Leptospirosis following heavy rains in 2017 in Mumbai: Report of large-scale community chemoprophylaxis

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ABSTRACT

Background. Globally, cities get flooded due to heavy rains. As the incidence of leptospirosis increases after such flooding in Mumbai, community chemoprophylaxis to selected individuals was a consensus recommendation by experts.

Methods. We surveyed a total of 1 499 293 houses in severely affected areas of Mumbai (where there was water-logging or high incidence of leptospirosis in the past) as well as in all slum areas. A total of 6 714 210 people (> 50% of the population) were screened. A total of 156 934 adults, 4465 children, 359 pregnant women and 4957 high-risk adults were given prophylaxis with doxycycline or azithromycin by paramedical staff (n=9526) under the supervision of medical staff. Social media and newspaper advertisements were used to create public awareness.

Results. Compared with previous floods, there were reduced number of cases of leptospirosis due to community chemoprophylaxis (432 confirmed cases in 2005 *v.* 128 [59 confirmed] in 2017).

Conclusions. Selective, time-bound chemoprophylaxis following floods is likely to reduce the incidence of leptospirosis, as well as associated morbidity and mortality.

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INTRODUCTION

A large amount of water needs to be drained following heavy rains, especially during the monsoon season, but water drainage systems do not have that capacity, leading to inundation of parts of cities across the world.[1–3] As a result, transport services get disrupted and people are forced to wade through water that is likely to be contaminated, which increases the occurrence of leptospirosis.[4,5]

A large increase in the number of patients with leptospirosis was seen from days 7 to 12 following a deluge in Mumbai. In 2005, at one of the hospitals (Nair Hospital), 432 patients were diagnosed to have leptospirosis using various diagnostic kits/ methods.[4] After the deluge on 26 July 2005, there was a 8-fold rise in the number of patients with leptospirosis compared with the previous 4 years. No published records of leptospirosis cases are available of those treated at other hospitals.

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Leptospirosis is generally transmitted to humans by water that has been contaminated by animal urine, which comes in contact with humans through unhealed breaks in the skin, eyes or with mucous membranes. This is a report on the outcome of a large public health intervention after a deluge that occurred in August 2017 in the city of Mumbai, Maharashtra, India.

THE SETTING

Deluge scenario

Mumbai is a metropolitan city of India with a population of 12.5 million. It has an annual rainfall of around 2500 mm with many spells of heavy rains. Mumbai is a city of reclaimed land joined by seven small islands. This has created a peculiar geographical situation of the city having many low-lying areas. Mumbai has a storm water drainage system. The rainwater is drained into the sea by gravity and by pumping stations. If heavy rainfall (>50–70 mm in an hour) occurs and coincides with the high tide at sea, drainage of water is hampered and it results in stagnant water on large stretches of the roads despite pumping of water being done. Heavy rains caused a deluge in some parts of Mumbai on 29 August 2017 and 19 September 2017.[6] A similar event had occurred on 26 July 2005. In all these episodes, people had to walk through stagnant water. Such instances predispose to an increase in occurrence of leptospirosis.

COMMUNITY INTERVENTION

The Municipal Corporation of Greater Mumbai (MCGM) Health department staff, the state officials from the Government of Maharashtra, Infectious Diseases experts, experts from Municipal Medical Colleges from the fields of Medicine, Paediatrics, Microbiology and Social and Preventive Medicine, Public Health officials and administrators evolved a consensus for the prevention of leptospirosis in the city of Mumbai. The decision was to recommend chemoprophylaxis for the prevention of leptospirosis. All experts recommended a policy for post-exposure prophylaxis for prevention of leptospirosis (Table I). A major public health intervention was carried out within 72 hours of the deluge. An extensive house-to-house survey was carried out by MCGM field staff (community health workers) under the supervision of Medical Health Officers and faculty from Community Medicine departments of the medical colleges. The survey was based on a questionnaire. The risk following exposure was categorized as low, moderate, high and for pregnant women and children <8 years of age. A total of 1 499 293 houses were surveyed in the severely affected areas (where there was water-logging or high incidence of leptospirosis in the past) as well as in all the slum areas, and 6 714 210 citizens (>50% of the population of Mumbai) were screened. A total of 156 934 adults, 4465 children, 359 pregnant women and 4957 high-risk adults were given prophylaxis with doxycycline or azithromycin by the paramedical staff (n=9526) under the supervision of medical staff.

The other measures taken were:

1. Special medical camps were organized in the community to provide preventive and curative services. Between 30 August 2017 and 17 September 2017, a total of 112 health camps (including 37 special Sunday camps) were organized and were attended by 28 500 beneficiaries.
2. An extensive public communication campaign was carried out during the same period to create awareness about preventive tips/doses of drugs to be followed.
3. Advertisements were given in the leading newspapers to create awareness about leptospirosis.

TABLE I. Policy recommended for post-exposure prophylaxis for prevention of leptospirosis

Category of risk	Definition	Dose for prophylaxis
Low-risk exposure	Individuals with a history of one-time wading in flooded or contaminated water without wounds, cut or open lesions of the skin	Capsule doxycycline 200 mg single dose within 24–72 hours from exposure *Pregnant women* Azithromycin 500 mg stat within 24–72 hours *Children* 200 mg syrup or 250 mg tablet stat single dose
Moderate-risk exposure	Adult individuals with a history of one-time wading in flooded or contaminated water and the presence of wounds, cuts or open lesions of the skin or accidental ingestion of contaminated water	Capsule doxycycline 200 mg once daily for 3 days to be started within 24–72 hours from exposure
Pregnant women with low- or moderate-risk exposure	Individuals with a history of one-time wading in flooded or contaminated water and the presence of wounds, cuts or open lesions of the skin or accidental ingestion of contaminated water	*For low exposure* Tablet azithromycin 500 mg stat, within 24–72 hours *For medium exposure* Tablet azithromycin 500 mg once daily for 3 days
Children (age <8 years)	Individuals with a history of one-time wading in flooded or contaminated water and the presence of wounds, cuts or open lesions of the skin or accidental ingestion of contaminated water	*Low-risk exposure* Syrup azithromycin 200 mg single dose or 250 mg tablet single dose within 24–72 hours *Moderate-risk exposure* Syrup azithromycin 200 mg or 250 mg tablet once daily for 3 days
High-risk exposure	Adults with *continuous exposure* in flooded waters especially in urban areas infested with domestic, sewer rats and accidental ingestion of contaminated water, e.g. solid waste management workers and other individuals working in flooded waters during relief and rescue operations	Capsule doxycycline 200 mg once a week for 6 weeks

TABLE II. Comparison of available data for different years of patients with leptospirosis

August 2005 (deluge, no public health intervention)		September 2016 (no deluge)		September 2017 (deluge with public health intervention)	
Cases	Deaths	Cases	Deaths	Cases	Deaths
432	Data not available	38	3	59	3

4. More than 7 000 000 bulk short text messages were sent to all citizens of Mumbai. In addition, WhatsApp messages were sent to private medical practitioners of the Indian Medical Association (IMA) and the Association of Medical Consultants (AMC).
5. Various medical officers, faculty and residents monitored the whole process. The medications were given under the direction of medical officers.

OBSERVATIONS

In 2017, during the 3 weeks following the deluge, in the whole of Mumbai, only 128 cases of suspected leptospirosis were reported from public as well as private hospitals. However, the PCR laboratory confirmed only 59 as positive (Table II). Compared with the data of September 2016 (when there was no deluge) there was some increase in the reported cases of leptospirosis but much less as compared to 2005.

DISCUSSION

Floods are common natural occurrences. They are also the leading cause of deaths in natural disasters worldwide. Between 1980 and 2009, globally there were 539 811 deaths, 361 974 injuries and 2 821 895 005 people affected by floods.[7] As per reports, floods were responsible for almost 53 000 deaths in the past decade alone (23 deaths in low- versus 1 death in high-income countries). After a typhoon in September 2009, an outbreak of leptospirosis occurred in Metro Manila, the Philippines, 471 patients were hospitalized and 51 (10.8%) died. A hospital-based investigation found risk factors associated with fatal infection to be older age, haemoptysis, anuria, jaundice, and delayed treatment with antimicrobial drugs.[8]

In Mumbai, whenever a deluge occurred in the past, the number of patients with leptospirosis and deaths due to the infection were high. Considering the vastness and population of Mumbai, it was expected that the deluge in 2017 too would increase the number of patients with leptospirosis. However, possibly because of the large-scale public health intervention, the number of patients has increased than the previous year with no deluge but was much less than in 2005; the PCR laboratory confirmed only 59 cases.[9] The National Centre for Disease Control (NCDC) guidelines recommend chemoprophylaxis for chronic high-risk persons who work in agricultural fields and canal workers. They suggest once-a-week chemoprophylaxis to reduce the incidence of leptospirosis. There is no record in the literature

recommending the said massive level public intervention. There is inconclusive evidence for the usefulness of chemoprophylaxis for low-risk exposure after a deluge.

In the absence of rigorous, evidence-based guidelines, a consensus was evolved in consultation with experts in the field including the Public Health Team of MCGM, experts from the Community Medicine, Paediatrics and Microbiology departments of medical colleges, officers from the Government of Maharashtra, and Infectious Diseases experts. Such a public intervention was unique and has possibly given beneficial results to the community by reducing the load of leptospirosis as well as associated mortality. Though the intervention was not planned as a study, data were collected through a well-established and extensive MCGM network and hence the results can be relied upon.

As occurrences of this kind are increasing worldwide, our protocol could be followed by public health authorities elsewhere till more evidence is available. There is need for an evidence-based consensus guideline for chemoprophylaxis of leptospirosis after a deluge in cities and in rural areas to prevent and/or minimize the occurrence of leptospirosis in the community.

A recent review[10] supports the use of chemoprophylaxis after floods to reduce the occurrence and impact of leptospirosis outbreaks. This study reviewed the literature on the current practices of chemoprophylaxis for leptospirosis and explored, using a mathematical model, how various chemoprophylaxis scenarios may have an impact on the progression of a leptospirosis outbreak. Twenty-six peer-reviewed publications were selected (10 quantitative studies, 2 systematic reviews and 14 articles of other types). Oral doxycycline was the most used antibiotic for chemoprophylaxis of leptospirosis. Evidence of the effectiveness of post-exposure prophylaxis was inconsistent, but it supported a protective effect for morbidity and mortality. The review suggests that chemoprophylaxis may reduce the number of leptospirosis cases after high-risk exposure; however, the effective benefit also depends on a variety of factors such as the timing and coverage of prophylaxis.

More research is needed to provide evidence-based recommendations for leptospirosis control during an outbreak. Global trends in urbanization and disease forecasting should be better reflected in measures recommended for flood preparedness and mitigation programmes. An improved understanding of the potential health impacts of floods and such selective, time-bound chemoprophylaxis policies is likely to reduce post-flood incidence of leptospirosis and associated morbidity and mortality.

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Conflicts of interest. None declared

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