men's and women's marathons, triathlons, cycling road and mountain bike races, 10 km marathon swims, 20 km walks and the men's 50km walk. Athletes participating in endurance events may breathe as much 100-150 litres each minute. AQ data was conveyed daily by BEPB to the IOC-MC and its AQ Panel. During the Olympic Games, AQ Expert Panel members made themselves available to review AQ evening forecasts prior to the days when one or more of these endurance competitions was scheduled.

Outcomes

The air pollution control programmes and action plan before and during the Games period resulted in major environmental benefits, with good or excellent air quality every day. Concentration of major air pollutants fell by around 50% compared with the same period of previous years, reaching the best level in a decade. The Olympic family and the athletes, the international fraternity and the citizens in Beijing were delighted with the cleaner air.

An Olympic/Paralympic Games Emergency Air Quality Action Plan during Extremely Bad Weather Conditions which had been prepared by the Ministry of Environment Protection in conjunction with the Beijing and Tianjin municipalities and Hebei Province was implemented just prior to the Opening Ceremony when Beijing encountered unfavourable weather conditions – high temperatures and humidity prevailed with slight winds – which were not conducive to disperse air pollutants. More stringent reduction measures to reduce pollution were required of industries emitting SO_2, NO_X and VOC.

This required shutting down or reducing production at 105 industrial plants in Beijing, 14 in Tianjin and 164 in Hebei province, while major sources of air pollution were subject to increased environmental controls in Shanxi and Shandong provinces and Inner Mongolia. These emergency responses coupled with improved weather conditions had an immediate impact, resulting in favourable air quality for the Opening Ceremony and commencement of the Games.

During the Olympic Games (August 8-24), the average daily concentration of major pollutants SO_2, CO, NO_2, PM_{10} was between 47-54% lower than the same period of previous year (Table 2). During the Paralympic Games (September 6-17), the average daily concentration of the same pollutants SO_2, CO, NO_2, and PM_{10} was between 48-57% lower than the same period of the previous year (Table 3).

Table 2. Air quality during the olympic period: Unit: mg/m^3

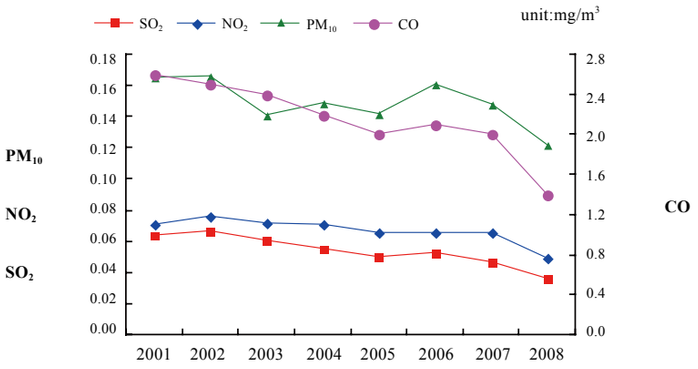
Pollutant Concentration	SO_2	CO	NO_2	PM_{10}
2008	0.008	0.8	0.023	0.057
2007	0.015	1.4	0.054	0.123
Percent change	-46.7%	-42.9%	-57.4%	-53.7%

Table 3 Air quality during the paralympic period: Unit: mg/m3

Pollutant concentration	SO_2	CO	NO_2	PM_{10}
2008	0.012	1.0	0.034	0.071
2007	0.023	1.8	0.073	0.166
Percent change	-47.8%	-44.1%	-53.4%	-57.2%

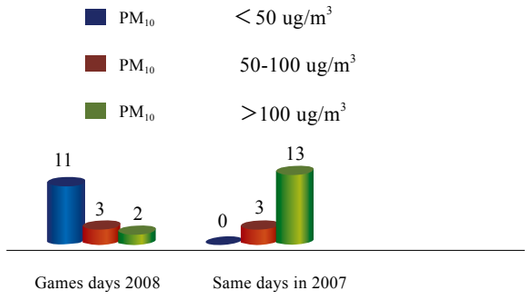
Air quality data demonstrated continuous improvement throughout 2008 Beijing enjoying 274 days with "good" AQ, meeting national Class two standards or better which roughly equates to Interim Target 1 of WHO 2005 AQ Guidelines. In 2008, the percentage of days with good AQ was 74.9%, a significant increase from 185 days (50.7%) in 2001 (Figure 1).

Figure 1. Air quality development trend 2001-2008



The data supplied daily to the IOC-MC by BEPB was from midday to midday and data on PM10 from midday on 8 August (Opening Ceremony) to midday 24 August (Closing Ceremony) i.e. 16 days is summarised in Figure 2.

Figure 2. 24-hour mean concentration PM_{10} comparing 2008 with 2007



Thus for 11 out of the 16 Game days in 2008, the concentration of PM_{10} met the highest WHO 2005 AQ Guidelines compared with not one day in 2007. As PM_{10} concentrations did not even approach the established critical concentration of 150μg/m^3 24 hours on any day, the Chair of the IOC AQ Panel was required merely to keep IOC AQ Expert Panel members regularly informed.

Because air quality in Beijing was far superior to that anticipated, asthma did not pose a problem with team doctors reporting virtually no untoward issues with their athletes.

Eleven athletes from eight NOCs underwent bronchial provocation tests in the dedicated pulmonary function laboratory and 12 athletes from 10 NOCs had spirometry performed in the Village Polyclinic. Only two athletes, both from track and field, were presented to the Polyclinic with acute asthma. One attended the evening before his event. Spirometry and a bronchodilator test confirmed the diagnosis of asthma and the athlete was immediately approved to inhale a beta 2 agonist. The second athlete was transferred from the stadium to the Polyclinic after her event, a relay. She had been approved to take prohibited asthma medication and she had recovered without additional medication by the time she arrived at the Polyclinic.

The large number of world and Olympic records set during the Beijing Olympic Games is further testimony that exercise performance was unaffected by AQ.

Further confirmation on the effectiveness of the AQ Action plan was provided by the United Nations Environment Programme's (UNEP) Independent Environmental Assessment— Beijing 2008 Olympic Games [20]. It concluded that many of the "Green Olympics" promises were met if not exceeded in some cases and a lasting environmental legacy has been left for Beijing, China, the Olympic movement and the world. Via their satellites, atmospheric scientists at NASA who analysed gas emissions over China found that NO_2 levels over Beijing were reduced by 50% during the two months that restrictions were imposed in 2008 compared with 2005-7 and CO was reduced by 20%.

The satellite pictures [21] clearly demonstrate that these reductions were observed over Beijing and not over other major cities in Eastern China. In 2009, Beijing won the first IOC Sports and Environment Award at the 8th World Sports and Environment Conference for its excellence in promoting environmental improvement at the 2008 Olympic Games.

Evidence of sustainability – the legacy

The multi-faceted actions undertaken to improve air quality at the 2008 Olympic Games have left an impressive and enduring legacy for Beijing. These comprise an enhanced public transport system including increased rail transit lines, the replacement of old polluting buses with new cleaner vehicles, and the early introduction of stringent vehicle emission standards.

It also includes improved dust control measures, both in the construction industry and road cleaning and post Games, the on-going removal from Beijing roads of all private vehicles one weekday each week. With the more environmentally-friendly power generation and the closure or relocation and renovation of high polluting factories and industries, Beijing has undergone radical changes to improve the environment.

Air quality issues have also been addressed ranging from public awareness to the "greening" and re-forestation of Beijing and surrounds, the development, adoption and implementation of major national and regional laws to improve AQ and the understanding and appreciation that cities and provinces can and do pollute the air of their neighbours.

With the addition of improved air quality monitoring equipment and systems to enhance AQ forecasting, these many accomplishments can be directly or indirectly attributed to Beijing being awarded the 2008 Games and the city's costly but effective measures to improve air quality.

The Beijing experience has demonstrated to the IOC that air quality at future Olympic Games should be carefully assessed and monitored from a health viewpoint. If indicated, the IOC should commence a dialogue with the Games Organising Committee to ensure that appropriate remedial actions are implemented as China in general and Beijing in particular undertook for 2008 Olympic Games with excellent outcomes.

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Chapter 14

Health emergency preparedness and international cooperation

Gao Xing[1], Bao Hua[1], Xing Jun[2], Li Libing[3], Maurizio Barbeschi[4], Cris Tunon[4], Lee Chin Kei[4]

Strengthening health emergency preparedness can make the difference between potential disaster and public protection at times of large-scale emergencies. A comprehensive system capable of responding to and dealing with such emergencies is essential to ensuring urban safety, public health, social stability, and promoting sustainable economic development.

After a long period of peace in China, during which there was little need for preparedness of this kind, the nation's public health emergency response system (PHERS), especially regarding mass gatherings, was weak when Beijing bid for the 2008 Games. This weakness was exposed with the outbreak of SARS (severe acute respiratory syndrome) in 2003. This revealed problems such as the self-contained or insulated medical and health systems of the state, the local authorities, and the military. There was a serious lack of information-sharing between them, an absence of unified command, and inadequate distribution of medical facilities, medicines, and human resources. The explosion that occurred during the Atlanta Olympic Games in 1996 was a reminder of the need for Olympics host cities to be prepared for emergency incidents.

The aim, therefore, was to set up an integrated health emergency system, which would include a command structure, related laws, regulations, policies and preparedness and response plans. There was also a need to include a network of health laboratories, information platforms, emergency teams and stockpiles of emergency materials. This system was intended to guarantee an immediate and effective response to any public health emergency during the 2008 Games.

The legal foundations for this system were laws and guidelines. These included "Emergency Management Law of People's Republic of China" [1] (referred to as "Emergency Management Law), "Public Health Emergency Regulations" [2], "National Public Health Emergency Plans (Implementation)" [3], "National Disaster Prevention Planning" and "the Instructions of the State Department on Strengthening the National Health Emergency Management", as well as the WHO Communicable Disease Alert and Response" [4], the public health emergency response guidelines of the United States of America among others.

1.Beijing Municipal Health Bureau
2.Ministry of Health of the People's Republic of China
3.Beijing Red Cross, the 999 Emergency Rescue Center
4.World Health Organization

Measures

Legislation and law enforcement

To take effective control of a massive outbreak of communicable diseases, the State Department issued the "Public Health Emergency Regulations" in May 2003, and amended the "Communicable Diseases Prevention Act" in 2004. To prevent the hazard of food poisoning, it amended the "Food Sanitation Law" in 2004 and enacted it as "Food Safety Law" in 2009. In light of the increased risks of natural disasters, accidents, public health and social safety incidents (referred to as emergencies), the National People's Congress issued the "Emergency Management Law of People's Republic of China" (referred to as "Emergency Management Law) in August, 2007 and the Beijing Municipal People's Congress passed the "Implementation of Emergency Management Law in Beijing" ("Implementation") in 2008.

The State Department brought the Ministry of Health and the departments of industry and commerce, quality inspection, drug inspection together to supervise the enforcement of law. These measures provided a legal guarantee for the health emergency response during the Games, and for the safety of mass gatherings in future.

Public health emergency preparedness and response plans

Before the out break of SARS in 2003, responses to public health emergencies mainly relied on administrative leadership decision-making, command, and mobility, which easily led to confused and unsystematic consequences. In setting up the new system, with the aim of minimizing risks to public health, account was taken of the WHO influenza pandemic preparation plans [5], and other international emergency management, guidelines. The following plans were set up.

At a national level, normative documents were promulgated by the State Council. These were aimed at public health emergency response and medical rescue for emergencies, including the "national public health emergency plan" and "national public emergency plan for medical rescue", and for serious communicable disease outbreaks, such as "National Emergency Plans for Plague Control".

Ministry of Health emergency plans included normative documents aimed at a public health response for higher-risk public health events, such as pandemic influenza, high-temerature, heat-related health emergencies, and carbon monoxide poisoning.

Similar normative documents by the host city and BOCOG, were directed towards a variety of possible public health risks during the Games, and related to a medical health insurance programme for the Games. These plans were the basis for responding when an emergency

occurred and for assessing the impact of such an event afterwards.

A national public health emergency command centre was established to cover the State, provinces, cities and counties. This was in accordance with National Disaster Prevention Planning, instructions of the State Department on Strengthening the National Health Emergency Management, and the Managerial Specification on the National Health Emergency Management.

The command centre consisted of the state departments of health, police, railway, entry-exit inspection epidemic and the health department of Peoples Liberation Army (PLA) and People's Armed Police(PAP) Corps, and was responsible for emergency response to large serious events, with that responsibility echoed in provinces, cites and counties .The medical institutions of the military, armed police and central units became involved for the first time, in unified management, responsible for ensuring the full integration and coordination of medical resources.

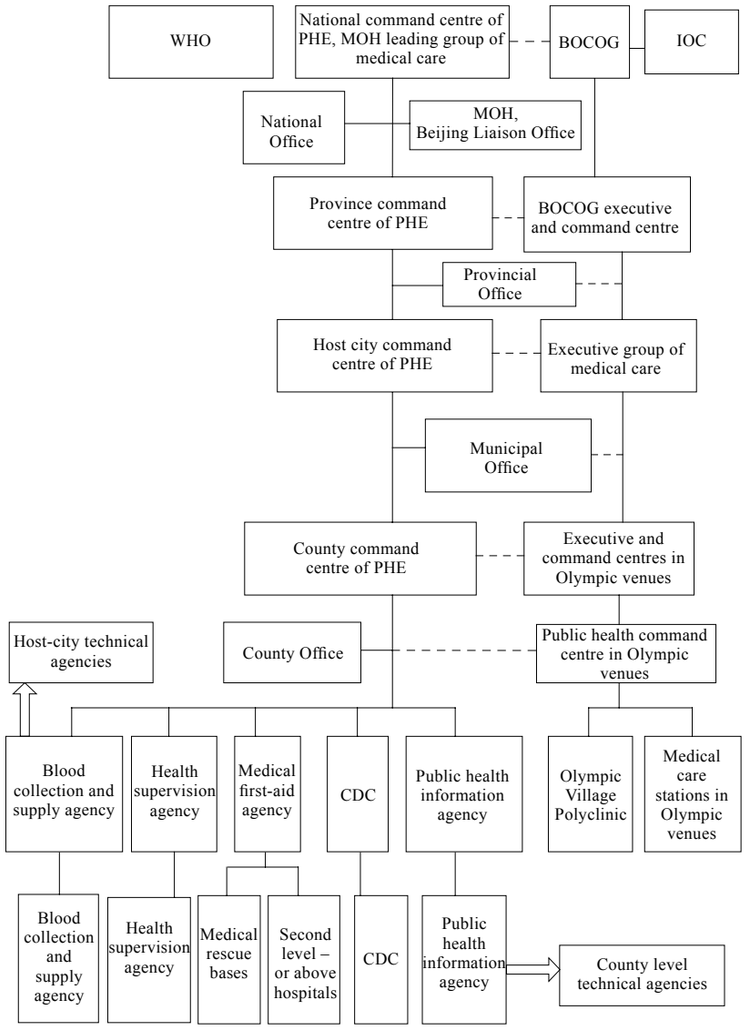
Improving the public health emergency surveillance and alert system

The WHO monitoring and warning system for communicable diseases [6] and the Chinese Emergency Management Law and Communicable Disease Control and Prevention Law confirmed that the public health emergency surveillance and alert system had been set up in early 2008. The categories for surveillance and alert included major communicable diseases, unidentified diseases, food poisoning, occupational poisoning and other major public health problems. If morbidity and mortality became more than twice the annual average, the alert system would go into action. It was graded according to four levels of importance, the first level being the most urgent and potentially most hazardous. (Table 1).

Table 1. Classification of emergency response measures

Alert grade	Colour	Events grade	Category of response
1	Red	Large serious	State council
2	Orange	Serious	Province government
3	Yellow	Major	Municipal government
4	Blue	General	County government

Figure 1. Structure of national public health emergency command centre



International Mass Gathering Events Advisory Group meet in March,2008.

Information reports and media releases

Daily epidemic information reports were produced with the help of WHO media communication planning guidance of immergence incidents [7]. From 20 July to 20 September, 2008, more than 500,000 information items were reported to the Beijing Municipal Government and the Olympics operation and command centre from medical stations, designated and other hospitals, CDCs, health supervision agencies, blood collection and supply agencies and other health facilities in the seven cities, WHO provided weekly reports on the epidemic situation, and the command centre held daily video conferences. Five press conferences were held during the Games.

Strengthening medical rescue capability

The medical rescue experiences during the Wenchuan earthquake in Sichuan revealed many problems, such as insufficient numbers of emergency personnel, obsolete ambulances and equipment. Response capacity was weak, and it was difficult to obtain timely treatment for many acute serious and fatal cases [8]. Therefore before the Games began, Beijing was added to the out-of-hospital emergency rescue system and an overhaul was made of staff, ambulances and communication and medical equipment. Improved communications were required to coordinate on-site medical first aid, hospital treatment, intensive care, and health and epidemic prevention.

Establishing public health laboratories network

The public health laboratories network was established in 2007, composed of bio-safety, health chemical and radioactive laboratories at national, provincial, city and county levels, CDCs, and other facilities. These included treatment centres for communicable disease, poisoning and radiation sickness, and laboratories for disease-causing microorganisms. The laboratories were designated as national laboratories, reference laboratories or sentinel laboratories [9] in accordance with their authorized functions (See Figure 2). During the Olympics, those laboratories were responsible for detecting symptoms of avian influenza, chicken pox, cholera, dengue, food poisoning, malaria, severe pneumonia, water pollution, and other health conditions.

Figure 2. Medical and health security and emergency information procedures

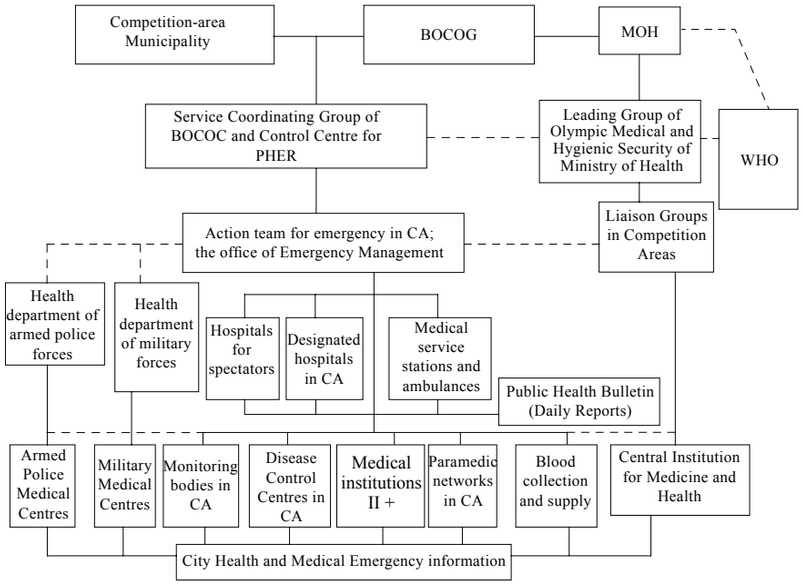
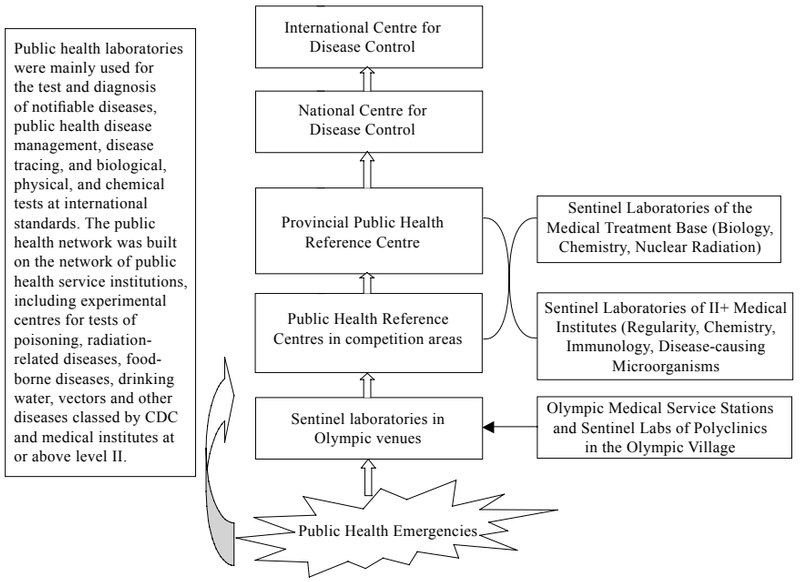


Figure 3. Network of PHER national laboratories



Health emergency teams and training and exercises

To improve the on-site emergency response capacity, the Ministry of Health established national health emergency rescue teams including medical first aid, pandemic prevention, professional medical rescue and comprehensive medical treatment personnel. The teams were equipped with on-site communications, information reports, command and distribution, medical rescue and personal protection, and medical testing vehicles and ambulances. Teams were also set up at provincial, city and county levels, and were responsible for initial emergency responses. These teams gained experience in the Indian Ocean tsunami, the southern snow disaster, a major traffic accident in Shandong, the Wenchuan earthquake in Sichuan and other serious events.

The Ministry of Health launched "National Health Emergency Training Programmes 2006 to 2010" with the participation of local health departments' staff, including supervisors and specialists in medical health institutes. The training involved disease control, health care, health supervision, blood collection, mental health intervention and health security.

The Ministry also organized exercises in the medical rescue in nuclear radiation incidents and plague prevention and control, avian influenza prevention and control, in collaboration with Hong Kong and Macao health section. These exercises significantly strengthened the ability of rescue teams [10].

Health emergency stockpiles and dynamic distribution

In line with the national emergency management law and public health emergency events planning, the central and local government set up a special fund in 2004 for public health emergency responses, including emergency bases, personnel, drug and materials, vehicles, medical rescue and information communication equipment. The national fund provided for coordinated strategic stockpiles of equipment, including the production of vaccines and antiviral drugs for plague, avian influenza and other diseases.

Local government offices coordinated the emergency material and drug stockpiles between bases and medical health institutions. The medicine supervision departments were in charge of the medicine reserves and approved central and local manufacturers and suppliers. Health departments were responsible for drug and material stockpiles, including diagnostic reagents, highly effectual drugs, vaccines, medical equipment, personal protection equipment and other materials. The Development and Reform Department carried out the production of emergency equipment, and regulated commodity prices [11].

Improving international communication and cooperation

WHO delegations in China were in charge of communicable disease surveillance and provided information and support according to international standards. Before the start of the Games, WHO supplied international public health laboratories with links to advanced equipment and diagnostic reagents, and guidelines on the diagnosis and identification of newly-emerged or complicated communicable diseases. A series of international academic activities were convened, such as a public health emergency management forum between China and the United Kingdom, a medical rescue forum between China and France, an Olympic public health safety forum, and WHO training courses for surveillance and identification of newly-emerged or complicated communicable pathogens.

At the same time, Beijing also set up out-of-hospital medical rescue cooperation programmes with other countries, enabling exchange staffs to learn from each other. Thirty Beijing medical personnel were sent to France to study the EMS and European management experience. Beijing also invited specialists from Israel to give instruction in medical rescue in massive disasters.

Results and discussion

During the seven years of preparation period for the 2008 Games, the public health emergency response system gradually improved. Although no major public health

emergencies occurred during the Games, the system provided a safety guarantee for the host city. At the same time, it also provided experiences for other cities holding mass events in China.

The national and host city health emergency response system was fully established, and played an important role during the Games. The integrated system included national, provincial, city and county level command centres, five networks of out-of-hospital first-aid, in-hospital treatment, medical rescue bases, public health laboratories, public health information, and related emergency laws, regulations and plans.

National and host city health emergency response capacities improved significantly.

More than 15,000 health emergency staff was trained in on-site first aid, disease prevention, health supervision, psychological crisis intervention and blood collection and supply safety. The capacity of materials and drugs stockpiles and dynamic distribution of state and local governments and medical rescue bases also showed significant improvements.

Enhanced international cooperation

In close cooperation with WHO, the Ministry of Health benefited from surveillance and alert information on international communicable diseases such as avian flu, cholera, malaria, plague, SARS, and yellow fever, as well as other public health emergencies. This helped build the Chinese national and city surveillance and alert system. WHO also helped set up identification techniques and methods for newly-emerging or complicated communicable pathogens, and improved the capacity of epidemiology investigation and analysis, and laboratory testing.

In conclusion, there has until now been little systematic information of public health emergency preparedness and response during large-scale sporting events. The Beijing Olympics experience shows that a public health emergency system has first and foremost, to guarantee the safety and health of residents in the host city, and lay the foundation for health emergency management. The Beijing system went on to play an important role in the prevention and control of the H1N1 influenza pandemic in 2009. Gradual improvements have been seen in the structure of government-oriented, hierarchical responsibility, dependency management, rapid response, cooperation and public control.

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Chapter 15

Risk assessment

Zhao Tao[1], Pang Xinghuo[3], Gao Ting[3], Li Huiyan[3], Liu Xiuying[3], Li Xinyu[2], Brian Oldenburg[3]

Mass gatherings can present significant public health challenges as a result of a large increase in the local population within a short period of time. Increasing attention has been given to identifying potential public health risks and the required responses at recent Olympic Games and other major sporting events [1]. Public health problems that have occurred have included heat-related illness (Meehan 1998; Weiss 1988), food-borne and waterborne illnesses (Meehan 1998; Panella 1992), accidents and injuries (Jorm, 2003) and illegal drug use (Jorm, 2003) [2]-[5]. Some incidents of communicable diseases have also been documented. (Goodman 1994). These experiences indicated important lessons for developing a strong and effective public health risk assessment and control system and these include:

- Careful planning to begin at least five years in advance.
- Comprehensive and timely public health surveillance system.
- Clearly defined lines of reporting and communication.
- Strong inter-agency/department collaboration is critical .
- Such mass events can be used to develop a more permanent public health infrastructure and capacity.

Given the occurrence of SARS and avian influenza in Asia since 2003 as well as the other potential public health challenges confronting China, which is undergoing such rapid socioeconomic development, the identification and control of public health issues were given significant attention in the years leading up to and during the Beijing Olympic Games.

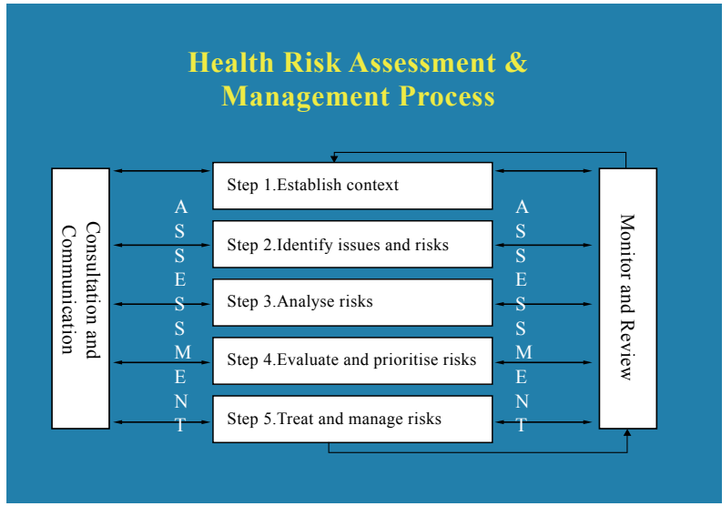
For example, Beijing's Centre for Disease Control had already been established in 2000, and China's National Centres for Disease Control in 2002. Additionally, both the International Olympic Committee and BOCOG made it clear how important it was to identify and address any public health risks that might be relevant to the Beijing Games.

Developing the public health risk assessment and control programme

From the successful bid to be the host city for the 2008 Games onwards, Beijing CDC begun a comprehensive assessment and evaluation programme of all potential related public health risks. Following the identification of all such possible risks and the development of appropriate control measures, extensive consultations were held with key stakeholders and the required improvements were then made to existing surveillance and monitoring systems in Beijing and the other Olympic cities [6,7].

In the 12 months before the Games began, surveillance and monitoring systems were further enhanced, and much attention was also given to workforce training and to public education. In the third and final stage of the programme, close monitoring and surveillance was conducted during the Games themselves. Further follow-up work has been conducted following the Olympic Games. Figure 1 summarizes the steps used in this comprehensively conducted programme.

Figure 1. Summary steps to identify and control public health risks



Step 1. This involved a number of sub-stages, including: defining the scope and context of the risks to be identified, defining the interests and requirements of stakeholders and concerned communities, and defining the context and settings and what the risk acceptance criteria would be. The rapidly changing context of health in Beijing and China involved consideration of the quadruple burden of health-related issues. This include: (1) infectious and communicable diseases, (2) rapidly developing non-communicable diseases and their associated behavioural and other risk factors, such as smoking and poor diet, (3) emerging health threats such as SARS and avian influenza, and (4) environmental health issues related to air, water and food in particular. However, the risk assessment project emphasized those risks or health threats of most concern to Beijing CDC.

Step 2. This was concerned with identifying the issues involved, the interrogation of all available and existing databases, reports and other publications as well as interviews and brainstorming with experts and many others.

1.Beijing Municipal Health Bureau
2.Beijing Centers for Disease Control and Prevention
3.Monash University, Australia

Step 3. Once all the potential risks had been identified, this step involved formal identification of the likelihood and consequences of each risk and then a determination of the level of risk by combining their likelihood and potential consequences.

Step 4. The risks were generally grouped into the following categories of risk: quality and safety of drinking water, food-borne diseases, infectious and communicable diseases that also included the emerging diseases, vector-borne diseases and other environmental health concerns that also included illness associated with hot weather. It was also important to consider the timeline or occurrence of the risks, that is, whether they would be likely risks in the years and months prior to the Games (3-24 months); in the months just before the Games (1-3 months); and/or to be risks immediately before, during and/or after the Games. It was important not only to consider the direct and specific health impact of any defined health risk, but also, the broader social and political impact of risk as well. Furthermore, it was also important to consider the settings and target populations that might be affected.

Step 5. Once all the previous steps had been conducted, attention was then focused on strategies for managing and/or preventing each important risk that was identified. These strategies were categorized according to the following: risk avoidance, risk reduction, risk transfer or risk acceptance. This involved the development of a risk management and communication plan for each identified risk.

Findings, results and outcomes

Identifying the public health issues and the steps to be taken (Phase 1)

After the preliminary identification of risks, the 45 risks were provisionally identified and grouped in relation to the 2008 Games. This included:22 different communicable diseases, 14 food safety issues, 4 different concerns with drinking water, and a few issues in relation to vector organisms and some other miscellaneous concerns [7]. Each of these was then subjected to a more detailed analysis of the likelihood of occurrence, risk severity and level of risk. These details are included as an attachment to this chapter. According to the risk level that was calculated, prevention and control measures were then identified for each.

Developing the responses and the control measures (Phase 2)

Specific initiatives and programmes were undertaken to improve the existing monitoring and surveillance systems in relation some key identified risks, including:

1. Monitoring of food-borne pathogens in the Beijing restaurant industry;

2. Monitoring and early warning of intestinal infections in Beijing;

3. Monitoring and early warning of infections in primary and secondary school children in Beijing;

4. Monitoring of vector organisms leading up to Beijing 2008 Olympic Games;

5. Monitoring and early warning of the health quality in Beijing Olympic public places; and

6. Monitoring and early warning of the health quality of public drinking water in Beijing Olympic venues.

Each of these initiatives was used to provide further data and technical support in order to improve the early warning systems for mass events such as the Beijing Olympics. Attention was also given to risk communication with other organizations and stakeholders, including the broader public health and community.

Worker training, education and development were also important components of the planned response to the detailed risk assessment and control programme for the Beijing Olympic Games in 2008. This included special training of relevant workers for public health protection, disaster management, and many other tasks. The concepts and methods of risk assessment and control were also introduced more broadly to the public health workforce and managers in relevant organizations, in order to improve disease prevention and public health management across all levels of the health system and government. Indeed, the Beijing Public Health Emergency Committee had wide-ranging exchanges with other relevant public administrative departments of the municipal government and health organizations, in order to guide the development of improved safety protection and preparation for the Games.

Final implementation and protection for the Olympic Games (Phase 3)

As the Games approached, appropriate command and management structures were established to address public health incidents as they occurred. Linkages and systems were set up between early detection of incidents, appropriate laboratory testing (if relevant and required), the required resources, and the team to be involved with risk control and communication. Further training of professionals and workers was undertaken, more supplies of vaccines, drugs and reagents were reserved and many exercises were undertaken to test and improve the response to high-risk events, as required [8].

The legacy following the Games (Phase 4)

This new and coordinated approach to risk assessment, management and control for china has subsequently been extended to the planning for the Shanghai World Expo, Guangzhou Asian Games, Shenzhen Universiade and many other events in China and to other mass events in other parts of the world. However, most importantly, Beijing will continue to apply this approach to its daily work as well as to future international and domestic mass events. Indeed, the Beijing Municipal Government has continued to promote and develop this approach to the prevention and control of important infectious diseases, such as Human Avian Influenza and H1N1 Influenza.

Discussion

Although public health planning and surveillance was an important focus of previous Olympic Games, this issue required a very special effort in relation to the Beijing Games because of the rapid changes occurring in Beijing and China and also because so much workforce development and systems development were also required. This necessitated the very early identification of risks, so that there was sufficient time to enhance the existing

surveillance systems, or in some instances, actually develop new systems. It is most likely that the large scale effort put into system development, prevention and control measures in the years before the 2008 Games largely minimized the risk level and the seriousness of health issues that occurred in the lead up to and during the Games. This provided a more effective approach for early warning and prevention of major public health events. It also helped with the optimal use of health resources and to design more scientific and planned methods for prevention and control.

The comprehensive preparatory work and operational protection of public health safety, introduced a new approach to identifying and managing such risks in Beijing, and this undoubtedly led to improved levels of public health management in the city. Determining in advance at least 45 different kinds of risks to public health in Beijing in the lead up to and during the Games was a very important first step. However, it was also very important to sort and rank by the level of risk and to identify appropriate prevention, control and risk communication strategies. This was then very helpful in informing decision-making in preparing and planning for the public health situation during the Games.

This process contributed to the comparing and contrasting of different kinds of risk events and to planning for the optimal allocation of public health resources. This work programme led to the establishment of, or improvement to, at least 10 public health risk monitoring systems in Beijing. It helped to establish a much more dynamic approach to public health risk monitoring, and it introduced the concept of risk assessment of public health events into daily working life in Beijing CDC and established the importance of early warning in the identification of public health hazards and risks [9]. It also led to considerable emphasis on training and workforce development and an emphasis on prevention and control for the future.

While the other chapters in this book discuss the health legacy of the Games, the summary of achievements before, during and after the Games, strongly suggests that this new, systematic approach to identification, assessment and management of public health risks have made an important contribution to this health legacy. The identified public health events that occurred in the lead up to, and during the Olympic Games were all dealt with in a timely and effective manner. Indeed, notifiable diseases and some other infections declined in comparison to previous years. There was also a fall in the number of cases related to food poisoning, water supplies and vector borne diseases. Athletes and foreign visitors to the Games reported high rates of satisfaction with health protection measures [10].

Suggestions for improving public health management of future mass events include the following:

1. Because public health involves such a wide range of professionals, it is important to establish a strong assessment and indicator system that is understood by all concerned. For the Beijing Olympics, much of the analysis was only based on qualitative and semi-quantitative assessment methods. It is important to improve on this approach and make it more scientific and more strongly evidence-based in the future.

2. The process of risk management must also consider methods and approaches that are demonstrable cost effective. However, the methods and approaches for doing this kind of analysis need considerable development.

3. Very often, the management of public health emergencies is conducted in a reactive fashion, that is, after a health issue or incident becomes evident. However, the risk assessment and management approach conducted for the Beijing Games provides a more effective management pattern for the early warning and prevention of major public health events.

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Attachment of risks identified by Beijing CDC project

Table 1. Level of risk assessment of infectious disease events during the Games

	Risk of events	The level of risk		
		Possibility of occurrence	Degree of seriousness	Risk level
1	Cholera	B (very likely)	Level 4 (larger)	E (extremely serious)
2	Plague	C (possible)	Level 4 (larger)	E (extremely serious)
3	Human infect the high pathogenic avian influenza	D (unlikely)	Level 4 (larger)	H (high danger)
4	Anthrax	D (unlikely)	Level 4 (larger)	H (high danger)
5	Ebola haemorrhagic fever	D (unlikely)	Level 4 (larger)	H (high danger)
6	Infectious atypical pneumonia	D (unlikely)	Level 4 (larger)	H (high danger)
7	Bacillary dysentery	B (very likely)	Level 3 (medium)	H (high danger)
8	Acute hemorrhagic Conjunctivitis	B (very likely)	Level 3 (medium)	H (high danger)
9	Venereal diseases (gonorrhea, syphilis, genital herpes, Chlamydia infections)	B (very likely)	Level 3 (medium)	H (high danger)
10	Hepatitis A	C (possible)	Level 3 (medium)	H (high danger)
11	HIV/AIDS	C (possible)	Level 3 (medium)	H (high danger)
12	Influenza	C (possible)	Level 3 (medium)	H (high danger)
13	Legionellosis disease	C (possible)	Level 3 (medium)	H (high danger)
14	Haemorrhagic fever with renal syndrome	C (possible)	Level 3 (medium)	H (high danger)
15	Measles	C (possible)	Level 3 (medium)	H (high dangerous risk)
16	Epidemic cerebrospinal meningitis	C (possible)	Level 3 (medium)	H (high danger)
17	West Nile Fever	D (unlikely)	Level 3 (medium)	M (medium danger)
18	Poliomyelitis	D (unlikely)	Level 3 (medium)	M (medium danger)
19	Human rabies	D (unlikely)	Level 3 (medium)	M (medium danger)
20	Yellow fever	D (unlikely)	Level 3 (medium)	M (medium danger)
21	Dengue fever	D (unlikely)	Level 3 (medium)	M (medium danger)
22	Brucellosis	D (unlikely)	Level 2 (smaller)	L (low danger)

Table 2. Risk assessment of food safety

	The risk event in public health	Possibility of risk occurrence	Seriousness of consequence	Level of risk assessment
1	Bacterial food poisoning (key participants and visitors dining in protected places)	B (very likely)	Level 4 (larger)	E (extremely serious)
2	Bacterial food poisoning (social participants dining in public places)	A (almost certainly)	Level 3 (medium)	E (extremely serious)
3	Food-borne stimulant examination masculine (athletes dining in public places)	E (rare)	Level 4 (larger)	H (high danger)
4	Lentils poisoning (key participants and visitors dining in protected places)	C (possible)	Level 3 (medium)	H (high danger)
5	Nitrite poisoning (social participants dining in public places)	C (possible)	Level 3 (medium)	H (high danger)
6	Lentils poisoning (social participants dining in public places)	B (possible)	Level 2 (smaller)	H (high danger)
7	Ganophosphorus pesticide poisoning (social participants dining in public places)	D (unlikely)	Level 3 (medium)	M (medium danger)
8	Fresh day lily poisoning social participants dining in public places)	D (unlikely)	Level 3 (medium)	M (medium danger)
9	Food-borne parasitic diseases (social participants dining in public places)	E (rare)	Level 3 (medium)	M (medium danger)
10	Fresh day lily poisoning (key participants and visitors dining in protected places)	E (rare)	Level 2 (smaller)	L (low danger)
11	Other food poisoning (social participants dining in public places)social crowd which dines in the general place)	E (rare)	Level 1 (negligible)	L (low danger)
12	Food-borne stimulant examination masculine social participants dining in public places	E (rare)	Level 1 (negligible)	L (low danger)

13	Food allergy (all groups in all public places)	E (rare)	Level 1 (negligible)	L (low danger)
14	Unsuitable diet(all groups in all public places)	E (rare)	Level 1 (negligible)	L (low danger)

Table 3. Level of risk of safety of domestic water

Serial number	The risk event in public health	Possibility of risk occurrence	Seriousness of risk consequence	Level of risk assessment
1	Drinking water pipe pollution events	C (possible)	Level 4 (larger)	E (extremely serious)
2	Drinking water source pollution events	D (unlikely)	Level 4 (larger)	H (high dangerous)
3	Secondary water supply pollution events	D (unlikely)	Level 3 (medium)	M (medium dangerous)
4	High hardness of water cause the temporary digestive tract unwell	D (unlikely)	Level 2 (smaller)	L (low dangerous)

Table 4. Risk assessment result of vector organisms

Serial number	The risk event in public health	Possibility of risk occurrence	Seriousness of risk consequence	Level of risk assessment
1	Bites by vectors	A (almost certain)	Level 2 (smaller)	H (high dangerous)
2	Effects on vectors on public perceptions and environment	B (very likely)	Level 2 (smaller)	H (high dangerous risk)
3	Vectors (mainly mice) damaging power cables and causing supply disruption	D (unlikely)	Level 3 (medium)	M (medium dangerous)

Table 5. Risk assessment of other public health events

Serial number	Risk events in public health	Possibility of risk occurrence	Seriousness of consequence	Level of risk assessment
1	Mass of heat stroke	C (possible)	Level 3 (medium)	H (high dangerous)
2	The air-conditioning system pollution led to the health hazards caused the public health events	D (unlikely)	Level 2 (smaller)	L (low danger)

Chapter 16

Tobacco control

Liu Zejun[1], Sun Xianli[1], Cui Xiaobo[2], Li Xinhua[3], Jiang Yuan[4], Rao Yingsheng[1], Sarah England[5]

Tobacco use is one of the biggest public health threats the world has ever faced, and is a risk factor for six of the eight leading causes of death [1]. China is home to more smokers than any other country, approximately 350 million, which is about a third of the global total [2]. Prevalence data from 2002 shows the rate of smoking in men is 57.4% and the rate of smoking in women is 2.6% [3]. Each year in China, approximately one million needlessly premature deaths are attributed to tobacco[4]. If current trends continue it is estimated that tobacco use could result in 100 million deaths in China in the first half of this century [5].

Acting as a catalyst for change, the Beijing Olympic Games were an opportunity to set new standards for tobacco control in China. In general, Olympic Games have the ability to promote health and change social norms due to the involvement of tens of thousands of participants and spectators, with expansive media coverage. As a celebration of good health, the Games can encourage positive lifestyle changes such as the promotion of smoke-free environments. The Beijing Games were an opportunity to support a cultural shift towards these environments and leave a legacy of longer, healthier lives.

As a result of the policy implemented by the International Olympic Committee (IOC), all Olympics have been smoke-free in principle since the 1988 Calgary Winter Olympics [6]. The Beijing Games were the first summer Olympics since the World Health Organization Framework Convention on Tobacco Control (FCTC) [7] came into force in 2005. This was the world's first treaty negotiated under the auspices of WHO [8] and was designed to reduce the devastating health and economic impact of tobacco [9].

The Convention:

- Establishes tobacco control and protecting public health as a priority,
- Engages cross-sectoral action on tobacco control beyond health,
- Ensures that public health is the guiding principle behind tobacco policies,
- Provides evidence-based guidelines and protocols for sound tobacco control measures,
- Introduces a mechanism for firm country commitment and accountability, and
- Calls for scientific and technical cooperation and exchange of information for tobacco control.

China ratified the Convention in October 2005 [10] and as a result, an Inter-departmental Coordination Mechanism consisting of eight ministries and agencies was established

1.Beijing Municipal Health Bureau
2.Capital Medical University, Beijing, China
3.Ministry of Health of the People's Republic of China
4.China Centre for Disease Control and Prevention
5.World Health Organization

to implement it. The Premier of China, Wen Jiabao met with the former World Health Organization (WHO) Director-General Dr Lee Jong-Wook in 2004, and committed to a "Green and Smoke-Free Beijing Olympic Games".

This chapter describes the goals of the Smoke-Free Beijing Olympic Games, the strategies adopted to achieve these goals and the outcomes. The legacy of the Smoke-Free Beijing Olympic Games is acknowledged and based on the Beijing experience, and a number of recommendations are provided for future Smoke-Free Olympics.

Goals

A multi-agency group consisting of the Ministry of Health (MOH), WHO, the Beijing Organizing Committee for Olympic Games (BOCOG) and the seven Olympic Games host cities collaborated to develop goals for the Smoke-Free Beijing Olympics. These goals were guided by the requirements of the IOC [11].

The goals were:

- To ensure that the Olympic Village, all indoor Olympic venues and Olympic-contracted hotels were clear of tobacco smoke and that spectators did not use tobacco.
- To ensure that Olympic Games host cities established local tobacco control policies and regulations, banned tobacco advertising and promotion and established no-smoking public areas.
- For Olympic Games host cities to become best-practice examples for the nationwide tobacco control movement.

Strategies

Enactment of tobacco control policies and regulations

In September 2006, BOCOG issued a draft "Work Plan for Beijing 2008 Smoke-Free Olympics" in accordance with the WHO Convention and the goals of the Smoke-Free Olympics. Beginning in 2007, the Ministry of Health organized conferences on medical and health security for the Olympics and supervision, supervision at the Olympic site, and issued documents which defined the requirements of the Smoke-Free Olympics. These conferences provided a basis for policy development in the host cities.

In March 2008, the Beijing Municipal Government circulated the "Stipulations on Scope of No-Smoking Public Places in Beijing", which were developed based on similar stipulations of 1995. In May 2008, the "Notice on Implementing the No-Smoking Policies in Olympic Venues" was issued by BOCOG which clarified the specific strategies for the Smoke-Free Beijing Olympics.

In order to further strengthen these preparations, the Beijing Municipal Government released three successive notices implementing tobacco control in Beijing taxis, in the catering industry and in medical institutions. Further rules and regulations on the creation of smoke-free public places were issued in the other six Olympic host cities.

Capacity building for tobacco control

In 2006, the Ministry and WHO established a budget to support the Smoke-Free Beijing Olympic cooperation programmes. The budget was administered by the Tobacco Control Office of the China Centre for Disease Control and Prevention (China CDC). The Ministry and WHO convened meetings with the Health Administration Departments of Olympic host cities and with professionals working in chronic disease control and prevention. Training and discussion meetings were held, with the aim of strengthening the capacity for smoke-free environment advocacy as well as facilitating valuable exchanges on national and international experience. Six intervention manuals on Smoke-Free public places were printed and distributed by China CDC and these were used for the training and discussion meetings. Capacity building meetings, sharing of national and international experiences and development of written manuals assisted in the creation of Smoke-Free environments in the Olympic host cities.

The Beijing Patriotic Health Campaign Committee (BPHCC) and BOCOG founded the Smoke-Free Olympics Action Group which was responsible for preparation and training of Olympic staff and volunteers. Training on the Beijing Smoke-Free Olympic Games was provided to thousands of volunteers, including how to ask smokers to stop smoking in the designated no smoking areas. Training was provided to Tobacco Control Health Inspectors who had the authority to fine smokers in designated no smoking areas.

Improved coordination for tobacco control

The Leading Group of Interdepartmental Coordination (LGIC), comprising a number of governmental ministries, prioritised the work required to ensure a Smoke-Free Beijing Olympics. The MOH worked with international organizations and provided relevant technical support. Tobacco advertising in Olympic host cities was regulated by the State Administration of Industry and Commerce.

During the Games, there was close collaboration among the organizations of the LGIC. As a result of this coordination, it was quickly discovered that the tobacco industry was using the Olympic torch as an avenue for tobacco advertising and the Games mascots were being printed on counterfeit cigarette packages.

Based on China's commitment to the WHO Convention and the IOC's tobacco-free policy, the LGIC was able to take the correct steps in rectifying these problems. A number of international organizations working in tobacco control, particularly WHO and the IOC, provided valuable technical and financial support for the tobacco control efforts surrounding the Games.

Public education on tobacco control

An extensive education campaign was implemented in China to increase public awareness of the Smoke-Free Beijing Olympics. Government departments used the media to publicise the harms of tobacco use. Mass-media strategies included television, the internet, radio, outdoor signs and billboards. From April 2008 to August 2008, the number of media reports on tobacco control reached 185, and there appeared to be strong public support for the Smoke-Free Beijing Olympics.

Table 1. Illustrates the methods used to educate the public on tobacco control issues and the Smoke-Free Beijing Olympics.

Table 1. Public education methods

Method	Implementation Process
No smoking signs	600,000 No Smoking signs were placed in and around Beijing city, 6,700 were placed in Olympic venues. No smoking signs were provided free to spectators.
Television	Twelve instalments of a feature programme were broadcast over 5 channels on CCTV and BJTV. A scientific advertising special named "A Smoke-Free Future" was filmed and 5,000 DVD copies were screened in hospitals and shopping centres. They were provided to various schools, hospitals, communities, enterprises and public institutions. An advertisement titled "Smoke-Free Olympic Sailing" was shown on Qingdao TV.
Internet	Information relating to the Smoke-Free Beijing Olympics was published in Chinese on the WHO China Office website. Over 6,000 internet users participated in an online quiz on the Smoke-Free Beijing Olympics. Websites were used to publicise the harms of tobacco use.
Radio	A feature programme called "Healthy Olympics, Healthy Beijing" was developed for Beijing Traffic Radio, and broadcast in 16 instalments. A further five expert interview programmes were developed under the name "Healthy Olympics, Healthy Beijing" and were aired on a sports radio channel. A large number of radio public service announcements on the harms of tobacco use were broadcast repeatedly over Central People's Broadcasting Station and Beijing People's Broadcasting Station.
Public service announcements (PSA's)	8 PSAs on the harms of tobacco use were broadcast over 10 channels of Beijing TV 100 times a day.
Newspapers and magazines	Print media such, as the Beijing Daily, Beijing Evening News, Beijing Youth Daily, Legal Evening News, Beijing Star Daily, Beijing Times and Health News, were used to provide public information on tobacco use. From April 2008 until June 2008 there were 165 total news reports relating to tobacco use and explaining the new government directive.
Public transport	Tobacco control PSAs was placed in over 230 bus shelters and subway stations throughout Beijing.
Posters	400,000 posters were printed with the title "Stipulations on the Scope of Non-Smoking Public Places in Beijing'" and a further 800,000 public education posters were printed. In addition 10,000 posters were issued by WHO titled "Smoking Endangers Health".
Leaflets	30,000 leaflets entitled "It's Not Easy to Quit Smoking, But You Can Do It" and 200,000 leaflets entitled "Smoking and Teenagers" were provided to the public. Over 40 resource kits containing tobacco control information, WHO FCTC information and information on the government directives were sent to the Municipal Health Bureaus, Municipal PHCCs (Patriotic Health Campaign Committee's) and CDC's of 18 different provinces. They were also sent to six smoking cessation clinics.
SMS texting	Innovative strategies reminded Olympic spectators to obey no-smoking policies, such as the use of smoke-free voice prompts, text messaging and scoreboard displays. Six million Olympics tickets were sold and each ticket holder was sent a reminder of the no-smoking policies via SMS text messaging.

"Smoke-Free" local area SMS at National Stadium Beijing Olympics closing ceremony

Targeting key sectors

A major challenge was implementing tobacco control measures in areas with large numbers of smokers and consequent high levels of second-hand smoke (SHS). These areas included schools, restaurants, hospitals and taxis.

Schools: In May 2007, a campaign entitled "Clean and Clear Schoolyard, Tobacco Free Initiative" was launched among elementary and secondary schools, with an extremely high participation rate. Health education courses on the dangers of tobacco use were completed in over 1,000 elementary and secondary schools, with students participating in a competition on tobacco control. Students showed their understanding of the dangers of tobacco use, by signing their names on a petition, indicating they were committed to refusing their first cigarette.

Restaurants: In April 2008, the Beijing Municipal Bureau of Public Health, the Bureau of Commerce, Bureau of Tourism and the BPHCC jointly issued a "Notice on Carrying out Tobacco Control Work in the Catering Industry", emphasizing the need to strengthen public education and adopt measures to control tobacco use. As part of this notice, a 100% smoking ban was required within restaurants in Olympic-contracted hotels, Olympic venues and the Olympic village. In accordance with the regulation "No Smoking in Public Places in Beijing", catering businesses were required to have a 100% smoking ban, and restaurants located in major tourist sites and cultural heritage parks were also required to have a complete smoking ban in place before June 2008.

Hospitals: In China, a large number of health professionals, particularly male doctors, are smokers. In May 2007 a tobacco control initiative was launched which required targeted medical and health institutions to become 100% smoke-free and provide an example of best practice 100% smoke-free hospitals. As a result of this initiative 219 hospitals and CDCs from 18 districts and counties within the Beijing Municipal Area became Smoke-Free.

Smoke-Free hospital work continued after the Olympics. In May 2009, the MOH in conjunction with the State Administration of Traditional Chinese Medicine, the Health

Department of the General Logistics Department of the People's Liberation Army, and the Logistics Department of the Armed Police Forces jointly issued a "Decision on banning smoking completely in the medical and health system from 2011". This decision provides that by the year 2010, all health administration offices, both military and non-military, and at least 50% of all medical and health institutions should become smoke-free units, so that the goal of a total smoking ban in all health administration offices and medical and health institutions can be fulfilled by 2011.

Taxi Services: A multi-agency campaign entitled "Green Taxis - Smoke Free Taxis Keep Everyone Healthy" was launched in September, 2007. The purpose of the campaign was to ban smoking in 660,000 taxis throughout Beijing.

Enforcing Tobacco Control

Various enforcement strategies were used to ensure that the Smoke-Free Beijing Olympics were achieved. The BPHCC, the Beijing Bureau of Public Health and the Health Supervision Office coordinated large-scale inspections throughout Beijing, particularly in targeted smoke-free areas such as Olympic venues.

The regulation "No Smoking in Public Places in Beijing" came into force on May 1, 2008. Following the introduction of this regulation, Beijing government officials led inspections which were carried out four times per day throughout Beijing. A complaint hot-line was established for the public to report breaches of the new regulation.

As part of the enforcement strategies, 22,435 public institutions and organizations were inspected. Of these, 20,981 of them had carried out the smoke-free policies effectively, but 306 had not.

They were given a warning and asked to rectify within a specified time period. Approximately 30,000 smokers were dissuaded from continuing to smoke in a no-smoking area by the inspectors. During the Olympic period, the public health inspectors intensified the patrol, particularly in the Olympic venues. Staff working in the Olympic venues were required to report problems relating to enforcement of the smoke-free policies to a higher authority.

Evaluating Tobacco Control

Following Beijing's successful bid in 2001 for the Games, the Capital University of Medical Science conducted four annual surveys of the smoking rate in Beijing. To evaluate the effects of the implementation of tobacco free policies, a series of surveys were conducted in 2007 and 2008 with the results issued publicly.

The surveys conducted by professional academic institutions provided accurate data, laid the foundation for the development of tobacco control strategies and assisted in evaluating the effects of the tobacco control strategies implemented. Some of the surveys were completed by national and international tobacco control organizations. The results of these surveys played an important part in establishing and evaluating the Smoke-Free Beijing Olympics.

Table 2. Evaluation surveys

Date	Content	Scope
2001, 2004, August 2007, October 2008	A survey on the implementation and feasibility of introducing the regulation titled 'No Smoking in Public Places in Beijing'.	Multi-stage random sampling was used to complete a cross-sectional survey of six districts in Beijing. A district was selected and based on the districts' setting, a residential committee was assigned, and each residential committee selected communities within their districts as a sampling unit. Adults age 15 and over in each household were chosen as interviewees.
April 2008	Research was completed on exposure to second hand smoke in targeted public places. A survey was completed on the tobacco control situation in the catering industry and the attitude of wait staff in Beijing towards tobacco control.	Concentration of Particulate Matter (PM) 2.5 [13]was monitored in 6 different types of work places. Survey and field investigations were conducted in 138 restaurants in Beijing.
May 2008	Media surveys on "No Smoking in Public Places in Beijing" were completed.	Staff working in the media industry in Beijing were surveyed about their attitudes towards "No Smoking in Public Places in Beijing".
August 2008	A survey was completed titled "Assessment of the Effectiveness of Smoke-Free Beijing Olympic policies".	800 adults were surveyed in the Olympic venue sites. 20 telephone interviews were completed with tobacco control organizations.
October 2008	A survey was completed of Beijing residents on tobacco control and the implementation of "No Smoking in Public Places in Beijing".[14]	A field survey was carried out in the same districts and counties as those of the original survey completed in August 2007. The same survey methodology was used, 5 ,629 interviews and questionnaires were completed.

Outcomes

As a result of introducing new tobacco control regulations, targeting key industries and implementing strategic public education campaigns, several outcomes were evident from the Smoke-Free Beijing Olympics.

These included restrictions on tobacco advertising and promotion and "no smoking" messages reaching all event spectators via signs, text messaging, notices and promotional leaflets in Olympic venues and the Olympic villages. Smoking was not allowed in Olympic-contracted hotels, in 66,000 taxis, in buses, trains, railway stations, waiting rooms and shopping malls in Beijing. There was also no smoking allowed in 1,020 restaurants, including canteens of enterprises and institutions and facilities of the State Council and smoking was also banned in 2,449 primary and middle schools.

The results of the survey titled "Assessment of the Effectiveness of the Smoke-Free Beijing Olympics" showed that:

The concept of the Smoke-Free Beijing Olympic Games was known to 85.2% of the respondents.

84.4% knew the basic contents of the government regulation “No Smoking in Public Places in Beijing”.

91.51% of the respondents who were smokers obeyed the regulations.

80.8% of the respondents acknowledged that there were fewer smokers evident in public places in Beijing.

85.3% of respondents reported an obvious decline in the number of smokers in restaurants.

Recommendations

Important lessons were learned from hosting the Smoke-Free Beijing Olympic Games.

Legislation is the key to success. In the case of Beijing; the government regulations provided a solid legal framework for implementation of tobacco control policies.

Comprehensive education results in a high level of public understanding of the concept of a Smoke-Free Olympic Games. As a result of effective tobacco control education campaigns in Beijing prior to and during the Olympic period, the general public had a greater understanding of the reasons for the new regulations which banned smoking in targeted public places.

Cooperation between departments was an important success factor. As part of the preparations for the Games, a multi-departmental mechanism for tobacco control was established. This enabled collaboration between Olympic Games host cities, venues and key industries and agencies to achieve smoke-free goals and provide best practise examples.

Support from the general public is the basis of success in hosting a Smoke-Free Olympics. Amongst Beijing residents, there were high levels of compliance with the government directives, ensuring the maximum effect from smoking bans.

Conclusion

As China is a country with a high prevalence of smoking, implementing effective tobacco control measures is an extremely challenging task. The Games were a powerful vehicle for advancing tobacco control work. The results include a positive impact on people’s lifestyles and attitudes [15,16],as well as on their that awareness of the harms of tobacco use and second-hand smoke increased in Beijing over the Olympic period. The Games facilitated continued prioritisation of tobacco control regulations and policies. In May 2009, the Beijing government finalised a plan entitled “Healthy Beijing Residents - A Ten Year Action Plan to Improve National Health”, which includes strengthened tobacco control measures.

According to the plan, by 2018, there will be no smoking in public places in the city of Beijing and the overall prevalence of smoking will be reduced. The Smoke-Free Beijing Olympic Games may well prove to have been a turning point in China’s fight against the tobacco epidemic.

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Chapter 17

Health behaviour in the Olympic communities

Liang Wannian[1], Chen Bowen[2], Xiao Feng[2], Zhao Dong[3], Liu Min[4], Lv Yiping[5], Brian Oldenburg[6]

Typically, there is a period of at least seven years from a successful bid to the actual convening of an Olympic Games. With the demand for social and economic development in preparation for an Olympic Games, the host city will inevitably need to make adjustments and changes in policies, regulations, urban construction and facilities, communications, the environment, public health and many other fields.

In short, preparing for the Games influences many aspects of society and people's way of life. Research is still needed to evaluate whether citizens' health awareness and behaviour really changed in the lead up to the Beijing Games, and whether it is possible to use such a large-scale activity to promote the population's health.

If the idea of health popularized by the Games can be integrated into national policies and transferred to the host city's population, the Games could help to improve the health of the whole population. Therefore, the Beijing Municipal Science & Technology Commission (Beijing Science and Technology Committee for the Olympic Games) and the Beijing Municipal Bureau of Health sponsored the project, "Evaluation of the Health Legacy of the Olympic Games", commencing in 2004.

The project is one of the first to use a cohort study to investigate the effect of the Olympic Games on the health of a whole community. It involved conducting a series of surveys with people in the community to assess their knowledge, attitudes and perceptions (KAP) in relation to the health environment, economic condition and lifestyle practices concerning individual health and hygienic services. The survey employed indicators and measures of these that are commonly used internationally for other applications.

The study also aimed to make a comprehensive assessment of all Olympic-related activities and their influence on communities, households, and residents, as well as the sustainable development of community fitness and health promotion. The study was also conducted to provide experience for other host cities of mass events to evaluate their 'health legacy'.

1.Ministry of Health of the People's Republic of China
2.Capital Institute of Pediatrics, Beijing, China
3.Beijing Anzhen Hospital
4.Peking University Health Science Centre
5.Beijing Municipal Health Bureau
6.Monash University, Australia

Description and evaluation methods

Survey population

It was decided to choose neighbourhoods from the Chaoyang District which is close by to where the Beijing Asian Games Village was located and where most of the 2008 Beijing Olympic venues were concentrated. Cluster sampling methods were used to select the neighbourhoods and household residents from these. The residents' committee was chosen as the sampling unit, according to the population distribution in the community, to determine the proportion of samples, taking 2-3% from residents over 15 years of age to constitute the participants in the study cohort. The survey started in December 2006 with a follow-up survey of participants in December 2008.

Research methods

To evaluate the influence of the Games on people's health, a prospective cohort study method was adopted to observe the changes in health and related health behaviours of residents at two time points. A combination of quantitative and qualitative research methods was employed to collect the relevant information. Households were randomly selected and all household members over the age of 15 of participated voluntarily in the survey. The sample was stratified according to age, gender and occupation. Additional sampling was conducted to allow for a non-response rate of 20% .

Survey contents

A questionnaire was derived from other existing questions that are used in the national health survey and other research questionnaires. The questions primarily focused on health knowledge, health behavior and related risk factors, health status, physical activity, use of medical and health services and perceived satisfaction with the environment and life.

Questionnaires were checked after completion by study participants, data quality was also checked by quality control staff and they also followed up with 5% of the households that were surveyed. Once questions were appropriately coded and data entry completed, furthers computerized checks were also conducted.

Findings and results

General description of the communities

Yayuncun Street is located at the northwest of Beijing Chaoyang District and is centrally located in relation to the main venues of the Games, surrounded by the National Olympic Sports Center and the National Stadium on three sides. The entire region is on the periphery of the Olympic venues as well as the key areas of Olympic building construction.

There are 10 neighbourhood committees in this region and the total permanent population was 74,463 at the time of the initial survey in 2006. Of these residents, 1,627 residents

were surveyed, and 1,412 were followed up by regular visits by 2008. The loss to followup rate was 13.2 percent. The result of age-sex distribution comparisons between the follow-up sample and the loss to followup group did no show any significant difference in age or gender.

In the follow-up sample there was: 693 men, average age 48.8 ± 16.1 years; 719 women, average age 47.2 ± 15.5 years; and there was no significant difference between the two. Their sociodemograph details of participants are summarized in Table 1.

Table 1. Distribution of age-sex cohort groups

		Male	Female	Total
Age	15-18	11 (45.8)	13 (54.2)	24
	18-45	254 (48.1)	274 (51.9)	528
	45-65	306 (47.2)	342 (52.8)	648
	>65	122 (57.6)	90 (42.3)	212
Marital status	Unmarried	115 (48.8)	116 (50.2)	231
	Married	568 (50.2)	562 (49.8)	1,128
	Other	12 (22.6)	41 (77.4)	53
Education	Illiterate/ Semiliterate	2 (10.0)	18 (90.0)	20
	Primary	24 (34.8)	45 (65.2)	69
	Junior Middle School	133 (44.6)	165 (55.4)	298
	Senior/Technical/Vocational middle school	235 (50.5)	230 (59.5)	465
	College	140 (52.6)	126 (47.4)	266
	Undergraduate and above	159 (54.1)	135 (45.9)	294
Total		693 (49.1)	719 (50.9)	1,412

Note: The situation of the baseline survey

Changes of community residents' health knowledge

Knowledge of nutrition and health: Residents were asked 12 questions such as: in which foods are the content of fat, protein, iron, calcium, vitamins and cholesterol high or, whether multi-salt and high fat can lead to high blood pressure, and so on. The analysis of answers found an average score in the first survey was 70.1 ± 16.9 in 2006, and in 2008, 73.8 ± 15.0 points.

Physical activity and sedentary behavior: The question "how to calculate the suitable heart rate of adults during exercise" was used to evaluate the changes of residents' knowledge regarding the relationship between physical activity and health. In the 2006 survey shows in Table 2,339 people answered correctly, 474 people correctly answered in the final survey.

Healthy behaviour

Smoking: In the 2006 survey, there were 282 smokers among 1,412 residents, accounting for 19.97% of the whole sample. By 2008, the number of smokers had dropped to 223, accounting for 15.79%.

Diet and nutrition: The two surveys found no obvious changes in diet and nutrition. China's Nutritious Dietary Guidelines recommend eating more fruits, vegetables and tuber crops, milk, soybean or its products every day, with an appropriate amount of fish, poultry, eggs and lean meat.

In the 2006 survey the population who followed the guidelines accounted for 63.8%, with a decrease to 62.3% in 2008. The difference has no statistical significance (See Table 2).

Table 2. Changes in health knowledge and health behaviour

	N (%) in 2006	N (%) in 2008	X^2	P
Sports knowledge	339 (20.84)	474 (33.67)	22.81	<0.0001
Health behavior: smoking	282 (19.97)	223 (15.79)	467.58	<0.0001
Diet	1,038 (63.8)	879 (62.3)	0.6704	0.4129

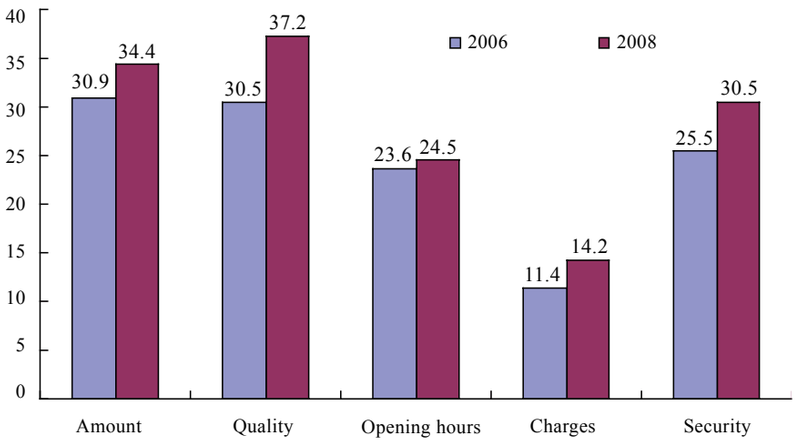
Changes in physical exercise

In the 2006 survey, 82.04% of residents said they could reach nearest sports facilities within a 15-minute walk from home. This proportion rose to 87.03% in 2008.

Satisfaction with the existing sports facilities

Residents were asked about the number, quality, opening hours, fees, and security satisfaction with the existing sports facilities. The results showed that although satisfaction with the quantity, quality and safety increased, satisfaction did not exceed 40%.

Figure 1. Residents' satisfaction with sports facilities



Obtaining sports knowledge

The survey results show that the main source of sports knowledge was television programmes. However, from 2006 to 2008, there was increased awareness due to coverage of Olympics topics and growing Internet usage. (Table 3).

Table 3. Sources of sports knowledge

	2006	2008
Introduction of Olympics topics*	27.9 (390/1, 398)	47.6 (670/1, 407)
Special community lectures*	13.0 (182/1, 398)	17.1 (241/1, 408)
Purchase of sports books *	21.1 (295/1, 398)	22.1 (311/1, 408)
Television programmes**	76.5 (1070/1, 398)	62.1 (875/1, 408)
Internet*	18.6 (260/1, 398)	31.3 (440/1, 408)

*P<0.01 **P<0.05

Changes in use of medical services

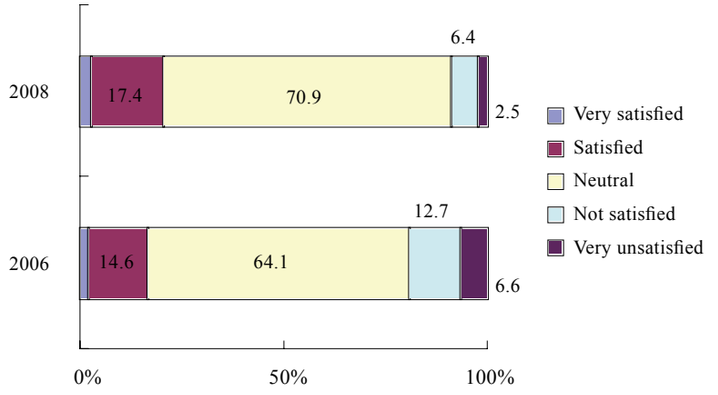
Medical support: In 2006, 81.9% of respondents either had access to public medical services with comprehensive arrangements for serious disease, or were part of the medical insurance system for urban workers. In a second category, just over 4% had purchased additional private medical insurance. By 2008, the rate increased to 86.0% for the first group, but fell to 3% for those buying commercial medical insurance. Four percent of respondents took up basic medical insurance support, which was launched for urban workers since 2007.

Most-visited medical institutions: Between 2006 and 2008, most people used community medical services (43.5% and 47.3%, respectively). After 2008, use of the district hospital decreased. Differences among the rate of using the medical institutions at the municipal level and above-municipal level, and other medical institutions are rather less.

Satisfaction rates for most-visited medical institutions: The results show that the citizens' satisfaction rate with medical institutions increased, and dissatisfaction decreased.

The survey results indicate that from the opening of the Games, citizen's satisfaction with living standards increased from 50.3% to 60.9%, and the satisfaction rate of each index has improved at different levels.

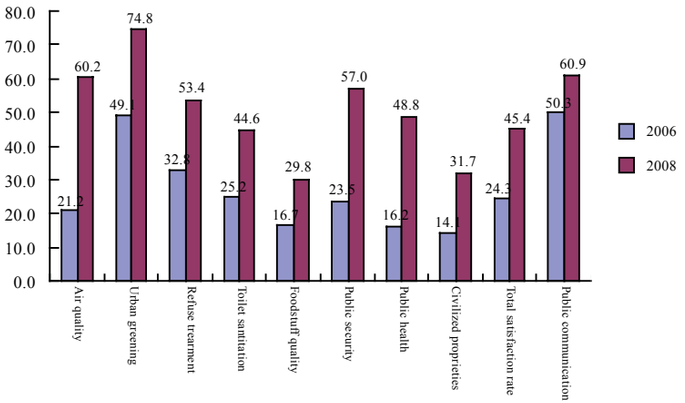
Figure 2. Satisfaction rates for community environment and living standards



The satisfaction degree changes for the community environment and living standard.

After the survey analysis, from opening the Olympic Games, the citizen's satisfaction degree for the living standard has been increased from 50.3% to 60.9%, and the satisfaction degree of each index has been increased in the different level. The difference has statistical meaning (P<0.0001).

Figure 3. Satisfaction degree changes for the community environment & living standard



Discussion and conclusion

The staging of the Games and the popularizing of the Olympic spirit have helped to improve thinking about public health and other modern concepts. The development of the health insurance system has also begun to improve urban health. The construction and transformation of the natural environment, municipal and sporting facilities and other improvements to the Beijing urban environment have probably contributed to many residents' increased satisfaction with urban life [1].

The Yayuncun Community in Chaoyang District, Beijing, located close to many Olympic gymnasiums, was strongly influenced by all kinds of policies and publicity from the very beginning of bidding for the Games. Taking the community as a representative sample, the study evaluated the influence and continuing effect of the Games on local residents' perceptions of health and many related issues.

The results show an increase in the health knowledge of the survey participants. Additionally, health awareness has been continuously strengthened. However, the scientific change in residents' diet was not significant. Much international research indicates that behavioural change does not necessarily follow directly from increased knowledge. It may require other intervention strategies and changes to the environment, policies and regulations. Therefore, health education must be enhanced in changing live-styles, and diet in particular.

As discussed in Chapter 16, a ban on smoking in public areas by the Beijing authorities was implemented on May 1, 2008. From 2006 to 2008, the percentage of smokers among surveyed groups decreased by 4% at an unprecedented speed [2-3], showing that legislation is vital to reduce smoking. The fewer numbers smoking and the increase of smoke-free places to avoid passive smoking is one of the reasons for Beijing citizens' increasing satisfaction with urban life.

In recent years, and especially after Games, people's interest and motivation to join sports and related activities has increased very significantly. The local authorities have adopted many measures to develop public sports and sports entertainment businesses, to encourage people to join a variety of sports and physical exercises, and to promote further the development of sports activities [4].

The data from this research shows that there was an increase in the proportion of people who could reach sport facilities within 15 minutes from home. The level of satisfaction with sports facilities also increased. It shows that the government set up more physical facilities to enable residents to have more opportunities for physical exercise with the convening of the Games. Moreover, they can also receive the latest information about physical activities through the media, lectures and other sources.

Along with the development of the Beijing municipal health system, improvements in community health services also played an important role for residents.

The total satisfaction rate with medical facilities increased in the community. This was related not only to the emphasis put on community health services and related investment by the Chinese government and the Beijing Municipality. It also reflected services provided by community health institutions around the Olympic gymnasiums, such as family care wards and household visits by health workers. Such services were previously available only in large hospitals.

From 2006 to 2008, residents' general satisfaction rate increased significantly because of the Games. Air quality, urban greening, food quality, traffic and the Beijing Municipal Government through legislation and policies regulated all propriety conditions. Local residents showed a higher evaluation of these efforts. This is one of the most important health legacies that the 2008 Games have left to the host city's citizens.

Suggestions and lessons

With two follow-up surveys to the cohort group before and after Olympic Games, the residents' life attitudes, health knowledge, and physical exercise appear to have changed for the better. However, restrained by limited funds, the study was only conducted with residents in Chaoyang District, Beijing. It did not involve residents from any other Beijing communities. It is important to compare these results with those from other Beijing communities if possible, perhaps by using at least some comparable data from other communities and collected via other sources.

The results from this research also need further analysis. If possible, further follow-up of the cohort should be conducted in order to evaluate the sustainability of the health legacy in the longer term.

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Chapter 18

The HIV campaign

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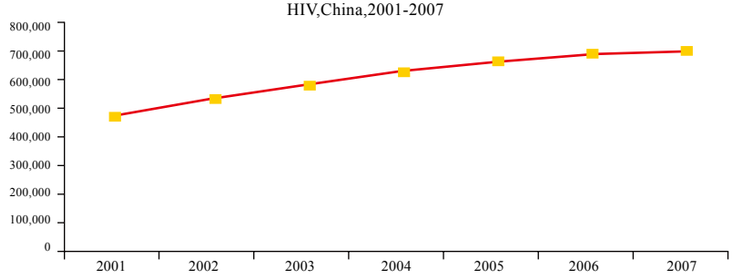
Around 33.4 million people around the world are living with HIV [1]. However, overall HIV prevalence in China remains low – estimated at less than 0.1% of the total population – but at the time of writing, the epidemic continues to grow in all parts of the country. HIV transmission associated with the sale of blood and blood plasma in central China in the 1990s appears largely contained and the majority of new HIV infections are now related to sexual transmission and injecting drug use.

By the end of December 2009, 740,000 adults and children were estimated to be living with HIV, up from 470,000 in 2001 in China. In 2009, there were an estimated 105,000 AIDS cases and 48,000 new HIV infections [2].

Figure 1. Estimated number of people living with HIV,China,2001-2007



(Source:UNAIDS/WHO,2008 Report on the globai AIDS epidemic,July 2008)

1.UNAIDS.

2.International Olympic Committee

3.Beijing Municipal Health Bureau

4.Beijing Organizing Committee for the Games of the XXIX Olympiad

Although China has several good quality condoms brands there are significant problems with large numbers of low quality condoms on the market.

Blood collection, testing and use of blood products have in recent years been improved and are now well managed. However, universal precaution in clinical environments is not well understood and not systematically implemented in China [3]. This has of course implications for staff working in clinical environments including dentistry and doping control.

Stigma and discrimination, which help drive the epidemic, are at an alarming level and many myths and misconceptions persist [4]. These prejudices not only impact the lives of people living with HIV (PLHIV) negatively, they also have a harmful effect on HIV prevention. This is because they create fear from being associated with AIDS, which impedes people from seeking HIV information, getting tested and knowing their HIV status. This in turn means that people do not take proper precautions and those who are infected do not get treatment and care in time.

Importance of HIV to the Olympics

Many of the people around the world who have HIV are involved in sport, either as spectators, fans or as participants. The goal of the Olympic movement is to contribute to building a better world by educating youth through sport without discrimination. The spirit of the Olympics, including the respect of universal moral principles, is in line with the work to stop HIV and decrease stigma and discrimination.

The Olympic Games is a high profile event that provides great opportunities to expose the general and specific population groups to prevention and anti-stigma messages from health authorities, sports organisations, opinion makers and role models. It works well as a vehicle to reach groups including Olympic Games volunteers and populations beyond the host nation.

An Olympic HIV campaign is an opportunity to contribute to the achievement of Millennium Development Goal Number Six and universal access to prevention, treatment, care and support by decreasing stigma and discrimination and decreasing risk behaviours.

The HIV campaign during the Beijing Olympics had the potential to contribute to:

- prevention and countering stigma and discrimination among the Chinese population, Olympic volunteers and staff, visitors and national Olympic delegations,
- prevention among clinical staff providing services during the Games,
- provision of information, prophylaxis, tests and other clinical services to staff, delegations and visitors,
- provision of volunteer and professional services free of stigma and discrimination, which in turn helps avoid misunderstandings and conflicts due to misconception about routes of HIV transmission,
- HIV advocacy and social mobilisation work though sport stars with a reach beyond national borders, ethnicity, age, sexual orientation and gender.

Apart from risk situations that naturally occur where large groups of people interact and where clinical services are provided, experiences from some previous large sport events indicate that demand for the services of sex workers increases significantly during such events, and hence potential risk behaviour rises accordingly.

Anecdotal evidence collected from athletes and media stories indicate that some athletes' behaviour changes once they have finished competing. After a long period of focusing mainly on their sport they turn to social activities and hence some engage in drinking and social gatherings, which may lead to casual and/or unprotected sexual encounters.

Since 1992, HIV prevention has been promoted among the Olympic athletes and officials through the provision of free condoms in the Olympic Villages' polyclinics. In 2004, the IOC ran its first special HIV advocacy campaigns during the Olympic Games, in close partnership with the Organising Committee for the Athens Olympic Games and UNAIDS. A special fact sheet was developed and distributed to all athletes.

Description and evaluation methods

In 2004, the International Olympic Committee (IOC) and UNAIDS signed a Memorandum of Understanding (MoU) to combine efforts to enhance the role of sports organisations in the fight against AIDS, and to organize AIDS awareness activities with coaches, athletes and sports personalities [5]. This led to a range of initiatives culminating around the organizing of the 2008 Games.

Linked to the objectives of the MoU and prior to the games, other initiatives were implemented outside of the partnership by UNAIDS, China Red Cross, and others.

UNAIDS, together with a private sector stakeholder and a Chinese foundation, supported HIV awareness-raising activities targeting migrant workers at construction sites for some of the Olympic venues.

In close collaboration with organisations of PLHIV, China Red Cross, and the Beijing Health Bureau, UNAIDS organised an initiative to help prepare Beijing for the Olympics by making it "greener" while countering stigma. PLHIV planted trees next to the Olympic park with various celebrities and VIPs including a Chinese Olympic gold medallist and the Princess of Belgium. In addition, IOC and UNAIDS facilitated the participation of a PLHIV in the Olympic torch relay in Tanzania.

UNAIDS mobilized nine UN agencies, China Red Cross, Marie Stops International and PLHIV to train more than 7,000 Olympic volunteers in about 15 universities on prevention and countering stigma and discrimination. The training was initiated to:

- Avoid misunderstandings and discrimination based on real or perceived HIV status

of members of the national delegations (including those from HIV high-prevalence countries),

- Ensure that the young volunteers were equipped with correct knowledge so that they are able to protect themselves and their partners as well as share their knowledge with peers,
- Encourage them to volunteer for HIV organizations after the Olympics.

An additional pay-off was that the volunteers were among China's best performing students, and are hence possibly future leaders in their communities. Providing them with correct knowledge and understanding could have significant long-term effects on the AIDS response.

In parallel with the above mentioned activities and in extension of the IOC-UNAIDS collaboration that started in 2004, an Olympic HIV campaign "Play Safe – Help Stop HIV – Play your part in protecting the world around you" was jointly planned and executed in connection with the 2008 Beijing Olympics by UNAIDS, IOC and the Beijing Organizing Committee for the Games (BOCOG).

The campaign had several key aspects:

- There were 100,000 high-quality condoms, packaged in 50,000 leaflets with information on HIV prevention and anti-discrimination, made available in English, French and Chinese in the clinics in the Olympic Villages in Beijing, Hong Kong and Qingdao. The condoms were all of standard 53 mm size. Photographs and quotes from Yao Ming, the male Chinese basketball star, and Rania Elwani, the female Egyptian swimmer and member of the IOC Athletes' Commission, were included in the package.
- A poster was designed to bring attention to the information and condoms services available in the clinics. The poster was displayed at the clinics, at official affiliated hotels and on the IOC information platform "IOC Corner" at the Olympic village.
- Two different HIV videos in the three languages with UNAIDS Special Representative and German footballer Michael Ballack and Chinese Basketball star Yao Ming were shown on the monitor in the waiting rooms at the clinics and on the "IOC Corner".
- Fact sheets on HIV as well as the two videos were included in the flash sticks ("IOC Athletes' Information Kit") that IOC distributed to all athletes [6]. Yao Ming and Rania Elwani also featured with photos and quotes on the fact sheets.
- Beijing Municipal Health Bureau resorts issued 400,000 condoms free of charge to the 119 Olympic contracted hotels and the city's major hotels. The condoms were placed in the bathrooms of each guestroom. In the mean time, 250,000 copies of the "textbook of HIV prevention" were placed in Olympic contracted hotels and tourist restaurants for free access.

Information provided as part of the campaign included how HIV is and is not transmitted, what people can do to protect themselves and others from HIV (as well as other sexually transmitted infections and unwanted pregnancies), and why people should not discriminate against PLHIV. Athletes were also provided with information on how they could help the response to HIV and where they could get additional information.

Thus, the campaign aimed not only to benefit the Olympians, the members of the national delegations and the more than 100,000 volunteers supporting the Games, but also encouraged athletes who are highly respected in their home communities to support the response to HIV globally and locally, thereby amplifying key HIV messages around the world.

The IOC President examines HIV prevention material.

The 100,000 condoms were donated by the China Reproductive Health Industry Association and produced in China following WHO quality requirements. UNAIDS partnered with the China Contraception Supply Centre to perform quality checks certifying that the condoms met international WHO standards. In addition to free condoms, free HIV and sexually-transmitted infections tests were made available at the Olympic Village polyclinic.

The campaign was launched on August 1 by the President of the IOC, members of IOC boards and committees including the Athletes' committee, UNAIDS, IOC and BOCOG staff. Press releases were issued to generate further attention to the campaign and the issues. The Deputy Prime Minister of China, Vice Mayor of Beijing, Minister of Health and other VIPs visited the polyclinic and were introduced to the AIDS campaign and services.

In addition, UNAIDS in collaboration with WHO provided state-of-the-art documentation and materials on universal precaution to BOCOG's medical department to assist with training on prevention of dental and health care staff. Dental care was one of the larger

health care programmes provided in the polyclinic and at certain competition venues. Over 100 dental care staff from 12 hospitals volunteered. An intensive training course on HIV was conducted for all of the dental care volunteers before the Games. Professors from the Capital Medical University conducted the training titled "Prevention of HIV and other communicable diseases in dental care "and" Anti-stigma for HIV and AIDS for the Olympic Games.

Due to lack of time, resources and sensitive issues, a proper evaluation of the activities in the Olympic village was not possible. However, an evaluation meeting between the Deputy Chief of the Polyclinic, the IOC Medical and Scientific Director and the responsible UNAIDS officer was held two days before the closing ceremony. Here, lessons learned and ways to improve the provision of HIV related services in future Games were discussed. Stock was taken of the leaflets and condoms remaining in the clinic.

Findings and results

Significant media attention to HIV issues was created through the pre-games initiatives such as the interventions targeting Olympic venue construction workers, the tree-planting event and the torch relay. Though long-term impact is difficult to gauge, the events contributed to keeping HIV issues in the public eye and promoting prevention and countering stigma and discrimination.

The individual evaluations of the Olympic volunteers training by participants were overwhelmingly positive. After the first round of training, additional universities signed up for training of volunteers at their institutions as the initial trainings had been very positively received.

The materials of the Olympic HIV campaign and the availability of condoms were well received and, importantly, no complaints about cultural, gender or privacy sensitivity issues were received. The campaign was widely reported in Chinese and international media and publicly endorsed by Chinese, IOC and UN leaders alike.

The condom packages were placed on a simple table not far from the entrance and the reception of the polyclinic and at the dental clinic. According to the Deputy Chief of the Polyclinic, people taking condoms included athletes, coaches, physicians, delegation officers and volunteers. One-third of those taking the condoms were women. Some team physicians brought supplies of condoms to Beijing for their own athletes.

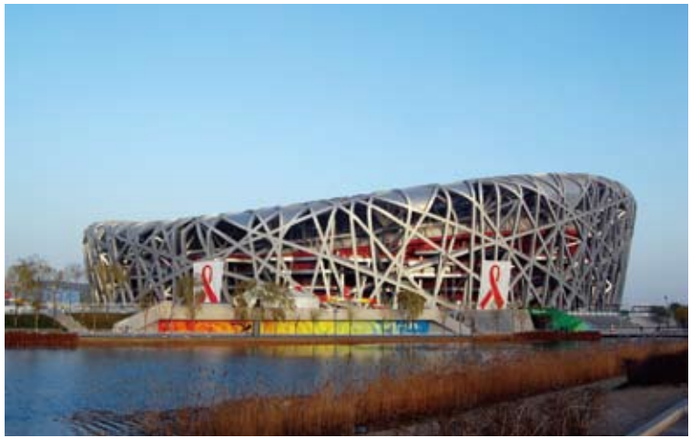
Two days before the end of the Games, stock was taken and 18,750 leaflets (each with two condoms) out of 46,000 (2,000 were sent to Qingdao and 2000 to Hong Kong) remained. Only 5,000 leaflets remained the day after the closing ceremony. This implies that up to 90,000 potentially risky sexual encounters were protected and made safe.

The Deputy Chief of the Polyclinic reported that a number of HIV and STI tests were requested at the polyclinic. One HIV test was found to be positive. It was also noted that ten women asked for a pregnancy test during the last days of the games. This might be seen as a further indication of unprotected sexual activity among delegation members [7].

Other main results have been in partnership building, mobilising organisations for common action and learning lessons for integrating sport and HIV for future interventions.

For example, China Red Cross and UNAIDS have continued the strong relationship in the local response to HIV by among other things co-organising an event in commemoration of World AIDS Day. The event was organised at the Olympic Green between the Bird's Nest stadium and the Water Cube Swimming stadium around December 1st. Among the many activities was the raising of five giant red ribbons in the Bird's Nest.

UNAIDS Credit



The partnerships are likely to have a long-lasting effect and impact on the response to HIV in China. Another example is the commitment and contribution of basketball player Yao Ming, who agreed to appear in a range of HIV campaign materials in 2009 focusing on stigma and discrimination.

Although this sport celebrity had earlier been involved in an HIV related public service announcement, the commitment and trusted relationship that has since resulted in additional materials were founded during the Olympic campaign.

Discussion

The long-term impacts of the pre-Games initiatives are difficult to determine, but they were particularly helpful in strengthening strategic partnerships prior to the Olympics and contributed to promoting prevention and countering stigma and discrimination among the general population.

The training of the Olympic volunteers appeared to be very successful due to several factors:

- the meaningful involvement of PLHIV, who were experienced and well educated trainers, as an integral part of the training teams;
- the participatory and game-oriented methodology used; and
- the effective coordination between involved organizations despite very short deadlines.

Notwithstanding the success in distributing the condoms and drawing attention to HIV issues through the Olympic HIV campaign the BOCOG, IOC and UNAIDS representatives all agreed during the evaluation meeting that there was room for improvement. The promotion of the services and information available in particular was discussed. A better presentation of the materials including condoms would be useful.

Promotion

To strengthen the promotion of the services in future events, special cabinets or other furnishings upon which the condoms and materials could be presented clearly should be considered.

The IOC Medical and Scientific Director suggested that a special kiosk shaped like a condom and prominently displayed, could be set up. This would be a central place where volunteers could provide HIV information, counselling, distribute materials, show videos and hand out condoms (in addition to the self-service in the clinic or elsewhere for those seeking greater discretion).

The model used in Chinese hotels could also be considered. Here condoms are (by decree) made available in all hotel rooms (not necessarily free of charge). People who do not want them can just leave them. The cleaning staff would carry replenishments on their trolleys together with other items such as extra soap and cleaning detergents.

Information on the campaign could also be featured in the Olympic Village magazines and in the Olympic Village cinema.

There was a much higher demand for condoms at the very end of the Games, probably due to the fact that more people became aware of the services available as time progressed. In addition, anecdotal evidence suggests that as more athletes finished their competition, they socialized more and were more likely to engage in sexual activity. Most likely a number of delegation members also took the opportunity to pick up condoms to bring home.

Posters

The production of posters should start well in advance and be pre-tested to the degree possible with the intended target group. For this purpose IOC and UNAIDS would benefit from further involvement of the IOC athletes commission. The role of the posters should be to create immediate attention and information on where to get more detailed information and/or services including the free condoms. Due to the restrictions on posting items within the Olympic village and venues, the current strategy of setting up the posters at clinics in the Olympic Village and in the venues as well as some partner hotels is recommendable, but further promotion could be considered.

Public service announcements and videos

The production of PSAs is very costly and the adaptation of existing sport and HIV associated PSAs can work well. To get the target group's attention it obviously is preferable that PSAs are sports related, but other relevant HIV announcements could be considered. However, they should be targeted and pre-tested if at all possible with segments of the intended audience.

The PSAs were broadcast in several ways, including on monitors in the waiting rooms in the clinics. However, they did not feature very often on the monitors, as sports channels naturally were more popular. It will be useful to have at least two separate monitors, so the same monitor is not used for both sport and public health announceements.

Broadcasting the PSAs before feature films in the Olympic Village cinema could also be considered.

Leaflets and condoms

Although the original plan was to provide two sizes (medium and large) of condoms, there was unfortunately insufficient time for ensuring that two sizes of tested international quality would be in place for the Games. Hence all condoms were of standard medium size (53 mm). In future international events, medium and large sizes should be offered if possible. It is of great importance that preparation for the provision of condoms begins well in advance to ensure that they can be tested, guaranteeing that they live up to WHO standards; and that sufficient time is allowed for producing both standard and large size condoms. Provision of female condoms could also be considered. Clear and transparent procedures for the approval processes of the host organization are helpful.

Most of those individuals who are exposed to the availability of condoms and information in the clinic are national Olympic delegation members who have business there. However, many will have no need to go to the clinic during the Games and thus be unaware of the availability of condoms. It is important to raise awareness of the service. Bringing part of the HIV campaign out of the clinic and closer to the target group as an element of better promotion should therefore be considered.

Fact sheets

For the production of fact sheets, appropriate stakeholders such as technical staff and athletes should be consulted early in the process. It is very difficult to assess the degree to which athletes accessed the information on the flash sticks. As many athletes might not be particularly computer-literate, offering a choice between hardcopies and electronic copies should be considered.

Lessons and recommendations

As far as possible, HIV prevention work should be mainstreamed throughout the cycle of planning and implementation of a large event. In cases where venues are being constructed or refurbished, the construction workers, and in particular migrant workers, should have access to health education and prevention tools including condoms. Volunteers and service providers including health staff involved before, during and after the events should receive appropriate information and tools for prevention.

The high profile status of the event should be used for creating general attention to HIV and other health issues as well as countering stigma and discrimination among the general population and event spectators.

Meaningful involvement of PLHIV should be ensured, which will help strengthen prevention and anti-stigma work. PLHIV can humanize the face of the epidemic and illustrate HIV as a reality rather than a distant abstract concept. PLHIV can talk about HIV in personal and poignant ways that have high impact on target groups.

High-profile events should be used to build partnerships that otherwise are less likely to be created. These could be between HIV service organizations, organizations of PLHIV, health authorities, sport organisations and event organizers. High-profile events should be used to recruit sport celebrities to help advocate for HIV issues.

Anti-stigma and discrimination information and education targeting health staff, volunteers, delegations and participants are necessary to counter any incidents of discrimination during the event. This will in addition have a longer-lasting positive effect on the general environment for HIV work after the event.

Universal precautions training for dental, doping test and health staff should be ensured and protocols and tools necessary to implement universal precautions should be in place. These will have beneficial impacts beyond the potential risks of HIV infections.

Services should be supported by communication materials. New ones can be created or existing appropriate materials can be adapted. Key stakeholders including the target group should be consulted and involved from an early stage of the development and onwards. The materials should be pre-tested and adapted to ensure that messages are effectively communicated.

Appropriate promotion of services should ensure that target groups are aware of available services.

Clear rules and guidelines should be established within the institution organizing the event to make campaign implementation easier. Such rules and guidelines should be transparent and easily available and include the process for procurement or delivery of free services and tools (such as condoms and information material).

Involvement and collaboration with local CDC or other authorities responsible for blood testing and particularly HIV testing should be well planned and areas of responsibilities clearly identified if the service is to be offered during the event.

At least two sizes of condoms of tested and approved national or international standards (WHO) should be available and female condoms should be considered. It should be expected that condoms would be picked up in large numbers particularly at the end of the event.

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4. A Knowledge, Attitudes, Behaviour and Practice (KABP) survey of over 6 000 respondents in six cities including Beijing showed that more than 48% thought they could contract HIV from a mosquito bite, and over 18% by having a PLHIV sneeze or cough on them. Nearly 65% would be unwilling to live in same household with a PLHIV and 48% of interviewees would be unwilling to eat with a PLHIV. Around 83% of interviewees had never searched for information on HIV. Source: "AIDS-Related Knowledge, Attitudes, Behavior, and Practices: A Survey of 6 Chinese Cities", UNAIDS, GBC, CHAMP and Renmin University 2008.

5.Atoolkithasbeendevelopedjointly:http://data.unaids.org/Publications/IRC-pub06/IOC_Toolkit_20Dec05_en.pdf.

6. Examples of the materials can be viewed in the E-magazine found here: http://www.unaids.org.cn/emag.

7. Post olympic report to UNAIDS and IOC by Deputy Chief of the Olympic Village Polyclinic.

Chapter 19

Anti-doping activities

Arne Ljungqvist[1], Don Catlin[1], Moutian Wu[2], Jian Zhao[2], Zhiyu Chen[2], Xiaozhen Zhen[3]

Doping is cheating. Not only is it against the Olympic spirit, but it also threads its way through society and becomes a public health issue[1]. Doping affects all levels of competition from high schools, to universities, professional teams and Olympians. Virtually all sports and all nations are affected. The 2008 Games were therefore a great opportunity for China, the world's most populous nation with millions of sports participants, to demonstrate how it has coped with this threat, how it conducted the Games, and how it will continue to confront doping in the future.

Although China has Beijing and a number of other large cities that are quite similar in their development to many other major international cities, there are many regions of China that are at a much earlier stage of socio-economic development. It is difficult enough to conduct really modern and complex anti-doping programs in advanced nations with sophisticated communications systems, so as the 2008 Games approached, it was a big challenge for China to develop a coordinated and sophisticated anti-doping program for the whole country, effective beyond the more modern cities.

Anti-doping testing is of vital importance in the eyes of the IOC. In recent years, there has been a continuing escalation in the number of athletes tested, the menu of tests, the staff needed to perform them, and the analytical equipment necessary for the tests.

Thus at the Beijing Games, thousands of samples were collected and analyzed for an extensive and complicated list of drugs. Doping control begins with collecting body fluids (typically blood and urine) from athletes at doping control stations situated at the venues, labeling and packaging them properly, and transporting them to laboratories for analysis.

1.International Olympic Committee Medical Commission

2.China Anti-doping Agency

3.Beijing Organizing Committee for the Games of the XXIX Olympiad

The Olympic Anti-Doping Laboratory of Beijing was first accredited by the IOC in 1989 under the name of the China Doping Control Centre in the National Research Institute of Sports Medicine. In 2007 the laboratory became a part of the China Anti-Doping Agency and was renamed the National Anti-Doping Laboratory. When the World Anti-Doping Agency (WADA)[2] was created in 1999, the Laboratory was accredited by it, and it maintains that status today.

Many different types of doping agents are known and examples are named on the Prohibited List issued by the WADA on an annual basis[2]. The best-known classes of doping agents are low molecular weight drugs or small molecules. In recent years the WADA laboratories have become adept at detecting these drugs, so athletes who are determined to dope have graduated to new classes of drugs that are more difficult to detect, such as peptides, proteins and glycoproteins. Some of these are insulin, growth hormone (hGH), human chorionic gonadotrophin and erythropoietin. The hGH test that was used in Beijing was based on two different antibodies for screening and another pair of antibodies for confirmation[3]. It was automated and therefore not difficult to perform, but the underlying science was rather complex.

In addition, techniques such as blood doping have developed. The test for heterologous blood doping is also very difficult. The most complex tests in Beijing were those to detect the many different forms of erythrocyte stimulating agents (ESAs) such as recombinant human EPO (rHuEPO), darbepoetin, and biosimilar recombinant human EPOs[4,5]. Mircera was not tested for in Beijing, but it was later in other laboratories[6].

The task for the Beijing Olympic Laboratory was to develop methods to detect all these drugs and techniques in massive numbers of samples in record time. This required very careful planning, written protocols, a large dedicated personnel and much practice. For testing to be successful, many highly trained and experienced individuals, with advanced degrees and years of experience, had to be available. The methods are exacting and the results had to be capable of withstanding intense legal scrutiny.

Description and evaluation methods

A prerequisite for creating a health legacy from anti-doping activities is that the testing must be conducted according to a detailed and comprehensive plan. The following sections explain the key elements of the plan for the Beijing Olympics.

Top-level organization of the plan

The doping control program as part of the Olympic Games was the shared responsibility of the International Olympic Committee (IOC), the local organizing committee (BOCOG), and the WADA. For all Games since those in Sydney, in 2000, this was accomplished in accordance with the 'host city contract'.

While the IOC was the primary responsible party for all matters, it delegated considerable responsibility to BOCOG. In addition some aspects regarding education and pre-Games sample collections were WADA's responsibility.

Sample number and analyses

The preliminary number of tests (4,500) and the types of tests (urine and blood) were pre-determined through discussion between IOC and BOCOG, with advice from the Beijing Laboratory. Distribution planning and implementation of pre-competition tests were decided and carried out by IOC, WADA and BOCOG, while the IOC, BOCOG and the International Federations agreed upon the number and distribution of in-competetion tests, i.e. tests conducted immediately following the various competitions.

As in Athens in 2004 and Turin in 2006, the controls were conducted in and pre-competition on Olympic athletes during a defined "Olympic period", starting with the opening of the Olympic village and ending with the closing ceremony of the Games.

In Beijing a total of 4,770 samples were taken from 3,956 competitors and analyzed during the Olympic period, 3,956 being urine samples and the remainder blood samples. Samples collected out-of-competition amounted to 1,462 while 3,308 samples were collected in-competition. The Beijing laboratory reported 9 positive cases during the Games.

However, a few months later, further analyses were conducted on the samples using methods that had been still in development and thus not available during the Games. These samples were screened by the WADA laboratory in Lausanne and confirmation analysis was conducted by the WADA laboratory in Paris. Six of those samples from five different athletes were positive for Mircera, raising the number of athletes who tested positive at the Olympic Games to 14.

All blood and urine samples were considered in-competition from an analytical point of view since they all were collected in relationship to the Beijing Games. The collections of the samples at the Olympic venues as well as all analytical procedures were conducted by BOCOG. Pre-competition samples that were collected outside the Olympic venues during the Olympic period were collected by WADA according to a schedule that was decided by representatives of WADA, BOCOG and the IOC.

IOC Medical Commission representatives supervised work at the doping control stations and in the laboratory. The laboratory representatives reviewed the documentation of any potential positive result before it was deemed positive and reported to the IOC, which was responsible for results management.

In general, anti-doping activities during the Olympic Games are not only intended to assure the Olympic athletes a level playing field but also to demonstrate that doping has no place in sport. To that end WADA had its educational "Outreach program" in place in the Beijing Olympic village, while the IOC was responsible for the doping control program. The Beijing Games offered an ideal opportunity to interact with many athletes from around the world.

WADA independent observers were present in Beijing as they have been at all such events since the Summer Games of 2000 in Sydney. These observers have access to all aspects of the doping control program. Typically they come and go on their own schedule thus their observations cannot be predicted or prepared for. They review analytical data to be sure that all the elements of the Standard Operating Procedure manual have been followed. Shortly after the conclusion of the Games, they issue a report on their observations.

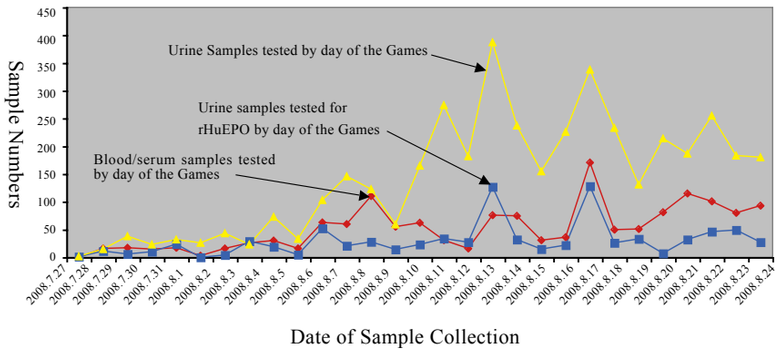

Figure 1 shows the number of blood/serum and urine samples tested from 7/26/2008 through 8/25/08. The yellow line which connects yellow triangles depicts the number of urine samples tested by the day of the Games. The samples tested for rHuEPO are shown by the blue squares connected by a blue line and the samples tested by one or more of the specialized methods are shown by red diamonds connected by a red line.

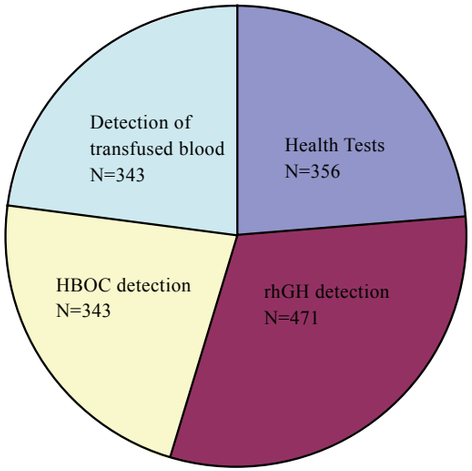

Figure 2 shows how highly specialized methods for difficult substances were tested for on blood. A total of 1,513 blood samples were collected from athletes during the Games. Certain subsets of athletes and sports were selected for specialized testing. On the request of the International Federations a so-called "Health Test"[1] analysis (not part of the doping control programme) was performed on 356 samples or 24% of the total. It consisted of tests for hemoglobin, hematocrit, and reticulocyte count. Serum tests for recombinant human growth hormone (rHuGH) were performed on 471 samples (30% of the total). The background on this test has been described and the results of the analyses were monitored by WADA. Transfusion of blood (BT) from one person to an athlete was detected by flow cytometry that detected antigens on the surface of red cells[7]. The BT test was applied to 343 samples (23% of the total). Hemoglobin -Based Oxygen Carriers (HBOCs) were screened for by colorimetry. If the screen was positive, mass spectrometry was used for the confirmation[8]. This method was applied to 343 samples (23% of the total). None of these specialized tests discovered any positive cases.

Sample collection procedures

Organization of doping control stations

There were 41 doping control stations in total, 34 of them in Beijing, 5 in the other co-host cities, and 2 in Hong Kong, with a total of 917 staff of physicians and others assigned to them. Each station had at least two processing rooms. The largest station was at the Olympic Village with eight such rooms. Each station was fully equipped and toilets were equipped with mirrors on three of the four walls for proper observation of the athlete during the delivery of the urine sample.

The staff of the stations consisted of 54 venue doping control managers, 35 chaperone coordinators, 34 venue coordinators, 197 doping control officers (DCOs), 581 chaperones, 10 international DCOs, and 6 international volunteers. All DCOs were physicians, so there was at least one physician at each station at all times. In addition 10 international testing experts and 6 international volunteers were involved.

Collection of urine and blood

Each athlete selected for doping control was presented with a doping control notification, which indicated whether he or she was required to undergo urine, and/or blood collection. The athlete reported with his or her doping control access pass to the station as soon as possible, but in any event, not later than 60 minutes after the time of notification (as specified on the doping control notification). The athlete was accompanied by a chaperone to the control station.

The DCO informed the athlete of the procedures that were about to be undertaken in accordance with WADA International Standards.

Training of doping control staff

All doping control staff underwent four phases of training - centralized training for qualification, practice during the test events, a consolidation period, and additional intensive training just before the Games began. The collection sites operated successfully without any significant incidents. Likewise there were no incidents with the sample transportation from the collection site to the laboratory.

Transportation of samples

Unlike sample transportation in previous Olympics, the Beijing samples were transported in armored trucks and accompanied by armed guards in order to guarantee the safety and integrity of each sample. The vehicles were equipped with a global positioning system (GPS) and all routes were pre-planned. They made 473 separate trips, including 455 in Beijing, 10 in Qinhuangdao and 8 in Tianjin. The vehicles entered and exited the Olympic venues 1,852 times, logging a total of almost 30,000 kilometers.

Laboratory organization and personnel

A year before the Games began, it was decided to organize the laboratory as a non-competition venue and the Deputy Director of CHINADA (China Anti-Doping Agency) was designated as Deputy Director of the Venue, the person in charge of doping analysis at the venue. This enabled the laboratory director to have complete control of all the necessary functional units related to laboratory testing.

In total, 134 people were directly involved and working in the laboratory. They included 21 staff of the laboratory, 16 laboratory staff from other WADA accredited Labs, 24 professional volunteers and 56 student volunteers. The professional and student volunteers were obtained from Beijing University, Tsinghua University, Beijing Normal University, Beijing Institute of Forensic Medicine, National Institute for the Control of Pharmaceutical and Biological Products, Chinese Academy of Medical Science and the Peking Union Medical College.

In addition, some technicians from instrument manufactures were present to provide service on site. Several experts with vast experience in doping control and medical or scientific qualifications were present to provide special expertise in a wide range of scientific categories. Four experts from the IOC-MC Games Group reviewed all potential analytical adverse findings, the documentation packages and served as witnesses for B analysis. The objective was to screen all samples within 24 hours and to report the samples as either positive or negative. Positive samples required extra work and time.

Laboratory equipment

A considerable amount of specialized laboratory equipment was required. The number of blood and urine samples processed each day by the Beijing laboratory is shown in Figure 2.

Figure 3. Laboratory work benches that were used to prepare the blood and urine samples for analysis by the laboratory instruments.

Findings results and outcomes

Today the Beijing laboratory is the world's largest anti-doping laboratory. Its sophisticated equipment may stand for many years as a monument to the doping control activities at the 2008 Games.

Hundreds of people were trained in various aspects of doping control. Many laboratory scientists in Beijing by virtue of working side by side with the world experts have advanced their existing level of chemistry and mass spectrometry to the highest degree. A great many others have learned the correct ways to collect urine and blood samples from athletes. China thus now has a very deep reservoir of people who can manage all aspects of doping control.

Laboratory testing in the 2008 Games was a team event, with the team spread over many cities for sample collection while the actual analytical work took place in Beijing. Like at the Athens Olympic Games all the samples were later sent to laboratories in European countries with special expertise in complex analyses. This was for two reasons. First, testing for some substances has become so complicated that only one or two WADA-accredited laboratories can readily accomplish it. Second, new drugs have appeared that could not be tested for by existing methods. Such methods may, however, be developed within the 8 years of statute of limitation and allow for further analysis of the stored samples within that period".

Positive cases

During the Games, 10 urine samples in total were reported with analytical adverse findings. There were 2 EPO positive (one person, cycling), 2 propranolol (one person on two occasions, shooting), 2 testosterone (track and field), 1 furosemide (gymnastics), 1 methyltestosterone (track and field), 1 nandrolone (weightlifting), and 1 clenbuterol (kayak). In addition all double blind control samples were identified correctly (terbutaline, aminoglutethimide, modafinil + norethandrolone, finasteride and several negative controls).

Each of these positive cases is a reminder to the sporting world that drugs will not be tolerated by the Olympic fraternity.

In the ideal Olympics there will be no positive cases despite thousands of tests conducted using the most sophisticated testing procedures. This, however, remains to be achieved. The Beijing Olympics tested nearly 5,000 samples, more than ever before, from almost 4,000 athletes, just 14 of whom tested positive. This is a very low ratio, but even one athlete who tests positive demeans the spirit of the Olympics as well as risking the end of his or her sporting career.

Public awareness of doping

Today the Chinese public is much more aware of doping than when the Games were awarded to Beijing in 2001. This is due to partly to media coverage of the issue, public education and information, and the presence in and around Beijing for several years of many people working on the doping problem. National polls have shown that the Chinese public denounces doping.

Olympic-level athletes learn that doping leads to expulsion from sport for two years. This clearly has a deterrent value, but as yet there is no accurate way of measuring it.

Discussion

Doping control continues to evolve within the structure of the organization and general operations of the Olympic Games. The Beijing Games were extremely well organized, and as a consequence, so were the major elements of the anti-doping system, described in this chapter.

The 2008 Games surpassed their predecessors in many spheres, including doping control. This raises the question of whether or not the high standards set by the Chinese can be exceeded at future events. While the Beijing Olympic Games have been described as "truly exceptional" doping and the methods used to cheat will continue and to become more sophisticated. Olympics organizers will have to maintain extreme vigilance to meet that challenge.

A vital part of the Beijing Olympics health legacy is the extent to which the doping control program educated Chinese athletes and the Chinese public against doping and made China a stronger partner in the global anti-drug culture shared by other big nations.

Making progress in China alone is a daunting task. Nevertheless, it is important to note that the Games initiated that progress; only time will show tell whether China can sustain it.

Lessons and recommendations

Anti-doping activities represent the largest and most complicated scientific challenge faced by Olympics organizers. The Beijing Games stimulated awareness of doping and anti-doping program in China. Anti-doping exhibitions were held in Beijing and all the other co-hosting cities. Tens of thousands of athletes, media, students and other of the general public were reached.

In order to show the absolute and clear stand of the Chinese Government against doping, Mr. HU Jintao, President of China visited one of the Beijing exhibitions. He not only voiced his satisfaction with the work accomplished, but raised even higher expectations of the anti-doping program. China's responsibility, he said, was to serve as model to the world in anti-doping and in its contribution to clean Olympics.

A challenge for the future is to create tools to measure changes in the anti-doping campaign. The Olympic 'magnet' factor is at work. People are drawn to the Games because they are such huge and spectacular events.

It is impossible not to learn something about doping from them. They offer many "teachable moments". Anti-doping educational programs should continue to be developed and designed to take advantage of this captive audience. Both WADA and the IOC fully understand this concept, and each national organizing committee absorbs it.

An example of China's health legacy is that every athlete had to pass an anti-doping knowledge examination in order to compete at the October 2009 Chinese National Games[9]. The test, which was arranged by the State General Administration of Sport, was supported by classes and educational materials focused on anti-doping issues.

Future Games organizers will come under increasing pressure to control costs in general, including costs of doping control. Doping control is compared to health care in that the expenses are largely related to the technical resources that are available. The organizers of the forthcoming Games to be held in London are already focused on this point. The question now is how the escalation in doping control methods and costs can be controlled.

A mechanism should be developed for quantitating the units of work performed on each sample. This is important because the number of samples analyzed does not reflect the work involved, or the quality of that work. The best way to accomplish the latter is by proficiency testing during the Games.

Most doping control issues recur year after year. For example could information on resources in Beijing be useful for London? Elements applicable to the next Games are detailed schedules, staffing patterns, number and type of instruments. Addressing these questions could help avoid "reinventing the wheel" and learning the same old things the hard way.

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Part three

Synthesis

Chapter 20

Go London! Planning a physical activity legacy

Hilary Ross[1], Simon Tanner[2]

Thousands of people celebrated in Trafalgar Square when London's winning bid to host the 2012 Olympic and Paralympic Games was announced in July 2005. The London bid had placed the concept of a legacy at its heart, with promises to regenerate the disadvantaged communities of East London, and for all Londoners and United Kingdom residents to reap economic, social and environmental benefits.

While previous Games have achieved health legacies including new health facilities or new public health surveillance systems, the health authorities in London were determined to ensure that the population would also benefit from a legacy of health improvement.

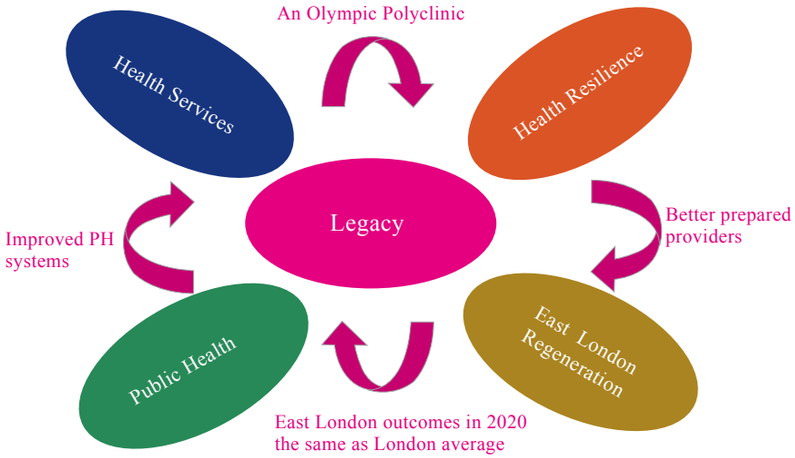
Overall Londoners experience good average health compared with England and internationally. However, this masks major inequalities in health outcomes which are evident geographically, including in the areas surrounding the Olympic Park, and among different population groups. While the ethnic diversity of the London population was seen as an important strength in the bid to host this international festival of sport, black and ethnic minority groups in London currently suffer disproportionately from poorer health.

A programme led by NHS London, the strategic health authority for London, has been initiated to lead the National Health Service response to the Games in the host city. Legacy runs through all of London's health work streams, as illustrated in Figure 1.

1.2012 Programme Director, NHS London

2. Regional Director of Public Health for London

Figure 1. Strategic context for 2012 health legay



The health improvement legacy is also, however, seen as an important workstream in its own right.

Although NHS London is considering how the Games could be used as a catalyst to improve health across a range of themes including obesity, sexual health, and alcohol misuse, the initial focus of the health improvement legacy work stream has been on physical activity.

This links closely with the work to encourage a sports legacy led by the Mayor of London.

A broader focus on physical activity is essential if it is to lead to health improvement particularly among those Londoners who are not currently active. These groups are unlikely to take up sport as a first step to becoming more active, but could be encouraged to walk more or build other types of everyday activity into their lives.

London has developed the following vision for a more active London inspired by the prospect of hosting the 2012 Games:

"London is a city where organisations work together to create opportunities and environments where Londoners easily choose to be physically active in their daily lives, achieving better health & wellbeing."

Londoners currently have very low levels of participation in physical activity with almost half of the adult population classed as sedentary or inactive [1]. While other host cities have

hoped for increases in participation in sport and physical activity following the Games, there is little evidence that this has actually been achieved. It is clear that increases in sport and physical activity participation will not take place automatically as a result of hosting an elite sporting event such as the Games. However, new research has shown it is possible if specific actions are taken.

Description and evaluation methods

Three-quarters of Londoners reported that they were not likely to become more active simply because the Games were being hosted in London [2]. It cannot simply be assumed that a physical activity legacy will manifest itself. In order to understand fully the opportunities for deriving such a legacy from the 2012 Games, the health authorities in England and the British Government commissioned a systematic review [3] of the best available international evidence for lessons learned from sports events including the Games, and the impact they can have upon physical activity, sport participation and health-related behaviour.

Three main conclusions were reached:

- while the catalyst provided by major sports events is not a direct step to behaviour change, they can stimulate "contemplation" of physical activity;
- major sporting events do generate a sense of communality, belonging, and feeling a part of a movement;
- by promoting a 'festival effect', there is an opportunity to re-connect people who may feel separated from elite sport, to consider moving out of inactive behaviour.

So, the Games can awaken a new desire – the challenge in London is to convert this to new attitudes, habits and longer term sustainable behaviours among the population.

Physical activity participation has already seen a renewed focus from the British Government with the publication of a new cross-government plan, Be active, be healthy [4] containing a commitment to encourage two million more people in England into physical activity.

In London, the conclusions from the research have been woven into a comprehensive strategy for physical activity and health improvement, using the Games as a catalyst [5].

The Go London health legacy strategy defines challenging objectives for a more active London by 2012 and beyond -

- use the once-in-a-lifetime opportunity of hosting the Games as a catalyst to generate a measurable and sustainable increase in physical activity participation among Londoners up to and beyond 2012;
- ensure that the increase in participation in physical activity will contribute to narrowing the gap in health inequalities by ensuring that the entire system promotes physical activity;
- ensure that the increase in physical activity is as common in the least active half of the population as in the highest.

Over 200 stakeholders participated in a workshop in March 2009 to develop the thinking behind the legacy strategy for London. Go London, the legacy strategy, was published in July 2009, and focuses on strengthening the work of service providers around five key themes –

- encouraging local usage of the 2012 "Festival Effect" – working with local communities to encourage participation through linking to the celebration and festival of the Games;
- energising local systems to focus on activity for the 2012 health legacy – encouraging local partnerships to work together and to ensure a systematic approach to increasing activity levels;
- targeting the inactive – groups less likely to be active in London include older people, people with disabilities or long-term conditions and people from black and ethnic minority groups;
- promoting physical activity for 2012 through "Workplace Health and Wellbeing" – particularly targeting the 170,000-strong National Health Service workforce in London; and
- exploring the use of "Incentivisation and New Technologies" to get Londoners more active.

Three years before the London Games NHS London had already launched a range of initial projects as part of the health legacy strategy to provide some momentum and to set some clear central direction.

Walking was identified as a central theme in the strategy and provided an initial focus for a series of 'early win' projects. Walking is important for the strategy because of its acceptability by inactive groups, as opposed to sport or other activities that require expensive kit or a degree of skill or technique.

Walking is an activity that most people can do, and has major benefits in terms of both the treatment and prevention of a range of long-term conditions [6].

The first project initiated was a major media campaign branded "Think Feet First" to promote walking, and aimed particularly at those in the population who are at risk of obesity. The campaign included outdoor advertising as well as advertisements on London's Underground network and information in every local family doctor surgery. The advertisements encouraged people to consider walking first for short journeys - approximately half of all journeys taken in London are less than two miles in distance, and so are potentially walkable [7]. Elements of the campaign were match-funded by the Mayor of London's transport agency, Transport for London. The campaign featured across the whole of London but posters were concentrated in areas with the highest levels of inactivity, including areas around the Olympic Park.

During the media campaign which took place in Spring 2009, NHS London also worked with Natural England, a non-governmental organisation set up to promote the natural environment, to increase the number of people participating in organised walks linked to local health services. The Walking Ambassadors scheme took place in 16 areas in London

with the highest inactivity levels and resulted in 495 new members joining 'walking to health' groups and participating alongside a total of 10, 000 people in 195 special campaign walks.

NHS London also made grants of £5,000 available to all London's NHS trusts to run a project to promote physical activity among their workforce. Forty-seven trusts including hospitals, primary care trusts and mental health providers took part in the project, which resulted in almost 2,500 employees participating in schemes such as organized walks, online health and wellbeing interventions, health checks, and dance, yoga and exercise classes.

Capitalising on the 'festival effect' in partnership with local health services, healthy lifestyle road-shows took place in 11 community festivals across London during the Summer of 2009. Over 25, 000 Londoners were encouraged to participate in the healthy activities on offer, to complete a health questionnaire, and to make a health pledge.

A project to promote physical activity among older people, black and ethnic minority groups and people with long-term conditions, which will link to a national roll-out of a new care pathway for physical activity based in primary care, was scheduled to begin in Autumn 2009.

While some initial momentum has been achieved, the Go London ambition will not be reached unless communities can truly be engaged through the 'festival effect' on an industrial scale. A study commissioned in September 2009 aims to determine a costed model that could be piloted in London using incentives for health to encourage more active lifestyles and potentially other types of healthy behaviour. Stakeholders in London have agreed that incentives for health could provide the underlying concept to a major new scheme to promote physical activity on the run up to the Games. Critically it is hoped that such a scheme would be sufficiently scaleable to achieve a difference that could legitimately be defined as "legacy".

Progress towards the Go London vision and targets also requires mainstream service providers such as local primary care trusts and local authorities to embrace the partnership working and culture shift required to drive increased participation through the system. For the first time, guidance provided by the strategic health authority on local strategic health plans will include expectations around 2012 health legacy. Work to engage all stakeholders in the ambition will continue throughout the run up to the Games.

Findings, results and outcomes

Specific evaluation frameworks were developed for each of the "early win" projects described above which has enabled their impact to be assessed in terms of outputs as well providing more detailed qualitative information.

At a population level, the ambition in London is to encourage at least 30,000 more adults to exercise for 30 minutes five times per week in line with the recommendation of the government's Chief Medical Officer. Another aim is to have at least 300,000 more adults participate in physical activity regularly by 2012 which is defined as exercising for 30 minutes three times per week. This definition corresponds to a national indicator that local authority partnerships in England had the option to adopt as a target that the government would measure performance against. In London this indicator was adopted by 13 of these partnerships who then negotiated targets on the basis of their local baseline data. The legacy ambition goes beyond what local authorities have pledged to deliver, so requires added impetus among all local partners for it to be achieved.

Critically, the legacy strategy is about improving health and reducing health inequalities, so a further aim is to increase the activity levels of the half of London adults who are currently classed as inactive. The target is to lift 150,000 adults out of inactivity by 2012. Because of the dose-response to physical activity, targeting the inactive has a strong potential to improve the poor health experienced by some key groups.

Figure 2. Go London legacy ambition targets.

Source: NHS London (2009) Go London! An Active & Healthy London for 2012 and Beyond.

Some host cities in the past have been hampered by inadequate data collection. Levels of physical activity participation in England are measured annually through a survey commissioned by Sport England, the government agency responsible for developing the English sport system. The Active People Survey [8] is the largest survey of sport and physical activity undertaken in Europe. The first survey conducted during 2005-2006 was by telephone and involved more than 350,000 adults aged over the age of 16 years. It included a sample of at least 1,000 adults in each local authority area. The robust sample size enables comparisons to be made about participation among different geographical areas and population groups including social class, ethnicity and disability.

The data illustrates a mixed picture in London with large variations in participation rates between local authority areas. Richmond and Twickenham, an affluent area with the highest levels of physical activity participation in London, has just over one-third of the population classed as inactive. Newham, a deprived area in East London where the Olympic Park will be located, currently has the lowest participation rate with over 60% of the population classed as inactive. Local primary care trusts and their local authority partners are helping to monitor the increase in local participation rates and the inactive proportion of the population.

The national government strategy provides data about the cost of inactivity borne by individual primary care trusts in England [9]. In London, the healthcare cost of inactivity is £105 million which equates to around £12 per capita. An audit of health spending by each local area in London identified that in comparison only an average of 85 pence per capita is spent on physical activity by primary care trusts [10].

Data on local spending on physical activity is an important indicator to monitor in implementing the legacy strategy for 2012, and further work is currently being undertaken to develop a more robust economic case illustrating the "spend to save" principle. Softer data about the enablers and barriers to local implementation of physical activity programmes will also be collated to enable the challenges to local delivery to be better understood and addressed.

Discussion

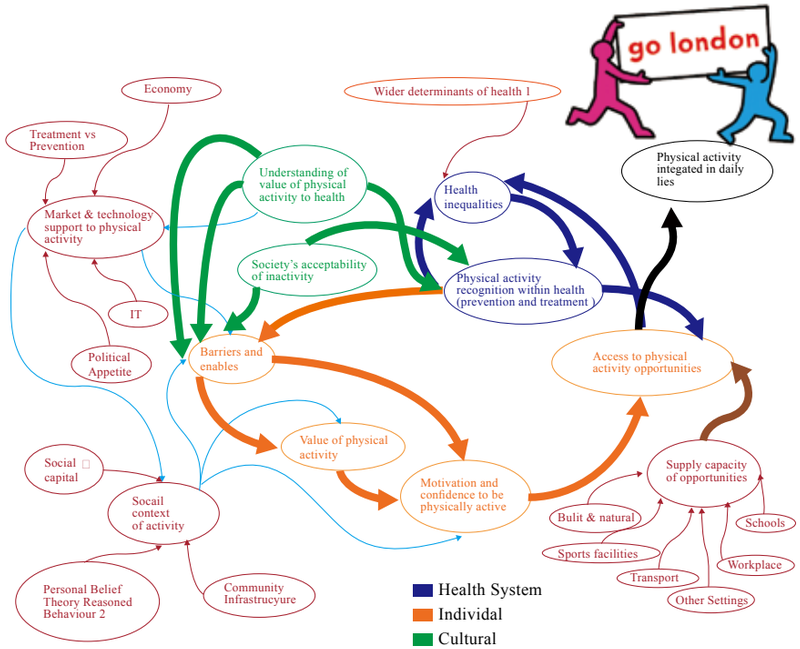
The strategy adopted in London has been based on a thorough analysis of the system for physical activity (Figure 3). This is the first time NHS London has conducted a systematic analysis of physical activity and improved understanding of the range of barriers (environmental, social, economic, and attitudinal) as well as the drivers (access to quality facilities, peer or family support, concern about health and fitness etc.). The "map" indicates that individuals' decisions to become physically active and to sustain that activity are influenced by three different levels:

individual motivation and choices (orange);

levels of health inequality (blue);

the wider cultural acceptance and understanding of the value of activity (green).

Figure 3. London's physical activity system.



Source: NHS London (2009) Go London! An Active & Healthy London for 2012 and Beyond.

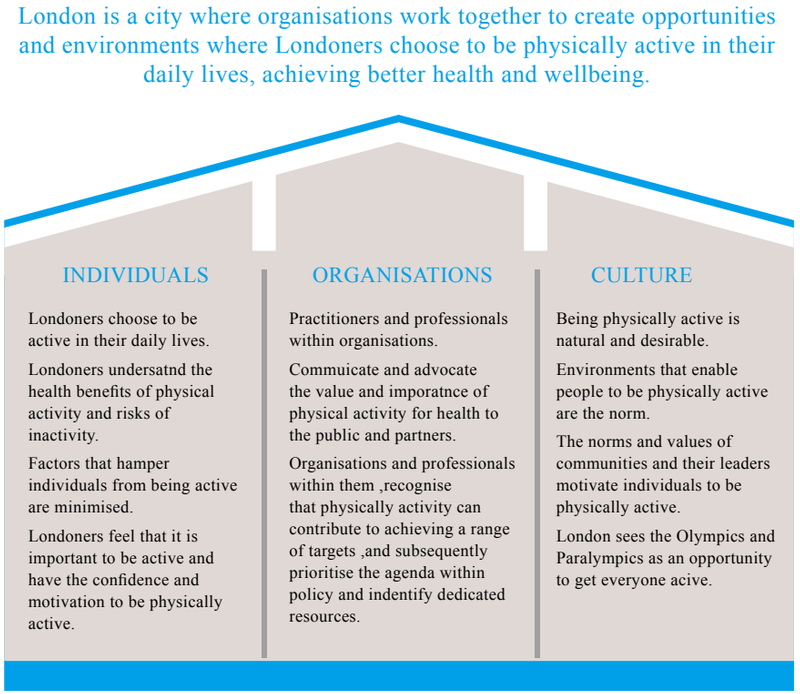
From this analysis of the system, the aim is to identify the areas where it seems possible to make the greatest impact in the shortest time to increasing participation in physical activity, while also improving overall health.

The system analysis has shown that while many public, private and charitable bodies are working to promote physical activity opportunities, they are not connecting sufficiently with inactive groups and impacting on overall participation rates. Where there are pockets of good practice, the work is not sufficiently scaled to make a difference.

There is a real opportunity to bring agencies together using the Games as a catalyst to support better joint working on this agenda and to link up the system to better effect.

The system analysis identified three domains where action must be taken if physical activity participation is to be increased. The challenge is to effect change at each of the three levels to achieve a legacy ambition that is sustainable beyond the Games.

Figure 4. Outcome framework for Go London strategy.



Source: NHS London (2009) Go London! An Active & Healthy London for 2012 and Beyond.

Lessons and recommendations

Beginning planning at the earliest stage is a key lesson that runs through every one of the health workstreams and no doubt through most aspects of Olympic and Paralympic planning. Research has also shown that host cities cannot sit back and expect the legacy benefits to "trickle down" from the Games without a concerted focus and specific strategies to utilise the "festival effect".

A governance structure that provides focus and leadership for legacy is also key to ensuring that legacy runs through every strand of work and that the legacy focus is retained as operational pressures mount as the Games draw closer. As the focus for our legacy workstream is physical activity, it has been critical to work in partnership with a range of stakeholders in London including the Mayor of London, transport planners, community safety officers, planners and NGOs. NHS London has engaged with these groups both formally through a governance structure which includes steering groups and an independent advisory group, and through less formal channels such as a stakeholder forum.

The work in London continues in eager anticipation of hosting the Games in 2012. There is anticipation, too, of sharing with the rest of the world the experiences and lessons of this unique event after it has taken place.

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Chapter 21

Public health achievements and lessons for the future

Michael O'Leary[1], Fang Laiying[2], Cris Tunon[1],Gauden Galea[1],Brian Oldenburg[3]

When the first modern Olympic Games were held in a developing country, Mexico, in 1968, many observers felt that Mexico City's altitude would have devastating effects on the athletes' performance. Forty years later, when China hosted the Olympics in 2008, concerns over factors that may affect the "success" of the Games had broadened to include many other issues. There was a very different set of expectations and the host nation, China, was expected to address and achieve success in relation to all of these.

Holding such vast and complex mass events in themselves posed a huge logistical challenge involving for example, the construction and adaptation of venues and facilities, strengthening the host cities' infrastructure and establishing information technology networks. Contrasting the Olympics in Mexico and Beijing, the number of competition venues and events almost doubled, from 52 to 93 and from 172 to 302, respectively. Almost twice as many athletes participated in the 2008 Games as had done so in Mexico - 10,500 athletes from 204 National Olympic Committees (NOCs) came to China, compared with 5,531 athletes representing 112 NOCs in Mexico [1]. The Beijing Games involved nearly 80,000 volunteers and more than 26,000 accredited journalists with an estimated global audience of around 4.7 billion viewers: the largest ever global TV audience [2].

These direct logistical challenges were substantial, but success depended also on many other factors. In the run up to the opening of the Games in Beijing, public health security measures were significantly improved in Beijing and China. A very high priority was to address the perceived potential threat of newly emerging infectious diseases such as SARS and avian influenza, which had affected several countries in Asia in recent years. Additionally, there was a heightened global awareness over such public health issues as air quality, the harmful effects of second-hand smoke, and the importance of a healthy lifestyle. Food safety and security were added to the list of public health and related issues of concern, which China needed to address in the years leading up to the Beijing Olympics.

A key element to take into account when planning an Olympics is to ensure that quality health care services are available and accessible to athletes and visitors. Accordingly, cities that immediately preceded Beijing as hosts of Olympic events, such as Athens, Sydney and Atlanta, not only developed services and programmes to cope with the likely health care needs of those involved with the games as athletes and visitors, but also took steps to strengthen their communicable disease surveillance and response systems [3].

Thus, in accepting the responsibility for organizing the 2008 Olympics, the Chinese national authorities also committed themselves to some of the key issues included in this wider public health security agenda.

The chapters in this book document China's experience in dealing with these issues. The aim was to highlight the longer-lasting effects of initiatives taken prior to and during the Olympic Games. In particular, these were to improve the capacity of medical services; to strengthen disease surveillance, risk management and response; to improve the living environment for the host city citizens; and to increase health awareness among athletes, visitors, and host country residents.

Increased health services capacity

The Beijing organizers provided intensive standardised training for thousands of health care professionals and volunteers on effective response to disease outbreaks or to incidents that might involve large numbers of casualties. This led to the development of new standard operating procedures for medical establishments. These are now gradually being integrated into nationwide systems. The establishment of a network of relevant local agencies was critical to ensuring the effectiveness of this training and securing a wider long-term impact. Success also depended on coordinated efforts by BOCOG and the central and municipal health authorities to integrate the training and new procedures into existing arrangements, and to upgrade when necessary the existing infrastructure and systems.

1.World Health Organization
2. Beijing Municipal Health Bureau
3.Monash University, Australia

Partnerships

Most local capacity strengthening was achieved with national resources and national technical expertise. Nevertheless, China also established collaborative initiatives with international counterparts (both multilateral and bilateral organisations and agencies as well as NGOs) to enhance local capacity in specific areas. In these instances, the process started with risk assessment involving the national experts, with participation also of relevant international organisations. Guidelines, tools and protocols developed by international agencies, including IOC, WHO, UNAIDS, UNEP, the International Committee of the Red Cross and the International Union against TB and Lung Disease, were adapted to conduct risk assessments and training activities. These ranged from tools for disease surveillance and vector control to instruments to ensure a stronger basic food safety infrastructure, such as assessments of food safety management needs during the Olympic Games, work plans for food safety inspection and training manuals for catering service providers.

Within China, the organisers also established strong communication networks among institutions dealing with related aspects such as health, environment, transport, sports, commerce, education, and public security.

The findings reported in this book stress the need to plan well ahead and to establish clear roles and functions for the various agencies involved in partnerships. For most of these partnerships, particularly those dealing with the potential response to acute and sudden risks such as terrorism threats, disease outbreaks, and the coordination of emergency medical services, there were elaborate implementation plans and strong communication networks linking the various partners.

Policies, interventions and communications

The health promotion and public health efforts in relation to air quality, food safety and tobacco control show that a multifaceted approach was needed to ensure a lasting effect and an enduring legacy. The need for environmental action prior to the Games saw the introduction of national and regional policies, laws, and guidelines to monitor water quality and improve air quality. Similarly, interventions were put in place to enhance the public transport system, dust control measures, and the relocation of high-polluting factories. There is some good evidence that these interventions worked quite well in most instances. Some of them, such as the restriction on private vehicles in the capital's roads and the reforestation of the city and its surroundings, have been continued after the Games, leading to long-lasting improvements in the environment.

The campaign for a "Green Olympics" was accompanied by public education efforts that helped to generate greater public awareness of environmental issues and a better understanding of what authorities, communities and individuals can do to improve local living conditions.

This combination of tested policies and interventions as well as health education strategies was also adopted for those working to ensure the safety of food during the Games as well as the Tobacco Free Olympics initiatives [4]. The latter was an especially good example of how the Olympics provided the opportunity to promote and implement new policies. Stringent restrictions on smoking in public places were introduced in the sports venues and in restaurants, bars, and hotels of the Olympic cities. Furthermore, the new rules were combined with extensive media coverage on the importance of smoke-free public places.

The findings described in this book document the need for this combination of legal frameworks, interventions, and information campaigns. But while it was possible to increase awareness and knowledge on health issues such as healthy lifestyles, achieving lasting behavioural changes is much more challenging. For example, the enthusiastic response to the campaign to promote smoke-free public places waned over time and, except for the Olympic venues which have remained smoke free, many restaurants and some hotels have reverted to allowing smoking in the premises. The findings also suggest that increased awareness about the advantages of healthy diet, have not yet translated substantially into changes in behaviour.

A legacy for health

Mass events such as the Olympic Games provide an opportunity to strengthen the health system's capacity to manage health emergencies as well as to promote preventive services and healthy lifestyles.

Assessing the public health impact of the 2008 Games and the effects of the measures taken by the national and local authorities has been a challenge. What was the undisputable impact of the Games on the health of the population in the host cities? This book suggests that there are still questions that need to be answered about the cohort studies and, particularly, about the long-term sustainability of the changes observed during and immediately after the Games.

Nevertheless, the experience shows that it is possible to advance a public health agenda by capitalising on the attention generated by the Games among Government agencies and

the society at large. During the Beijing Olympics, public health practitioners did this, at a very early stage, by conducting risk assessments and developing an agenda of interventions particularly in areas where tangible results could be obtained. This agenda of measures that could realistically make a difference was complemented by outlines of the corresponding legal frameworks that had to be developed to ensure their implementation.

The early formulation of this "expanded public health agenda" enabled its incorporation into the overall planning of the events partly because the advocates and leaders took care to spell out the implications of the measures to improve health and how they would contribute to the overall success of the Games. These efforts clearly demonstrate how taking action to implement this agenda would be consistent with international standards for good practice.

Secondly, the process also included a social marketing component and extensive use of the media which directly and indirectly presented the public health agenda at all times. For example, newspaper articles on the Games would include information not only on the venue and the visitors but also on what was being done to achieve the "Smoke Free" or "Green Olympics". During the Games themselves, participants received text messages on mobile phones about the regulations banning smoking in the venues and other public places. The educational and information materials were pre-tested for their suitability and their impact was also evaluated. In most cases, the materials were produced with the involvement of experts representing multiple agencies. Such a systematic approach, including a system for monitoring the impact and effects of the interventions, was important to the success of the interventions and to ensure the "legacy".

For the national and international agencies involved in public health matters in China, the experience of the Games provided concrete examples of what is achievable and what needs to be done in similar circumstances. This experience covers both the routine work of promoting health and helping to strengthen further the capacity of the services to deal with providing care and delivering more effective preventive services.

The Games also provided evidence to international and national agencies for the development of guidelines for smoke free public places and for response to health emergencies during mass events. Consequently some of the key lessons learned in Beijing were adapted by the organisers of the National Games held in September 2009 in Jinan and were also taken into consideration by public health authorities planning for the 2010 World Expo in Shanghai.

It is hoped that this volume is of value to organisers of future mass events, to enable them to ensure a legacy of positive health impacts on their communities.

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