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Original Article

Enhanced Surveillance for the Sports Festival in Tokyo 2013: Preparation for the Tokyo 2020 Olympic and Paralympic Games

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SUMMARY: Enhanced surveillance was conducted during the Sports Festival in Tokyo 2013 (September 28–October 14, 2013) for early detection of outbreaks of infectious diseases and other health emergencies. Through this enhanced surveillance, 15 cases were found that required additional gathering of information outside the routine process of creating/evaluating the Daily Report. However, none of these was assessed as critical. Through the enhanced surveillance, we structured a framework that allows for earlier response when detecting aberrations. It includes the role of the Tokyo Metropolitan Government in communications and contacts with relevant parties such as public health centers, as well as in monitoring of surveillance data. However, some issues need to be further considered toward the Tokyo 2020 Olympic and Paralympic Games, such as establishing the criteria for additional response steps, increasing the number of participating bodies in syndromic surveillance, and strengthening of cooperation with related departments, including those for crisis management assuming potential biological/chemical terrorism.

INTRODUCTION

When international sporting events such as the Olympic Games and Federation Internationale de Football Association (FIFA) World Cup, or other high-profile mass gatherings or political events are held, syndromic surveillance is conducted and enhanced for early detection of epidemics of infectious diseases and other health emergencies, including bioterrorism (1–11). Most recently, a comprehensive surveillance system was established for the London 2012 Olympic and Paralympic Games (3). In Japan, enhanced surveillance was conducted in the past in preparation for the Kyushu Okinawa Group of Eight Summit (G8 summit) 2000 (4,5), the FIFA World Cup 2002 competition (6,7), the Hokkaido Toyako G8 Summit Meeting 2008 (8), President Obama's visit to Japan in 2009 (9), the Yokohama Asia-Pacific Economic Cooperation (APEC) 2010, the Nagoya tenth meeting of the Conference of the Parties (COP10) 2010 (10), and the Fourth Japan-China-South Korea-Trilateral Summit (May 21 and 22, 2011) (11). Although no monitoring system has been established specifically for events held in stadiums or for participating athletes, our enhanced surveillance also covers foodborne illnesses or unusual health events that occur in the community where the events are held, including stadiums and participating athletes.

Drawing on these past experiences, enhanced surveillance was conducted during the Sports Festival in Tokyo 2013, the official name of the 68th National Sports Festival (September 28–October 8, 2013) and the National Sports Festival for People with Disabilities (October 12–October 14, 2013). National Sports Festival and the National Sports Festival for People with Disabilities are nationwide sporting events held each year at a different prefecture. The 68th events were held in Tokyo in 2013, with 27,000 players and managers participating in 50 sports. These games were held throughout the cities in the Tokyo metropolitan area. The enhanced surveillance for the Sports Festival in Tokyo 2013 was conducted in preparation for the Tokyo 2020 Olympic and Paralympic Games. This was conducted by utilizing the surveillance systems that were already active on a daily basis, with enhancements on the information sharing between parties that normally conduct surveillances independently, making daily reports, conducting risk assessments on a daily basis, and structuring a response framework when additional action is deemed necessary.

This report presents the overview and details of the enhanced surveillance. Through the results of this study, we identified both the usability and issues of the existing system. In addition, we aimed to provide fundamental information that would be useful for the implementation of enhanced surveillance for mass gatherings in the future.

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MATERIALS AND METHODS

As a joint work between the Bureau of Social Welfare and Public Health, Tokyo Metropolitan Government (TMG), and the National Institute of Infectious Diseases (NIID), enhanced surveillance was performed from September 21, 2013, 1 week before the event, to October 28, 2013, 2 weeks after the event. Four surveillance systems, namely the Official Syndromic Surveillance (OSS), Ambulance Transfer Syndromic Surveillance (ATSS) (12), Pharmacy Surveillance (PS) (13,14), and (Nursery) School Absenteeism Surveillance system ((N)SASSy), all of which operate routinely, were utilized, in addition to case-based and sentinel surveillance covered under the Law Concerning the Prevention of Infectious Diseases and Medical Care for Patients of Infections (Infectious Diseases Control Law). Data from OSS and ATSS were collected at the Tokyo Metropolitan Institute of Public Health (TMIPH), a division within the TMG that is focused on gathering and analyzing health information within Tokyo, and provides information to the public. Data from PS and (N)SASSy were collected at the NIID. Information from the four surveillance systems was then mutually exchanged, and daily risk assessment was performed jointly. The enhancements of the routine surveillance were conducted through reinforcement of the following processes involved: information sharing, daily risk assessment, daily situation reporting, and readiness for action when needed. Fig. 1 outlines the information sharing and Daily Reporting process.

External (third-party) evaluation was performed by Dr. Nobuhiko Okabe, Director of Kawasaki City Institute of Public Health. During the enhanced surveillance, we engaged Dr. Okabe as the external evaluator in the daily reporting process. When the surveillance was completed, we sent the final surveillance report to the evaluator, who then provided his feedback as ''evaluation from an external party'' in order to highlight issues and areas for improvement in the enhanced surveillance, in preparation for future mass gathering events, especially the Tokyo 2020 Olympic and Paralympic Games.

Surveillance systems: Four existing surveillance systems were utilized. Among these, the methods used in the OSS, ATSS, and PS were described in (11), but they have been updated as described hereinafter.

① **Official Syndromic Surveillance:** OSS, based on the Infectious Diseases Control Law, was first implemented on April 1, 2008. When a physician at the designated medical facility (sentinel clinic or hospital) observes that a patient meets the reporting criteria, the facility must immediately report the case to the public health center via Internet or fax. The report criteria are as follows: (1) fever higher than 38°C and respiratory symptoms (except for external injury or organic cause; respiratory symptoms refer to critical cases that must be admitted to a hospital); and (2) fever, and rash or blistering skin disease (except for symptoms that are clearly from diseases classified as categories II–IV under the Infectious Diseases Control Law). Throughout the duration of the enhanced surveillance, fever, and rash

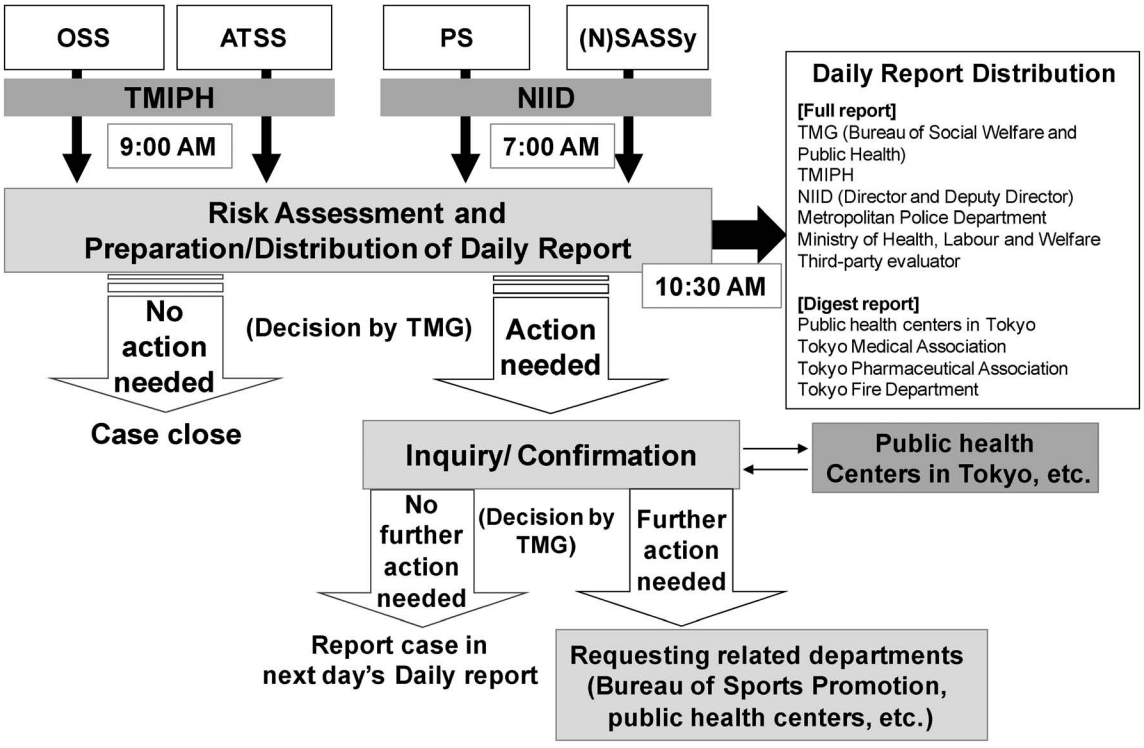

Fig. 1. Action flow of daily reporting and information sharing during enhanced surveillance for the Tokyo Sports Festival in Tokyo 2013 (September 28–October 14, 2013). OSS, Official Syndromic Surveillance; ATSS, Ambulance Transfer Syndromic Surveillance; PS, Pharmacy Surveillance; (N)SASSy, (Nursery) School Absenteeism Surveillance System; TMIPH, Tokyo Metropolitan Institute of Public Health; NIID, National Institute of Infectious Diseases; TMG: Bureau of Social Welfare and Public Health, Tokyo Metropolitan Government.

or blistering skin disease (criteria 2) was especially monitored closely for surveillance of bioterrorism using smallpox.

② **Ambulance Transfer Syndromic Surveillance:** From the results of fundamental studies conducted since 2005, TMG adopted the ATSS system as a countermeasure against bioterrorism attack, outbreak of infectious diseases, and other health-risk incidents. After making a test installation in 2008, the actual operation began in 2011. This surveillance system covers the Tokyo Metropolitan area almost entirely, excluding Inagi City and the small islands off the coast of Tokyo. This surveillance system captures the data of around 600,000 ambulance transfers per year that is initially recorded in the emergency record system. The surveillance system then rapidly analyses the information regarding the symptoms of each patient that were recorded during ambulance transfer. The data captured in the surveillance system are those of cases classified as acute diseases, or cases that have a record of one or more of the following four chief complaints: fever, diarrhea, vomiting, and rash. Ten items (date, day of the week, time, address, sex, age, degree of severity, disease, transferred hospital, and chief complaint) are captured for each case on a daily basis. During patient transport, the ambulance crew also enters clinical conditions classified into 12 categories as follows: vomiting/nausea, dizziness, palpitation, unconsciousness, breathing disorder, fever, spasm/paralysis, collapse/weakness, bloody emesis/nasal hemorrhage, rash, headache, and diarrhea/bloody stool. This data on the clinical conditions are used for analysis through the surveillance system. Data entered by 8:00 AM is analyzed through the system.

③ **Pharmacy Surveillance:** After a thorough fundamental study, PS has been performed nationally since January 2009. During the enhanced surveillance, 1257 pharmacies in Tokyo (about 13% of the total number of pharmacies in Tokyo) participated in the PS. In this surveillance, the only data collected is the number of prescriptions made, classified into therapeutic categories. Therefore, the collected data do not include any personal information. The data on the number of prescriptions are automatically extracted from the application service provider system for medical claim at pharmacies and analyzed daily. The surveillance monitors drugs categorized according to usage as follows, ''reliefs of fever and pain'', ''drugs for common colds'', ''antibiotics'', ''anti-influenza virus drugs'' (excluding Amantadine), and ''anti-*Varicella-Zoster* virus drugs'', with the last two categories further subclassified according to age as follows: ''younger than 15 years'', ''16–64 years old'', and ''older than 65 years''. As surveillance for potential bioterrorism using smallpox, we monitored the change in prescription of acyclovir to adults, without increase in the population of children or the elderly.

④ **(Nursery) School Absenteeism Surveillance system:** The (N)SASSy has been active since January 2009, after a thorough fundamental study. This unique surveillance is made available in Japan because parents of students are required by the schools to report the reasons for their child being absent from school activities. They are required by the schools to report their child's symptoms until a diagnosis is made by a physician. After receiving a diagnosis from the physician, parents are required to report the diagnosis to the school authorities as the reason for their child's absence. By reporting the diagnosis of their children as having a certain type of disease such as influenza or varicella, parents can have the school order their children to be ''suspended'' from school activities to prevent disease transmission inside a class, a specific grade, or school. The days during the suspended period are not counted against the total number of days required to advance to the next school grade. (N)SASSy is an Internet based system, through which the school representative, given access to the system, records the reported information regarding absenteeism/suspensions due to infection on a daily basis.

Of the 23 wards and 39 other municipal districts (cities, villages, etc.) within Tokyo, at the time of the event, Sumida Ward (estimated population as of January 1, 2013; 249,000), Setagaya Ward (886,000), Nakano Ward (314,000), Nerima Ward (717,000), Mitaka City (186,000), Higashiyamato City (84,000), and Inagi City (86,000) had implemented the surveillance system in Tokyo. Of the participating municipalities, Nakano Ward participated in both the school and the nursery school programs. Sumida Ward, Setagaya Ward, Nerima Ward, Higashiyamato City, and Inagi City only participated in the nursery school system. Mitaka City participated only in the school system (Fig. 2).

Through the (N)SASSy, we monitored for ''class/school closing'' of the school, ''number of absentees'' categorized according to symptoms, and ''number of suspensions due to infection'' categorized according to the diagnosed illnesses. For ''class/school closing'', the actual numbers of the institutions were monitored. For the ''number of absentees'', the aberrations were monitored by using the C1-MILD method of the Early Aberration Reporting System (EARS) of the Centers for Disease Control and Prevention (15). If the number of institutions in the surveillance unit (ward or city) with aberrations for the ''number of absentees'' exceeded 10% of the total number of participating institutions, then it was defined as a low-level aberration. In addition, the criteria require at least one institution with aberrations. If it exceeded 20% of the total number of participating institutions, then it was defined as a medium-level aberration. In addition, the criteria require at least two institutions with aberrations. If it exceeded 30% of the total number of participating institutions for the surveillance unit, then it was defined as a high-level aberration. In addition, the criteria require at least three institutions with aberrations. For the ''number of suspensions due to infection'', we utilized EARS, defining a low-level aberration as a value greater than the mean plus 3 standard deviations (SD), with the mean and SD based on the prior 7 days. Similarly, the medium-level was defined as a value greater than the mean plus 4 SD; and a high-level aberration, as a value greater than the mean plus 5 SD, with the mean and SD based on the prior 7 days.

Assessment system: In the risk assessment part, as also described in the World Health Organization (WHO) guidelines (16), daily information was verified, analyzed, and assessed by the Jointly Daily Risk Assess-

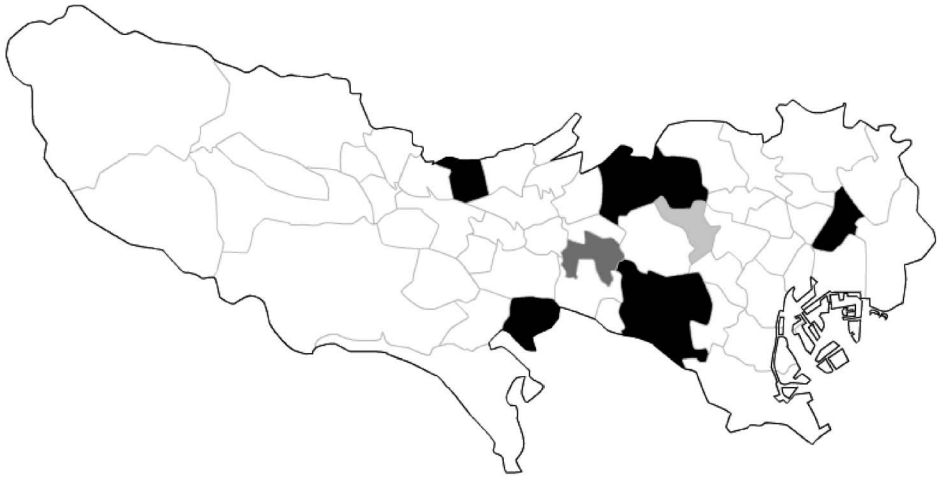

Fig. 2. Map of the coverage of (N)SASSy in Tokyo metropolitan area.
Black: Nursery School system only (Sumida Ward, Setagaya Ward, Nerima Ward, Higashiyamato City, and Inagi City); Dark Grey: School system only (Mitaka City); and Light Grey: School and the Nursery School program (Nakano Ward).

ment Team (JDRAT) from the TMIPH and NIID. Every day, including nonworking days, information from PS and (N)SASSy was collected at the NIID by 7:00 AM, and the information from OSS and ATSS were collected at the TMIPH by 9:00 AM. After sharing surveillance information, assessment of the information was conducted at the daily morning meetings at NIID on weekdays, and through e-mails and conference calls on weekends, in order to discuss whether further investigation was needed. The Daily Report was then finalized and distributed by 10:30 AM.

The following action steps were taken as response to the surveillance data. For OSS, if there was a reported case, we made an inquiry to the corresponding public health center for verification. For ATSS, if there was a high-level aberration, we confirmed if there were any identifications of accumulation, such as time, person, and place. If any accumulation were suspected, then we verified it with the corresponding public health center. For PS, we checked the aberration levels and assessed whether any correlation can be suspected with the other three surveillance systems. In order to use information from PS for diagnosis by physicians, if a high-level aberration was found, then we confirmed with the nearby sentinel clinics or hospitals via corresponding public health centers to confirm whether there was any unusual case or not. For (N)SASSy, if a high-level aberration was found, then we checked the details in the system to ascertain whether any accumulation was present. Then, we contacted the boards of education, departments of nursery schools, and public health centers in the respective cities.

RESULTS

① **OSS:** During the enhanced surveillance, 7 incidences were reported from three designated institutions in three different wards. However, the JDRAT decided not to seek additional investigation in any of these cases (Table 1). Because inquiry to the public health center was timely, details of each case were available when the JDRAT assessed it. Meanwhile, the average delay from the examined date to the reported date was 6.3 days, with a median of 6 days (range, 3–11 days).

Table 1. Details of the reported cases from Official Sydromic Surveillance during enhanced surveillance for the Sports Festival in Tokyo 2013 (September 28–October 14)

Case No.	Reported date	Examined date	Medical Institution	Age	Sex	Criteria[1)] (1) or (2)
1	2013/10/16	2013/10/5	A Hospital	6	Female	2
2	2013/10/16	2013/10/13	B Hospital	0	Female	1
3	2013/10/21	2013/10/15	C Clinic	5	Female	2
4	2013/10/21	2013/10/15	C Clinic	1	Female	2
5	2013/10/22	2013/10/15	B Hospital	1	Male	1
6	2013/10/22	2013/10/19	B Hospital	16	Female	1
7	2013/10/26	2013/10/18	A Hospital	0	Male	1

[1)]: (1), Fever over 38°C and respiratory symptoms;
(2), Fever and rash/blistering skin disease.

② **ATSS:** Surveillance for ambulance transfer identified 38 high-level aberrations (Table 2), of which, 30 were high-level aberrations for ''bloody emesis/nasal hemorrhage''. However, because the number of patients with bloody emesis/nasal hemorrhage in ambulance transfer is usually low, even a single case of transportation caused the aberrations to be at a higher-level. The other high level aberrations were for ''vomiting/nausea'' (4 times), ''dizziness'' (3 times), and ''unconsciousness'' (1 time). For these high-level aberrations, additional information was obtained from the system to assess for any concern of accumulations in the reported cases. However, through the risk assessment, the JDRAT concluded that no further investigation was necessary. In addition, data from ATSS were not available on one day during the enhanced surveillance period because of system maintenance.

③ **PS:** High-level aberration was not detected. Of 51 medium-level aberrations detected, 28 were for ''relief of fever and pain''; 17, for ''antibiotics''; 5, for ''anti-*Varicella-Zoster* virus drugs''; and 1, for ''drugs for common colds''. However, none of the cases required additional investigation (Table 3). For ''anti-influenza virus drugs'', 4 low-level aberrations were

Table 2. Number of aberrations detected from Ambulance Transfer Syndromic Surveillance during enhanced surveillance for the Sports Festival in Tokyo 2013 (September 28–October 14, 2013)

	High level	Medium level	Low level
Vomiting/Nausea	4	11	44
Dizziness	3	4	38
Palpitation	0	3	20
Unconsciousness	1	15	49
Breathing disorder	0	10	48
Fever	0	5	17
Spasm/Paralysis	0	2	30
Collapse/Weakness	0	5	34
Bloody emesis/Nasal hemorrhage	30	25	60
Rash	0	0	0
Headache	0	0	0
Diarrhea/Bloody stool	0	0	0
TOTAL	38	80	340

Table 3. Number of aberrations detected from Pharmacy Surveillance during enhanced surveillance for the Sports Festival in Tokyo 2013 (September 28–October 14, 2013)

		High level	Medium level	Low level
Anti-*Varicella-Zoster* virus drugs	0–14 years old	0	1	11
	15–64 years old	0	2	122
	over 65 years old	0	2	69
Anti-influenza virus drugs	0–14 years old	0	0	2
	15–64 years old	0	0	2
	over 65 years old	0	0	0
Reliefs of fever and pain		0	28	280
Drugs for common colds		0	1	124
Antibiotics		0	17	193
TOTAL		0	51	803

Table 4. Number of aberrations about number of absentees due to infection detected from (Nursery) School Absenteeism Surveillance System during enhanced surveillance for the Sports Festival in Tokyo 2013 (September 28–October 14, 2013)

	High level	Medium level	Low level
Headache	0	0	0
Fever	0	0	17
Rash	0	0	0
Diarrhea/Abdominal pain	0	0	0
Vomiting/Nausea	0	0	0
Acute respiratory symptoms	0	0	4
Influenza like illness	0	0	0
Others	0	0	1
TOTAL	0	0	22

Table 5. Number of aberrations about number of suspensions due to infection detected from (Nursery) School Absenteeism Surveillance System during enhanced surveillance for the Sports Festival in Tokyo 2013 (September 28–October 14, 2013)

	High level	Medium level	Low level
Influenza	0	0	0
Pharyngoconjunctival fever	0	1	0
Hemolytic streptococcus	2	3	1
Infectious gastroenteritis	0	0	0
Chickenpox	7	1	1
Hand-foot-mouth disease	5	0	1
Erythema infectiosm	0	0	0
Exanthema subitum	0	1	0
Herpangina	0	1	0
Mumps	1	1	0
Acute hemorrhagic conjunctivitis	0	0	0
Epidemic keratoconjunctivitis	0	0	0
Mycoplasma infection	0	0	0
RSV infection	1	3	0
Others	1	0	0
TOTAL	17	11	3

detected.

④ **(N)SASSy:** For the number of suspensions due to infection, 17 high-level aberrations were detected, of which 7 were for chickenpox, 5 were for hand-foot-mouth disease, 2 were for hemolytic streptococcus infection, 1 was for mumps, 1 was for RS virus infection, and 1 was for others (pertussis) (Table 4, 5). For the aberrations on the ''number of absentees'', no high- or medium-level aberrations were detected. However, 22 low-level aberrations were detected, of which 17 were for fever, 4 were for acute respiratory symptoms, and 1 was for other symptoms. In addition, for the ''class/school closing'', a nursery school inside a hospital in Akishima City was shut down for 4 days from September 27 to 30, owing to influenza cases.

⑤ **Assessment System:** In 15 cases, additional steps were taken for creating the Daily Report. Of these cases, 7 were from the OSS, obtained via inquiry to the public health center for the reported cases. In addition, 6 cases from the ATSS needed additional information to make the assessment; 2 cases from the (N)SASSy involved inquiries to the public health centers for confirmation. However, none of the 15 cases were assessed as a critical case that required any additional measures.

⑥ **External (Third-party) Evaluation:** External (third-party) evaluation was performed by Dr. Nobuhiko Okabe. The report of the evaluation is presented as follows:

''Compared with the enhanced surveillances conducted in the past, the enhanced surveillance for Sports Festival in Tokyo 2013 was characterized by being implemented as an official business of the TMG and NIID. This framework allowed for easier and faster response when aberrations were detected. Moreover, information was mutually shared with the Police Department. These new initiatives are positive steps in preparation for the Olympics. The surveillance framework also deserves credit, as it made prompt sharing and assessment of information possible.

As areas for possible improvement, the benchmark for taking action should be further clarified. Through the enhanced surveillance it was observed that this ben-

chmark for action taking was unclear, and the TMG had some issues in taking additional steps. Therefore, in the future, the organizers should conduct feasibility studies to clarify the benchmark for assessment of information and action taking.

Syndromic surveillances systems are expected to capture exhaustive information such as conditions of undiagnosed patients. (N)SASSy is a useful tool to capture such information, as it is able to capture the total number of absent students before being diagnosed by a physician. However, the number of municipalities implementing the system is insufficient in Tokyo. By 2020, it is expected that this system covers at least the areas where the Games will be played, and has the baseline data necessary to make precise assessments.

The TMG and the Bureau of Social Welfare and Public Health were fully engaged. However, the role of the Bureau is limited to the surveillance of infectious diseases. In order to fully cover possible health threats, including food poisoning and biological/chemical terrorism during the Games, other departments within the TMG that are responsible for the overall crisis management should also be involved in the surveillance.

The Daily Report should be simplified, because during the Olympics, it is expected that many different organizations will be receiving the Daily Report, most of whom are not familiar with the surveillance systems and the details of the captured syndromes/diseases. In addition, the Daily Report should be revamped to add information on the possible effects on the event that is being monitored (whether the operation of the Games will be effected, etc.). In case no actions necessary, the Daily Report should also provide assurance that the Games are not affected.

Conducting enhanced surveillance should provide deterrent effects on intentional criminal acts such as terrorism. In preparation for the Olympics, enhanced surveillances that include more tests, involving other prefectures as well (especially the neighboring prefectures), should be conducted to identify other issues and areas for improvement. Furthermore, the results should be published through domestic and international papers to enhance the deterrent effects on possible criminal acts.''

DISCUSSION

During the enhanced surveillance, each of the surveillance systems detected aberration signals as described in the Results section. However, we were unable to ascertain any connection between the aberrations detected through separate systems. Therefore, from the dispersion in these results, we denied any suspected case of possible outbreaks of infectious diseases or other health emergencies including biological/chemical terrorism attacks that might affect the games. We do understand why our employed surveillance do not always cover all possible outbreaks. However, other information sources, including the media, also did not identify any unusual events that could affect the Games. Here, we discuss each of the surveillance systems that were utilized in the enhanced surveillance, including areas for possible improvements for future utilization.

① **OSS:** Because the case from OSS was reported directly from a medical institution, confirming the reported aberrations was easy. As inquiry to the public health center was timely, details of each report were made available when creating the Daily Report. In addition, because this syndromic surveillance has been operating routinely, no extra expense or system construction is necessary to initiate enhanced surveillance. Meanwhile, we consider that the sensitivity might be insufficient. This is because once a diagnosis is made, the physician is not required to make a report through OSS. For instance, if a physician diagnosed a patient with smallpox as chickenpox, or novel influenza as seasonal influenza, the physician should not report to OSS. Therefore, we believe that OSS has its weakness in early detection of unusual diseases such as smallpox or novel influenza. Moreover, the current system does not require zero-reporting. Therefore, we are unable to distinguish whether any of the cases did not meet the reporting requirement or the medical institution simply failed to report the case.

Furthermore, the reporting timeliness rating of each of the 7 cases was quite low, because reporting from the medical institution took a long time after the patient was examined. In addition, the 7 cases were reported from just three institutions, which suggest that awareness of the surveillance reporting is quite different among the medical institutions, and it is difficult to discern whether none of the cases needed reporting or the system itself was not functioning to its potential.

② **ATSS:** This surveillance system through ambulance transfer is fully automated, imposing no burden on ambulance teams other than their routine tasks. The aberrations in this surveillance are reported when significant statistical increases are observed compared with past data. The public health agency monitors the deviations from the baseline and makes the assessment based on the aberration levels. The surveillance detected early the total number of severe cases. The system also allowed for easy monitoring of the persistence of the level of aberrations in each surveillance unit. In addition, detailed information such as age, sex, place the disease was contracted, and injury/disease type was available through the system. Based on this information, the JDRAT decided whether more information or countermeasures were required.

The surveillance frequently reported aberrations in bloody emesis/nasal hemorrhage, even though the cases of bloody emesis/nasal hemorrhage were few. Therefore, for these types of syndromes which have no high-level of ambulance transfer, even a single case of transportation can cause higher-level aberrations. Transportation of diarrhea cases in the Yokohama APEC 2010 indicated a similar tendency. For the future, sensitivity of the aberration detection might require adjustment. However, because arbitrary adjustments can lead to reduced sensitivity in aberration detection, these should be carefully discussed.

③ **PS:** Regarding PS, system construction had already been completed and no extra expenses were necessary. There is also no burden to data entry because the process is fully automated. In addition, the sensitivity of detecting patients with infection through PS is high and the promptness of response is comparatively high because the data are analyzed within 24 hours of the

person's visit to a pharmacy. There is also no risk of information being left out. Currently, no effective surveillance related to chickenpox or zoster in adults has been executed through other surveillance systems. Therefore, PS plays an important part. Fortunately, no high-level aberration of anti-*Varicella-Zoster* virus drugs occurred during the event. If increases in the prescription of anti-*Varicella-Zoster* virus drugs to adults were found without an increase in the prescriptions to children or elderly people, then a confirmation would need to be made to the medical facility.

However, the challenge for PS is that it is difficult to take action when an aberration is detected, because PS is not enforced by law. In Tokyo, because we have not experienced a case in which verification was made with the medical facility through the public health center, associating with the related institution seems difficult if an aberration is detected. Therefore, a study or training session should be conducted in order to brainstorm how we can best arrange a framework for verification with the medical facility when aberrations are detected through PS.

④ **(N)SASSy:** (N)SASSy was first added to the enhanced surveillance for the Yokohama APEC 2010, and at that time, the number of suspensions due to infection was counted in actual numbers. However, quite a number of suspensions due to infection were made, for which the actual number was deemed impossible to count. Therefore, during this enhanced surveillance, we used the EARS to identify the aberrations in the number of suspensions due to infection, similar to the method used to identify aberrations for the number of absentees.

The strength of (N)SASSy is that it can identify the exact institution and the exact classroom of the reported patient (17). Although the geographical coverage of (N)SASSy was not high, all of the infectious diseases, including unknown diseases in all members of the participating institutions, were timely monitored. This is a unique system in Japan, and no comparable systems have been established in other countries (18). Moreover, we verified the usefulness of (N)SASSy through the enhanced surveillance because the reporting from the participating institutions was the most timeliest in comparison with other surveillance systems. Public health centers can also access (N)SASSy; however, they might not always monitor the system closely. In some cases, the JDRAT captured information on the number of absentees and suspensions due to infection, and therefore identify aberrations, even before the public health centers could identify them.

However, (N)SASSy has little or no reporting during weekends, because most schools are closed. Therefore, by utilizing EARS, which obtains the data for the prior 7 days, most of the aberrations were concentrated on the first day of the week. In addition, by utilizing EARS, the continuity of the level of aberrations was difficult to understand. (N)SASSy was developed originally for the institutions to detect their own aberrations early. Therefore, we should conduct further feasibility studies in order to establish a benchmark for aberration detection using (N)SASSy and to utilize the system as a surveillance system on a larger scale (for an entire region). Furthermore, the number of participating municipalities should be increased, as it was limited to just 7 municipalities for this enhanced surveillance.

⑤ **Assessment System:** By gathering data on symptoms, the purpose of a syndromic surveillance is to assess the risks of possible outbreaks of infectious diseases and taking timely necessary actions. Through the enhanced surveillance, we were able to make a comprehensive assessment by utilizing several syndromic surveillance systems. Both the TMG and NIID have had experiences of conducting enhanced surveillances in the past. Because all four surveillance systems operate routinely, the assessment and response handling were executed smoothly. There was a day when data from ATSS were not available owing to system maintenance. For future operations, maintenance schedules for each of the surveillance systems should be checked in advance, and the relevant parties involved should be notified. However, even in such cases when one of the systems was unavailable, we were able to perform an assessment by utilizing the other three systems.

For the ATSS, when high-level aberrations were detected, we checked the detailed information available in the surveillance system for information such as age, region, and degree of severity in order to make qualitative data assessment. In addition, even for medium level aberrations, if the aberration continued to the next day, we checked the detailed information to make the assessment as well. However, symptoms such as nausea/vomiting and unconsciousness have many causes, and the details available in the system for the causes of these illnesses were limited to reasons such as ''others'', which made the interpretation of the information difficult.

For PS and (N)SASSy, the information was limited on weekends and the aberrations were concentrated on the first working day. Therefore, a consensus of how to assess the detected aberrations is an area to improve in the future. Furthermore, for PS and ATSS, because they are not regulated by law, taking action is difficult when an aberration is detected. In the future, raising awareness and understanding for enhanced surveillance is crucially important for public health centers and medical institutions.

Overall, the assessments were conducted smoothly. However, in the current scheme, the available human resources to run the assessment are limited, especially at the TMIPH. Therefore, reallocation of human resources from the NIID to the municipalities (or vice versa) could be a future solution.

⑥ **Toward the Tokyo 2020 Olympic and Paralympic Games:** Some issues need to be further considered toward the Tokyo 2020 Olympic and Paralympic Games, such as the criteria for additional response steps, increasing the number of participating bodies in syndromic surveillances, and strengthening cooperation with the related departments. Such issues were also pointed out by the external evaluation from Dr. Okabe. These departments include police departments, fire departments, the Ministry of Defense, and the Cabinet Secretariat for Crisis Management, assuming potential biological/chemical terrorism. Concerning the Food Sanitation Law, we did not find any reports based on the Law because most of these were reported to public health centers only and thus were not integrated to the

JDRAT. Although ATSS and (N)SASSy could cover food-borne illnesses, if the reports based on the Food Sanitation Law are integrated, we would examine to use the information.

This enhanced surveillance serves as an important part of the preparation for the Tokyo 2020 Olympic and Paralympic Games. Therefore, we should continue to identify the related issues and areas of improvement in other opportunities toward this end.

Conflict of interest None to declare.

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