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EVIDENCE FOR EXCESSIVE INCIDENCE OF INFECTIOUS DISEASES AT MASS GATHERINGS WITH SPECIAL REFERENCE TO SPORTING EVENTS

OZNAKI WSKAZUJĄCE NA ZWIĘKSZOMĄ ZAPADALNOOŚĆ NA CHOROBY ZAKAŹNE W CZASIE ZGROMADZEŃ MASOWYCH ZE SPECJALNYM UWZGLĘDNIENIEM WYDARZEWŃ SPORTOWYCH

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STRESZCZENIE

W ostatnich latach dużym wydarzeniom sportowym niemal powszechnie towarzyszy wzmożony nadzór nad chorobami zakaźnymi. W niektórych przypadkach stanowi on rozszerzenie i intensyfikację istniejących systemów nadzoru, w innych dokonywane są próby wprowadzenia nowych dla danego kraju systemów, często obejmujących nadzór nad objawami i zespołami objawów. Wśród przyczyn takiego podejścia można wymienić obawę przed atakiem bioterrorystycznym, którego skutki w czasie masowych zgromadzeń mogą być szczególnie dotkliwe. Istnieje też szeroko rozpowszechnione przekonanie, że masowe zgromadzenia przez nagromadzenie czynników sprzyjających zakażeniom, takich jak bliskość fizyczna ludzi w tłumie, liczne punkty szybkiego serwowania jedzenia oraz możliwość gromadzenia się osób takich jak dilerzy narkotyków i osoby oferujące płatny seks stanowią zagrożenie chorobami zakaźnymi większe, niż to wynika wprost z liczby uczestniczących w nich osób. Zbliżające się mistrzostwa Europy w piłce nożnej Euro 2012, które będą się odbywać w Polsce i na Ukrainie nadają tej problematyce szczególna aktualność.

Ten przegląd potwierdza ten pogląd w stosunku do niektórych zgromadzeń charakteryzujących się kilkudniowym trwaniem, i niedostateczną higieną przyrządzania potraw, nie znajduje jednak potwierdzenia w opisach efektów nadzoru epidemiologicznego wielkich imprez masowych związanych z wydarzeniami sportowymi. W interpretacji autorów wiąże się to zarówno z nadzorem higieniczno sanitarnym wprowadzonym przed wydarzeniami oraz w czasie ich trwania, a także z samym charakterem zgromadzeń, które trwają stosunkowo krótko i nie są związane z samodzielnym przyrządzaniem potraw.

Uzasadnienie dla wzmożonego nadzoru epidemiologicznego w czasie masowych zgromadzeń stanowi prócz oceny zagrożenia również fakt, że nadzór epidemiologiczny jest naturalną składową sanitarnych I higienicznych przygotowań do masowych zgromadzeń, a przede wszystkim stanowi podstawowy sprawdzian ich efektywności.

ABSTRACT

In recent years most of big spring events are accompanied by enhanced surveillance of infectious diseases. In some cases it is extension of existing systems in other almost completely new systems are designed. Some of them include syndromic surveillance pointed to symptoms and syndromes which may be related to bioterrorist attacks.

Such an approach is partially inspired by continuously present bioterrorist threat, but also by conviction that mass gatherings bring extra risk for infectious diseases beyond increase related to the number of participants. It is believed that such factors like close proximity of participants, large numbers of food vendors and presence of drug dealers and sex workers increase probability of increased incidence of infectious diseases at mass gatherings.

In some mass gatherings especially those lasting more then one day and lacking proper sanitary supervision of food preparation and of water sources such increased incidence takes place. But in the most of large international sport events no increase of incidence was observed.

Enhanced surveillance plays important role as an element of integrated sanitary and hygienic preparations to the events. It is also crucial tool for evaluation of the quality of those preparations. Oncoming soccer games Euro 2012 make this a problem of particular interest.

Słowa kluczowe: *Masowe zgromadzenia, nadzór epidemiologiczny, choroby zakaźne, międzynarodowe imprezy sportowe.*

Key words: *Mass gatherings, surveillance, infectious diseases, international sport events*

INTRODUCTION

In recent years almost universal employment of enhanced surveillance of infections at major international sport events indicates conviction among organizers, that mass gatherings, as a rule, are associated with increased incidence of infectious diseases. Such expectations are based on existing reports, but also on well established knowledge of transmission mechanisms of different types of infectious diseases and conditions that are observed or expected at mass gatherings. One of such expectations is close proximity of people gathered, which may promote spread of airborne infections. Fast food vendors, and increased turnover of servings and meals preparations, may lead to insufficient food hygiene resulting in foodborne outbreaks. There are also other potential threats as increased frequency of social encounters including drug use and commercial sex, which may lead to bloodborne infections and STI. Among them, infections with longer incubation periods are rarely notified by surveillance at the place of gathering. Those infections are usually brought home, diagnosed late and rarely associated with entertainment related to mass gathering, and even rarer reported as such in the surveillance systems.

Some previous international sport events were targeted by terrorists with explosive blasts, as it happened at 1996 Olympic Games in Atlanta, when religiously motivated terrorist attempted to bring down the Games and to embarrass the U.S. government for legalizing abortion. Or, as it happened in Munich in 1972, Palestinian fanatics took hostages in the Olympic Village with tragic results. Bioterrorist attack is also a possibility at mass gatherings. It would be less spectacular at the beginning, but its effect could last longer and lead to even more disastrous effects.

It would be difficult to assess before the event risk of increased incidence of infectious diseases and even more so to predict character and extend of deliberate release of infectious agents to the people attending particular mass gathering. There are so many variables which should be measured or at least considered in such analysis that their combined effect is extremely difficult to predict.

It would be useful to validate those expectations with really obtained surveillance data on incidence of infections and also on reported outbreaks.

One of the earliest, and most frequently quoted, contribution regarding increased incidence of illness at mass gatherings is included in editorial by Jacek Franaszek in the 1986 issue of Annals of Emergency Medicine (1). Franaszek referred to two other articles which appeared in the same issue and dealt with medical problems reported to medical services at different types of mass gatherings (1,2). Franaszek states: "[at mass gatherings]…the incidence of illness is greater then expected to occur naturally in a population of comparable size. This increased incidence may be the result of circumstances and, therefore, the added risk of the gathering". He does so without specification of the character of the events.

With all respect to plausibility of Franaszek statement it is worth to mention that even in his opinion relation between mass gatherings and incidence of illness is not unconditional and depends on circumstances, which may be variable within and between mass gatherings.

Out of two articles published in the same issue of Annals of Emergency Medicine, which were quoted by Franaszek, one by Ouananian and al."Medical Care at the 1982 US Festival" describes weather conditions and planning utilization of medical care at 410 000 gathering at 3 day long music festival as well as reported later health conditions of the participants.

The reported variables were controlled medication use and number of encounters of participants with health care providers. Among most frequent health conditions were reported minor surgical trauma, heat exhaustion with dehydration, drug overdose and reactive airway disease occurring not only in people with asthma. No reference was provided in this article to frequency of the same type of health problem in comparable population not related to festival. Article of Sanders et al. described use of medical services at 15 mass gatherings of different size and character including sport events. The mass gatherings were classified into two categories: lasting up to one day and more then one day. The final purpose of obtaining such information was to provide data to Arizona Chapter of American College of Emergency Physicians for the purpose of preparation of pioneering set of guidelines for emergency medical care at mass gatherings (3). At 9 gatherings lasting up to one day (seven of them were sport events) total number of participants was about 180 000 and number of medical interventions totaled at 342. Most of the cases classified on the base of symptoms were minor injuries, alcohol or drug abuse, and other of noninfectious character. On infectious side only 3 cases of diarrhea were reported.

In vast literature covering health problems related to mass gatherings attention devoted to infectious dis-

eases increased over last decades with special emphasis on bioterrorist threat. Marked disproportion may be observed between theoretical analyses and formulations of guidelines and checklists aimed at preparation to events versus collection of epidemiological data. The purpose of this review is to scrutinize evidence on reported increased incidence of infectious diseases at mass gatherings with special reference to sporting events. . Oncoming soccer games Euro 2012 make this a problem of particular interest.

FEW SELECTED EXAMPLES

Few selected examples with well documented increase of incidence of infectious diseases at mass gatherings are described below in more detail. They illustrate rather typical conditions which may lead to increased incidence of infectious diseases and question is raised which of the outbreaks are directly related to mass gatherings, and which are temporarily associated without convincing evidence of causal association with the event.

One of the most publicized mass gatherings which were associated with outbreaks of infectious disease is Muslim Hajj to Mecca. Big pilgrimage of Hajj gathers more then two million persons living for about three weeks in thousands of closely placed tents and participating in densely crowded religious events, many of them kissing holly black stone. Those circumstances create particular risk of airborne infections and also of transmission by saliva (4). First reported outbreak of diseases caused by *N. meningitidis* serogroup A occurred in 1987 (5). Before this outbreak vaccination against *N. meningitidis* serogroup A was required only for pilgrims from Sub-Saharan Africa. After 1987 all Hajj pilgrims were required to be vaccinated against serogroup A before obtaining visa to enter Saudi Arabia. Local outbreaks of the same serogroup which occurred at minor pilgrimages of Umrah and Ramadan in 1992 were followed by extended vaccination policy.

Then in 2000 surveillance services in several European countries detected marked rise of isolates of *N. meningitidis* serogroup W135, serotype P1,2,5. Cases of meningococcal infections caused by serogroup W 135 were reported in numerous countries including Saudi Arabia, USA, some African and also Asiatic and European countries. Most of those cases occurred in pilgrims or pilgrims contacts and were traced to preceding Hajj (4, 6). Since that outbreak new vaccination requirements were implemented on entering Saudi Arabia for the purpose of Hajj, Umrah, or for seasonal work in Hajj areas. Eeveryone must present a certificate of vaccination with ACWY, issued at least 10 days, but not more than 3 years before arrival.

There are numerous reports of outbreaks of foodborne infections which occurred at youth camps. One example was hepatitis A outbreak at youth camp in Australia (7), another example was outbreak of shigellosis at Annual Rainbow Family gatherings which subsequently spread to general public (8). Frequent occurrence and rapid spread characterizes outbreaks caused by Norwalk-like viruses in high density encampments (9).

Outbreaks of *Legionella* infections are frequently included among those associated with mass gatherings, as a 1976 outbreak, which killed 34 people attending an American Legion convention in Philadelphia (10).

There were also many reports of airborne infections related to mass gatherings. In most of them association with gathering is based mainly on supposition that close contact in dense crowd increases probability of infection contrary to more distant encounters. Infection can be easier traced to the index cases in those circumstances where disease rarely occurring in exposed subpopulation may be imported from another region (11).

Among outbreaks mentioned above, Hajj in Mecca has special position as gathering of enormous size with specific accumulation of serious risk factors like presence of pilgrims from endemic areas, close proximity of people in crowds, long duration of gathering and kissing the same stone by numerous pilgrims. For those conditions incidence rates among European pilgrims were not striking. In UK it was 41/100 000 and in France 21/100 000. On the other hand no cases of meningococcal disease were reported among 18 000 of pilgrims from Germany and 4500 pilgrims from Holland. Estimated total number of reported 400 cases over estimated 2-2,5 million participants of Hajj, results in average incidence of 15-20 per 100 000, more then it was reported in the most pilgrims countries of origin. Such incidence fully justifies mass vaccination program.

Two examples of foodborne infections, presented above, are outbreaks which occurred at camping gatherings lasting several days. In the first one outbreak was traced to coleslaw served by catering service. The second one, at which attack rate of antibiotic resistant shigellosis exceeded 50% of 12 700 participants, was related to generally poor hygiene of meal preparation by numerous individual families who frequently used water from sources rich in coliform bacteria and not always boiled it. In such gatherings crucial risk factors are poor food hygiene and duration of the event which determined big number of consumed meals and hazardous person to person contacts.

In the case of Hajj, its religious character and long lasting tradition excluded organizational or behavioural changes which would allow implementation of preventive measures other than enforcement of vaccination pro-

gram. But food born outbreaks were directly related to compromised food hygiene by common catering service or by individual families. In those cases the role, which was played by the number of people gathered, was in the size of population at risk. It led to increased number of cases without convincing evidence that gathering influenced increased incidence in those outbreaks. This argument suits well to outbreak of legionellosis at Philadelphia Convention. People most probably got infected in their hotel when taking showers or when breathing with aerosol from the air conditioning. Convention influenced number of cases by increasing number of exposed, but there is no evidence that there was any impact of gathering on the attack rate.

In those mass gatherings, at which increased incidence of infectious diseases was well documented, the frequently observed feature is their duration longer then one day. Another is also poor hygienic condition.

Many sporting events last shorter than one day and when they end, dense crowd loosens and many participants move to other locations. Even those sporting events, which like Olympic Games have duration over two weeks, do not gather people in a limited place for all that time.

The next section of this article contains systematic review of reported cases of infectious diseases at major sporting events with critical analysis of the evidence of relationship between observed incidence and gathering itself.

REPORTED INCIDENCE OF INFECTIOUS DISEASES AT MAJOR SPORT EVENTS

In quite extensive analysis of publications related to medical care at mass gatherings Milsten et al reviewed different events since antiwar demonstrations in 1969 until rock music festival in 2001 (12). Among 32 analyzed reports 9 concerned sport events. Those included 1984 Summer Olympics in Los Angeles, 1988 Calgary Winter Olympics, several American college football games and 1996 Summer Olympics in Atlanta (3 reports). In most cases estimations of incidence at mass gatherings included in the review were based on retrospective chart reviews. Recorded medical care provided at Olympic venues during 1984 Olympic games in Los Angeles discloses mostly acute health problems, which occurred at the events and concerned people who gathered at the games (13). The number of visitors was estimated at 3 447 807. Number of people seeking medical care was 5 516 (0.16%). Out of those 25% were minor muscular and dermal injuries, 12% heat related illness, and 8% (441 cases) minor gastrointestinal problems. There were also noted symptoms of heart problems (2%) and only 8 people requiring medical care for alcohol or drug ingestion. Among diseases listed in the report, only broad category of "minor gastrointestinal problems" could include diseases of infectious character. Even if all reported gastrointestinal diseases would be infectious, attack rate of 13 cases per 100 000 participants over two weeks was not impressive. On the other hand, acute character of the problems presented at medical posts open at the venues excluded most of the infectious diseases with incubation period longer then few days.

More detailed analysis of incidence based on medical care delivery is included in the article by *S.F. Wetterhal* et al. containing analysis of medical care provided at the venues of 1996 Olympic games held in Atlanta in 1996 (14). With 8 million spectator tickets sold, 1996 Summer Olympics were much bigger then Los Angeles games. The total number of persons treated at the games in Atlanta was 44142, but in Los Angeles only 5516. Frequency of using medical services by participants was moderately higher in Atlanta (22,9 visits per 10 000) then in Los Angeles (16 per 10 000). In Atlanta medical services were performed by 3346 volunteers including 664 physicians. Medical services were organized into large policlinic at the Olympic village and medical post at the venues and mobile teams. The analysis of medical care utilization and incidence of different types of reported medical problems were analysed according to the venue and to accreditation status of persons treated: athletes, officials, Olympic family, media , volunteers and spectators and also by gender and age. Use rates among people accredited in the village varied markedly by their status. The highest were for athletes (16,2 per 100), the lowest for volunteers (2.0 per 100). Rates of use of medical services at competition venues were much lower (22.9 pre 10 000) but the physician treatment rate was 4,2 per 10 000. Among reported diseases the most frequent were minor injuries. In the group of Olympic family, which was rather minor group, the most frequent was upper respiratory tract infection. But among spectators dominated heat-related illness. Number of hospitalized patients was 101. For chest pain were admitted 23 persons and only 7 for infectious diseases including 2 cases of malaria. No outbreaks of foodborne infections were reported during the 1996 Olympics. An interesting study was performed at the time of 1996 Summer Olympics at Emory School of medicine (15). The Authors performed prospective cohort study on patients from outside the usual catchment area at two children emergency departments and their satellite care centres. The patients with mean age of 6.7 years were most probably children of people who attended games as visitors. Among 263 patients the most frequent symptoms were rashes, respiratory difficulty and minor trauma. The Authors conclude that: large influx of people resulted in a relatively minor impact on

the emergent care system for children. They point to the problem of providing information to travellers whose children have chronic health problems about available regional health care centers and about the need for travelling with adequate medical documentation.

Epidemiological surveillance at Olympic Games in Seul (1988) was less elaborate. No enhanced surveillance system was implemented. Information included in Olympic Games Official Report – 1988 Seul (16) covers extensive activities of medical team, but on clinical services it is rather laconic. Total number of patients, who received medical help in the Village Medical Center, at competition sides, and at the function venues was 30 613. Most of the services were done to athletes, officials and media personnel. Spectators and "others" accounted only for 3 440 visits. There was no disclosure of categories of cases included in the Report.

At Olympic Games in Barcelona (1992) there was implementation of enhanced surveillance system aimed on expanded coverage and shortened timeliness in detecting outbreaks and investigating cases. According to *Panella* et al. "These modifications were introduced for group conditions (hepatitis, meningococcal disease, legionnaire's disease and food outbreaks), selected on the basis of incidence, time of the year, previous experience in other settings, and likelihood of outbreak occurrence" (17). Observed increase of outbreaks of foodborne diseases in households with concomitant decrease in restaurants may indicate effect of enhanced surveillance on effects of, unrelated to the games, domestic food preparation and at the same time better control of hygiene in restaurants connected to improved sanitary control in the time of Olympics.

At 2000 Summer Olympic Games in Sydney enhanced surveillance system was implemented, which included centralization of decisions, daily briefing sessions held to review emerging public health issues and facilitate responses with special attention to foodborne disease and conditions spread via respiratory route (18). The total attendance of those games was lesser then of those held in the USA. The estimated number of foreign visitors was 300 000, but mixed crowd at the opening ceremony reached 750 000 attendants. With meticulous sanitary and safety control Sydney Olympic Games did not bring substantial increase of cases. According to *L R Jorm* et al., no outbreaks of communicable diseases were detected. There were around 5% more presentations to Sydney emergency departments than in comparable periods in other years. With large numbers of visitors such an increase of cases can hardly be interpreted as an increase of incidence at the games (19,20).

Enhanced surveillance system of 2004 Athens Summer Olympic Games was meticulously prepared and included syndromic surveillance in sentinel hospitals. The list of syndromes reported clearly indicates that at those games, first after Sept 11, bioterrorist attack was seriously considered (21). Concurrently sanitary and public health preparations were aimed on improvement of sanitary conditions in the Olympic venues and also on cruise ships serving at that time for transportation and accommodation of visitors (22). With estimated number above 3 million visitors 2.8 –fold increase was observed of gastroenteritis (n=17), salmonellosis, and 1.7 –fold increase of bloody diarrhoea (n=10). With marked increase of the population at site and when considering higher sensitivity of the enhanced surveillance, those numbers of cases would hardly indicate any increase of incidence. And such was also conclusion of the Authors (23).

Beijing 2008 Summer Olympic Games were preceded by numerous warning signals and opinions pointing to hazards attributed to infectious diseases. Before the events there were widely publicised rumours on hand-foot-mouth disease caused by deadly EV71. Other information pointed to cases of H5N1, not all of them occurring in China, as a threat to Olympic visitors. Recommendations to travellers produced long list of vaccinations which included typhoid, hepatitis A and B, influenza, Japanese B encephalitis and rabies (24).

Chinese Center for Disease Prevention and Control, as well as numerous officials countered those opinions presenting information on the extensive preparation of medical and public health services aimed at preventing threats of infectious diseases and securing safety of visitors (25,26). For comprehensive report on the incidence of infectious diseases at Beijing Olympic Games is still too early, but it is almost certain that there was no health event which would bring marked attention of the international press.

Winter Olympics gather smaller numbers of spectators than Summer ones, and health hazards are also different. At the 1988 Winter Olympics in Calgary participation was estimated of 1.8 million spectator days (27). No enhanced surveillance system was implemented. Medical services were provided by medical staff at the venues and in 28 advanced support clinics. Medical staff included 98 physicians, 161 nurses, and 337 first aid attendants. Out of total 3, 395 encounters it was only 40 urgent and one emergent medical problem. The few serious problems occurred at Alpine ski venues and they were mostly related to accidental injuries to athletes. No health problems among the spectators were included in the report.

Extensive search for the epidemiological data on health problems at Winter Olympics in Albertville (1992), Lillehammer (1994), and Nagamo (1998) was unsuccessful.

Preparation of enhanced surveillance to 2002 Winter Olympics in Salt Lake City was particularly industrious considering recent attack on World Trade Center. Elec-

tronic Realtime Outbreak Detection System (RODS) was implemented and list of syndromes to be reported closely followed CDC list of syndromes to be mostly expected at bioterrorist attack. The level of alertness is best illustrated by the case of atypical chickenpox which was treated as smallpox with isolation of all personnel contacts until laboratory confirmed the final diagnosis (28). At the games 114 000 acute care encounters were monitored between Feb 8 and March 31, 2002. No outbreaks of public health significance were detected (29).

The system implemented at 2006 Winter Olympics in Torino was bases on integration of existing routine surveillance with newly formed syndromic surveillance system. System included two alarm lists. One list contained diseases which has to be instantly reported and another for alarm syndromes, which was very close to the CDC list prepared for the purpose of detecting bioterrorist attacks (30). Daily epidemiological reports were published on dedicated website of Piemonte Region. ECDC provided to Epidemiological Consultation Team about current international health treats. The Authors provide number of 1.4 million people living in the area but not the number of visitors. Medical data were also not categorized over different types of accreditation of patients. Syndromic surveillance, which covered 13 syndromes, reported 5282 people. 2355 (45%) of them had respiratory symptoms with fever, 1831 (35%) had gastroenteric syndrome, but only one cluster of gastroenteritis was epidemiologically confirmed. The Authors conclude that "2006 Olympic and Paraolympic Games had a limited public health impact, as has been found for similar mass gathering events" (31).

Another important group of sporting events gathering large numbers of visitors are international football tournaments. Among those the FIFA World Cup is the biggest. FIFA 1998 World Cup in France was the first tournament with enhanced surveillance of infectious disease (32). Enhancement of the system was in improvement of its timeliness – daily notifications instead of weakly, introduction of numerous, more than a thousand, sentinel general practitioners and employment in the reporting by all health care workers active at the venues. It was concluded afterwards, that „the 1998 World Football Cup had no epidemiological impact on general community health, as observed by sentinel networks" (33).

At 2002 World Cup in Korea and Japan two different systems of enhanced surveillance were implemented. In Korea it was syndromic surveillance system based on notifications by emergency departments (34), but in Japan it was web-based system operating in 87 hospitals and 11 prefectures hosting soccer games (35). People operating this system reported 3444 cases over surveillance period. This number is different than the number obtained from the analysis of patient load data from "in venue" and "out of venue" medical posts operating during the games (36). *Morimura* et al. gives number of 1661 cases reported in Japan (998 of them from intravenue reports). Total number of reported cases in Japan and Korea was 2966. No infectious diseases are listed in *Morimura* paper. Regarding syndromic surveillance system, *Suzuki* et al. (35) denies presence of major outbreaks of infectious diseases, but mentions that "aseptic meningitis epidemic was first detected as a neurological syndrome". Those discrepancies in reported categories of diseases and also in the numbers indicated imperfect coordination of coexistent surveillance systems and lack of joint data evaluation.

FIFA 2006 World Cup was held in Germany. Infectious diseases surveillance was based on pre-existing electronic modifiable disease reporting system without any change of definitions of reported diseases. Enhancement of the system was in acceleration of data transmission from weakly to daily reports and in additional free-text reporting system for public health events which were deemed relevant by local health authorities. Further extension concerned monitoring of domestic and international media sources and direct communication with also domestic and international health stakeholders (37, 38). Characteristic for the public health activity at 2006 World Cup was active and wide distribution of surveillance results. It was highly valued in international review (39).

With estimated 2 000 000 extra person-days of visitors there was no extra incidence of infectious diseases related to the World Cup mass gatherings, Outbreak of 61 norovirus infections which started in Munich International Broadcasting Centre would hardly be related to the crowds of visitors present at the games. Big outbreak of measles which preceded the games and continued at their time was also unrelated to the sporting events.

Additional sources of information, besides main surveillance system, played marginal role except for 3 diseases: measles, haemolytic-uremic syndrome and tick-borne encephalitis (40).

European football tournaments EURO 2000 in Belgium and Holland, EURO 2004 in Portugal and EURO 2008 in Austria and Switzerland had enhanced surveillance coverage of infectious diseases (41-44). None of those tournaments led to increased incidence of infectious diseases. *Goncalves* et al, in their report on the results of the surveillance covering tournament in Portugal, conclude: "Ten foodborne outbreaks, seven cases of meningococcal disease and one case of legionnaire disease, were detected. Visitors were not affected; furthermore, cases among residents seemed not to be influenced by the presence of thousands of visitors".

In many collegiate football games reports provide evidence that the most prevalent cases were minor trauma and heat related illness (45,46). In their analysis of

medical emergencies at the Syracuse University Carrier Dome, indoor stadium with 50 500 seats capacity, *De Lorenzo* et al. (47) found, in 7 years period, that there was no statistically significant correlation between crowd size and patient volume for sporting events, but there was small but statistically significant increase in patient volume for larger gatherings at rock concerts. Still the dominant category in their measures was minor trauma.

CONCLUSION

The most striking impression from reviewing literature covering surveillance of infectious diseases at mass gatherings is strong disproportion between numbers of papers covering preparation to the events or providing theoretical analyses versus those which give information on incidence or at least on numbers of reported cases.

There are some widely publicised catastrophes caused by panic, or aggression bursting in riots, but in almost all reports providing description of cases which occurred at mass gathering at sporting events, small injuries or heat related conditions were dominating. Infectious diseases in most cases were marginal and rarely increased beyond numbers expected on the basis of previous incidence in the same place.

Presumption, that there is special "mass gathering effect" leading to increased incidence of infectious diseases, requires revision regarding its generality. Although there are reports of very serious epidemics related to mass gatherings, they are almost always dependent on serious breaches of sanitary regime of food preparation or on poor sanitary conditions at the setting of gathering. Other potential risk factors are duration of the event, crowded camping and numerous close personal encounters among participants (5,7,8).

In this review covering the results of major sporting events like Olympics, or international football tournaments not even single example of documented increase of incidence of infectious diseases was provided. Even if there was some increase of cases, it remained in proportion to the number of participants.

Lack of convincing evidence, that large international sport events substantially increase risk of outbreaks of infectious diseases, legitimate the question: why bother? Why to put resources, efforts and time into implementation and operation of enhanced surveillance systems for mass gatherings at international sport events?

There is no simple answer to that question. Each of the reasons requires separate explanation.

1. Targeted epidemiological surveillance is a part of whole public health package prepared for the event which should be tailored to the size, season and character of mass gathering with consideration in the planning such variables like numbers of athletes, officials, services and visitors. Surveillance does not operate in isolation from other preparations. Hygienic background of the place, its adjustments and sanitary control as well as security measures are in that package. All the results of epidemiological surveillance should be analysed with consideration of public health measures. Low reported incidence of infections occurring at the time of games in venues and beyond, in a large part, may be an effect of sanitary precautions existing or implemented ad hoc. Epidemiological surveillance is a tool for assessment of the effectiveness of sanitary preparation to the games.
2. It is evident that Sept 11. 2001 influenced profoundly approach to the surveillance of infectious diseases. For many events syndromic surveillance was introduced based on CDC list of syndromes, which would signal most probable infections or intoxications which may occur at deliberate release of microbiological agents or toxins. So far no such an incident was reported. Syndromic surveillance, if operated well with high sensitivity, provides a lot of data, which need to be confirmed and evaluated. Big setup and operational effort of new surveillance system requires careful planning and analysis of pros and cons. In such an analysis should be considered (if possible) pre-event risk assessment, estimation of costs and also problem of personnel training. Functional effectiveness of the system, which would be prepared ad hoc for the event, may strongly depend on the skills of people who operate it.
3. Enhancement of existing surveillance system by improvement of timeliness and adopting extra sources of information, as it was done in 2006 World Cup in Germany, on certain conditions could be recommended as an example to follow. Such an approach diminishes costs of implementation and operation. It would be not new to the people who operate it, so training effort would also be low. It may be easily extended by other sources of information on infections which may increase sensitivity of the system without extra investment. The main problem is in the quality: sensitivity, elasticity, acceptance and the level of computerization of the basic routine surveillance system on which enhancement is based. If those requirements are met, small adjustments should be sufficient. With poor, paper based background; such limited improvements may be short of the target.

REFERENCES

1. Franaszek J. Medical care at mass gatherings. Ann Emerg Med 1986; 15(5):600–601.

2. Ounanian LL, Salinas C, Shear CL. Medical care at the 1982 US Festival. Ann Emerg Med 1986;15(5):520-527.
3. Sanders AB, Criss E, Steckl P, et al: An analysis of medical care at mass gatherings. Ann Emerg Med 1986; 15(5):515–519.
4. Aguilera J-F, Perrocheau A, Meffre C, et al. Outbreak of serogroup W135 Meningococcal Disease after the Hajj Pilgrimage, Europe, 2000. Emerg Infect Dis 2002;8(8):761-71.
5. Moore PS, Leee LH. Telzac EE, et al. Group A menningococal carriage in travelers returning from Saudi Arabia. JAMA 1988;260:2686-9.
6. Wilder-SmithA, Goh KT, Barkham T, Paton NI. Hajj-associated outbreak of Neisseria meningitidis serogroup W135; estimates of the attack rate in defined populations and the risk of invasive disease developing in carriers. Clin Infect Dis m2003;36(6):679-83.
7. Munnoch SA, Ashbolt RH, Coleman DJ, et al. A multi-jurisdictional outbreak of hepatitis A related to a youth camp – implications for catering operations and mass gatherings. Commun Dis Intell 2004;28:521-7.
8. Wharton M, Spiegel RA, Horan JM, et al. A large outbreak of antibiotic-resistant shigellosis at a mass gathering. J Infect Dis 1990;162:1324-8.
9. Norwalk-like Virus Associated Gastroenteritis in a Large, High Density Encampment. MMWR 51(30) 661-3, 2002
10. Fraser DW, Tsai T, Orenstein W, et al. Leggionnaires disease: Description of an Epidemic of Pneumonia. N Engl J Med 1977;297:1189-97.
11. Ehresmann KR, Hedberg CW, Grimm MB et al. An outbreak of Measles at International Sporting event with Airborne Transmission in a Domed Stadium. J Infect Dis 1995;171:679-83.
12. Milsten AM, Maguire BJ, Bissell RA. Mass gathering medical care: A review of literature. Prehospital and Disaster Medicine 2003;17 (3)151-62.
13. Baker WM, Simone BM, Niemann JT, Daly A. Special event medical care: the 1984 Los Angeles Summer Olympicsexperience. Ann Emerg Med 1986;15(2):185-90.
14. Wetterhall SE, Coulombier DM, Herndon JM et al. Medical Care Delivery at the 1996 Olympic Games. JAMA 1998; 279(18):1463-8.
15. Simon HR, Stegelman M, Button T. A prospective evaluation of pediatric emergency care in the 1996 Summer Olympic Games in Atlanta, Georgia, Pediatr Emerg Care 1998; 14(1): 1-3.
16. Olympic Games Official Report – 1988 Seul. http://olumpic-museum.de/o-reports/report1988.htm
17. Panella H, Plasencia A, Sanz M, Cayla JA. [An evaluation of the epidemiological surveillance system for infectious diseases In the Barcelona Olympic Games of 1992] (Spanish). Gac Sanit 1995;9(47):84-90.
18. Thackway SV, Delpech VC, Jorm LR et al.Monitoring acute disease during the Sydney 2000 Olympic and Paraolympic Games. MJA 2000;173:318-321.
19. Stiel D. Trethowan P, Vance N. Medical planning for the Sydney 2000 Olympic and Paraolympic Games. MJA 1997;167:593-594.
20. Jorm LR, Thackway SV, Churches TR, Hills MW. Watching the games:public health surveillance for the Sydney 2000 Olympic Games. J Epidemiol Commun Health 2003;57:102-8.
21. Panagitakos T, Costarelli V, Polychronopoulos E. The perspective of syndromie surveillance system on public health threats: a paradigm of the Athens 2004 Olympic Games. JRSH 2007;127 (3):111-2.
22. Hadjichristodoulou C, Mouchtouri V, Soteriades ES et al. Mass gathering preparedness: The experience of Athens 2004 Olympic and Para-Olympic Games. J Environ Health 2005; 67(9):52-7.
23. Panagiotopoulos T et al. Translating statistical significance into public health significance: the 2004 Athens Olympics experience. Ninth EPIET Scientific Seminar, Mahon, Menorca, Spain, 14–16 October 2004 (http://www.epiet.org/seminar/2004/index.html, accessed 15 May 2007).
24. Milne C J and Shaw M T M. Travelling to China for the Beijing 2008 Olympic Games. British J Sports Med 2008;42:321-326.
25. Beijing Centers for Disease Control and Prevention Holds the Working Conference of Infectious Disease Epidemics Reporting and Disposing Process during the Beijing Olympic Games. http://english.bjhb.gov.cn/index.htm
26. Beijing to Build Network for Infectious Diseases before Olympics. Xinhua News Agency April 8, 2007) http://www.fmprc.gov.cn
27. Thompson JM, Savoia G, Powell G et al. Level of medical care required for mass gatherings: The XV winter Olympic games in Calgary, Canada. Ann Emerg Med 1991;20 (4):385-90.
28. Utah Department of Health. Statemernt of A Richard Melton. http://help.senate.gov/Hearings/2006_03_16/melton.pdf
29. Gesteland H, R M Gardner, Tsui F C et al. Automated Syndromic Surveillance for 2002 Winter Olympics. J Am Med Inform Assoc 2003 ;10:547-54.
30. Epidemiological Consultation Team. Surveillance system in place for 2006 Winter Olympic Games, Torino, Italy 2006. Eurosurveillance 2006;11(6).
31. Epidemiological Consultation Team. Results of integrated surveillance system for the 2006 Winter Olympic and Paraolympic Games in Italy. Eurosurveillance 2006;11(33).
32. Coulombier D.Surveillance for the World Cup, France, 1998. Eurosurveill 1998:1204
33. Hanslic T, Espinoza P, Boelle PV et al. Sentinel monitoringof general community health during the 1998 World Football Cup. Rev Epidemiol Sante Publique 2001;49(2):135-145.
34. Cho JP, Kim IS, Ahn MY et al. Syndromic surveillance based on the emergency department in Korea. Journal of Urbam 2003;80 Suppl 1: i124-i125.
35. Suzuki S, Ohyyama K, Iamiguchi K. Web based Japanese syndromic surveillance for FIFA World Cup 2002.
36. Morimura N, Katsumi A, Koido Y et al. Analysis of patient load data from FIFA World Cup Korea Japan. Prehosp Disast Med 2004;19(3)278-84.

37. Josephsen J, et al, Preparations for infectious disease surveillance during the football World Cup tournament, Germany 2006. Euro Surveill 2006;11(4):E060427.2.
38. Schenkel K, et al, Enhanced surveillance of infectious diseases: the 2006 FIFA World Cup experience, Germany. Euro Surveill. 2006;11(12):234-8
39. Lombardo JS, Sniegocki CA, Loshen WA et al. Public Heath surveillance At mass gatherings. Johns Hopkins Apl Technical Digest 2008;27 (4):247-54.
40. Williams C. J., et al. FIFA World Cup 2006 in Germany: enhanced surveillance improved timeliness and detection Epidemiology and Infection Jul 2008.
41. Ronveaux O, Quoilin S, Van Loock F, Infectious disease surveillance in Belgium during Euro 2000 football tournament. Euro Surveill 2000:4(25;pii=1576.
42. Goncalves G, Castro L, Coreira AM, Quieros L. Infectious diseases surveillance activities in the north of Portugal, during the EURO 2004 football tournament. Eurosurveil 2005;10(4),01 April
43. Strauss R et al. EURO 2008 – Preparations for the Football Championship In Austria. Eurosurveillance, Apr-Jun 2008;13(14)
44. Strauss R., Fußball-Europameisterschaft 2008 – Rückblick, European Centre for Disease Prevention and Control, Preparedness and Response Unit,
45. Shelton S, Haire S Gerard B.. Medical care for mass gatherings at collegiate football games. South Med J 1997;90 (11):1081-3.
46. Spaite DW, Meislin HW, Valenzuela TD et al. Banning alcohol in a maior college stadium: impact on the incidence of injury and patterna of injury and illness. J Am Coll Health 1990; 39(3):125-8.
47. De Lorenzo RA, Gray BC, Bennett PC et al. Effect of crowd size on patient volume at a large, multipurpose, indoor stadium. J Emergt Med 1989;7(4):370-84

Received: 12.05.2009
Accepted for publication: 8.06.2009

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