10.5005/jp-journals-10056-0071

ORIGINAL RESEARCH

Epidemiological Perspectives of Leptospirosis in a Metropolitan City with Focus on Quality of Disease Surveillance Data

[1]Ratnendra R Shinde, [2]Anuradha Mohapatra, [3]Ravindra S Kembhavi, [4]Minni Khetarpal, [5]Sheela Jagtap

ABSTRACT

Introduction: Leptospirosis, an emerging infectious disease, has a checkered history of outbreaks in Maharashtra. The last few years have seen a surge in number of cases in Mumbai.

Aims and objectives: The objective was to analyze the available disease surveillance data of leptospirosis in Mumbai for the years 2015 and 2016, highlighting the magnitude of the problem and assess disease surveillance data quality in terms of completeness, adequacy, and consistency, and identify gaps if any.

Materials and methods: This is a record-based study. Daily line-listing and count data of leptospirosis in standard formats were scrutinized for analysis.

Results: There were 443 confirmed cases and 28 deaths from 2015 to 2016. The cases are present round the year, but the upsurge is observed during July to October. About 69% affected were males. Maximum affected age group is 26 to 40 years (31%). About 40% of the cases are reported within 24 to 48 hours of admission. The data are complete in all parameters in only 1.5% cases. Sociodemographic details are complete in 61% cases. Occupation was mentioned in only 21%. Reporting from private sector is neither adequate nor consistent.

Conclusion: Gaps in the reporting are found in terms of completeness in both sociodemographic profile and clinicoepidemiological history. There were also issues in the adequacy and consistency of data. A strong and well-functioning disease surveillance system can gather enough evidence for planning prevention and control activities.

Keywords: Data quality, Leptospirosis, Surveillance.

How to cite this article: Shinde RR, Mohapatra A, Kembhavi RS, Khetarpal M, Jagtap S. Epidemiological Perspectives of Leptospirosis in a Metropolitan City with Focus on Quality of Disease Surveillance Data. Int J Educ Res Health Sci 2017;3(4):199-204.

[1]Professor and Head, [2]Junior Resident (3rd Year), [3]Additional Professor, [4]Deputy Executive Health Officer, [5]Assistant Health Officer

[1-3]Department of Community Medicine, King Edward Memorial Hospital and Seth Gordhandas Sunderdas Medical College Mumbai, Maharashtra, India

[4,5]Department of Public Health, Municipal Corporation of Greater Mumbai, Mumbai, Maharashtra, India

Corresponding Author: Anuradha Mohapatra, Junior Resident (3rd Year), Department of Community Medicine, King Edward Memorial Hospital and Seth Gordhandas Sunderdas Medical College Mumbai, Maharashtra, India, Phone: +919449564095 e-mail: anuradha.moha@gmail.com

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Leptospirosis is a zoonosis of ubiquitous distribution, caused by infection with pathogenic *Leptospira* species. The spectrum of disease ranges from subclinical infection to severe multiorgan dysfunction with high mortality.[1,2]

Leptospirosis is now identified as one of the emerging infectious diseases, exemplified by recent outbreaks in many parts of India. The high burden of disease has been reported from Andaman & Nicobar, Gujarat (4 districts), Kerala (14 districts), Maharashtra (4 districts and Mumbai city), Karnataka (9 districts), and Tamil Nadu (2 districts and Chennai city).[3]

Leptospirosis (in endemic areas) is a known disease under surveillance in the Integrated Disease Surveillance Project (IDSP). As data under IDSP are computerized, it becomes necessary to standardize formats used for recording and reporting information at various levels.[4]

In the last few years, there has been a surge in the number of probable as well as confirmed cases of leptospirosis in Mumbai. In 2013, 233 confirmed cases of leptospirosis occurred of which three died. Similarly, in 2014 and 2015, 79 and 176 confirmed cases of leptospirosis were detected of which 4 and 19 died respectively. In 2016, there have been 267 confirmed cases and 9 deaths.[5] Disease surveillance is an important tool for early detection of outbreaks, so that effective control measures can be implemented in time. The disease surveillance mechanisms are yet to be strengthened in India. Delays in detection of impending outbreaks are commonly seen.

This study had, therefore, been taken up to understand the current epidemiological perspectives of leptospirosis and the quality of corresponding disease surveillance data and identify gaps so as to ensure quality reporting of detected cases for the planning of control and prevention activities.

AIMS AND OBJECTIVES

The study aimed to carry out a detailed epidemiological analysis of disease surveillance data of leptospirosis in Mumbai for the years 2015 to 2016. The specific objectives

were: (i) To highlight magnitude of problem (morbidity and mortality) of leptospirosis; (ii) to describe in time, place, and person distribution of leptospirosis through hospital-based data; (iii) to assess disease surveillance data quality in terms of completeness, adequacy, and consistency of reporting system and identify gaps, if any; (iv) to evolve recommendations for planning of prevention and control activities based on the study findings.

MATERIALS AND METHODS

This is a cross-sectional, record-based study. Data in the form of daily line-listing, L form (lab confirmed cases form) and P form (presumptive cases form), were obtained from the Epidemiology Cell of the Public Health Department, Municipal Corporation of Greater Mumbai, India for the years 2015 and 2016 in a standardized format of IDSP via e-mail. Due permissions were taken in this regard. Standard case definitions for suspect, probable, and confirmed cases of leptospirosis given by National Centre for Disease Control were used.[3]

There are 27 reporting units in Mumbai under IDSP, consisting of four Municipal Medical Colleges (KEM, Sion, Nair, and Cooper), 4 Sir JJ Group of Hospitals, 18 peripheral municipal hospitals, and the Kasturba Hospital for Infectious Diseases. These units report regularly to the epidemiology cell on a daily basis. Apart from these, out of a total of 64 (in 2015) to 67 (in 2016), only 45 private nursing homes send daily reports to the epidemiology cell.

Initial review of the data revealed a lot of gaps in terms of completeness and adequacy. Data entry was done in Microsoft Excel 2010. Datewise mainstreaming and merging of data were done. Data cleaning, identification of duplicate records, and filling of gaps from other parallel reports were done. These data were then subjected to analysis. Since these data are hospital-based, inadequate, and incomplete in some parameters, it limited the use of any advanced statistical methods.

Table 1: Burden of leptospirosis in Mumbai

Years	*Total no. of cases of leptospirosis (probable and confirmed)*	*No. of confirmed cases of leptospirosis*	*No. of confirmed deaths*
2015	894 (1 outside Mumbai)	176	19
2016	1726 (6 outside Mumbai)	267	9
Total	2620	443	28

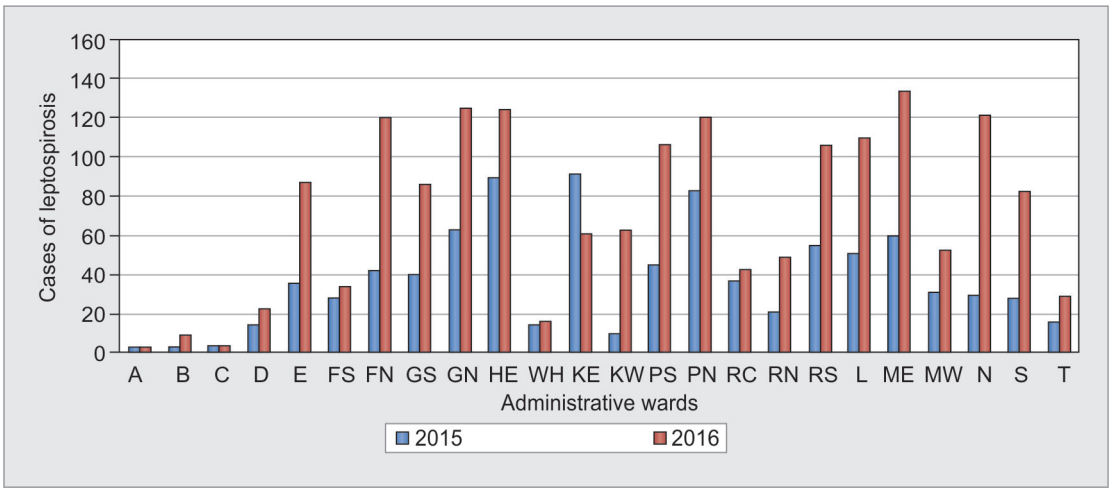
RESULTS

Morbidity and Mortality Spectrum

The total number of cases obtained from line-listing according to the IDSP format was 894 cases in 2015 and 1,726 cases in 2016. This included both probable as well as confirmed cases of leptospirosis. Total numbers of confirmed cases were 176 in 2015 and 267 in 2016. The numbers of deaths were 19 in 2015 and 9 in 2016 (Table 1).

Mumbai city for administrative purposes is divided into six zones, and further into 24 wards. Zones 2, 3, and 4 harbor the maximum number of cases. Out of which, zone 4 consisting of wards PS, PN, RS, RN, and RC has reported the maximum cases in last 2 years. Ward-wise distribution of cases is given in Graph 1. In the year 2015, the maximum number of cases of leptospirosis were seen in HE, KE, and PN wards. In 2016, many wards had shown a rise in cases with the maximum being in ME, GN, HE, N, PN, FN, L, PS, and RS wards. In many of these wards, the cases have increased drastically from the previous year. Leptospirosis cases are present round the year with rise in number of cases significantly during July to October. This coincides with the rainy season in Mumbai.

The maximum cases reported are from the Municipal Medical Colleges (35%), the peripheral municipal hospitals (44%), and Kasturba hospital (12%). Private sector reports 8.5 % of the total cases and JJ group of hospitals around 0.5%. A total of 1,74,642 samples were tested for leptospirosis in the year 2015 and 2016. Table 2 shows the number of samples tested by various methods. The



Graph 1: Ward-wise distribution of cases of leptospirosis

Table 2: Samples tested for leptospirosis by different methods

Years	*Total samples tested (suspected leptospirosis cases)*	*Sample tested by ELISA*	*Sample found positive by ELISA*	*Leptospirosis confirmed by PCR*
2015	52,290	7,472	894	176
2016	122,352	8,541	1,726	267
Total	174,642	16,013	2,620	443

percentage of probable cases among suspects was found to be 1.5%. The percentage of confirmed cases among suspects was 0.25%. The percentage of confirmed cases among probables is 16.90%.

In the year 2015, a total of 19 confirmed cases of leptospirosis died, out of which 17 deaths occurred in the month of July. In 2016, 9 confirmed cases of leptospirosis died. Out of these, maximum deaths were in July and August. Most of the deaths were reported from wards R/S (8), P/N (5), P/S (4), R/N (3), and M/E (3). The case fatality rate was found to be 6.32%.

Of the total 2,620 cases, we see that 69% (n = 1819) were males and 30% (n = 801) were females. In both public as well as private sector reporting, males were seen to be affected more than females. The age is found to be 29 days to 100 years. The maximum (i.e., 59%) cases are seen in the age group of 16 to 40, especially, 26 to 40 years (31%). The least affected is 0 to 6 years of age (2.7%). There is no difference in the distribution of cases in males and females in the younger age group, i.e., 0 to 6 years. There is a significant difference in the distribution of cases in males and females in the age group 16 to 40 years (41.67% in males compared with 14.27% in females).

Data Analysis

Since no major difference was observed in reporting for the years 2015 and 2016, the quality of the data has been assessed together for both the years. On analysis of data of 2,620 cases, it was found that data were complete in only 39 cases, which is about 1.5%. The rest, viz., 98.5% the data were incomplete in some or the other aspects. The entry reported was done on different dates, but, all details were consistent. The same reporting unit appears multiple times with different names.

Completeness of Sociodemographic Profile (n = 2620)

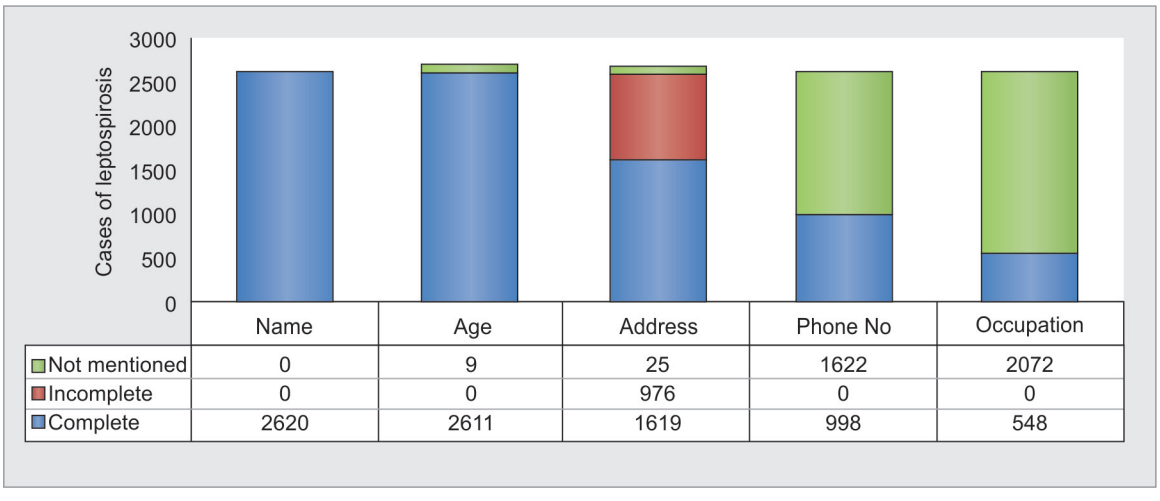
Complete name was written in 100% of the cases (Graph 2). Age was written in 99.6% of cases, i.e., only 9 out of 2,620 cases had no mention of age. Complete address was written in 1,619 cases, i.e., 61.8%, incomplete in 976 cases, i.e., 37.27% and no address was mentioned in 25 cases, i.e., 0.9%. Contact number was mentioned in 998 cases, i.e., 38.1%. Occupation was mentioned in only 548 cases and the rest, i.e., 2072 cases (79.1%) had no mention. Occupation, though mentioned, did not clearly indicate nature or type of work. e.g. .terms, such as service, housework was used.

Completeness of Clinical Profile (n = 2620)

Date of onset of symptoms was mentioned in 851 cases, i.e., 32.5%. Date of admission was mentioned in 2,104 cases, i.e., 80% (Graph 3). Date of reporting to hospital was mentioned in 100% cases. Epidemiological history was not mentioned for any case. Brief clinical history was mentioned in 1,153 cases, i.e., 44%. Lab investigations (either Rapid or Elisa or PCR) were mentioned in 2,592 cases, i.e., 98.93%. Final diagnosis was mentioned in all cases.

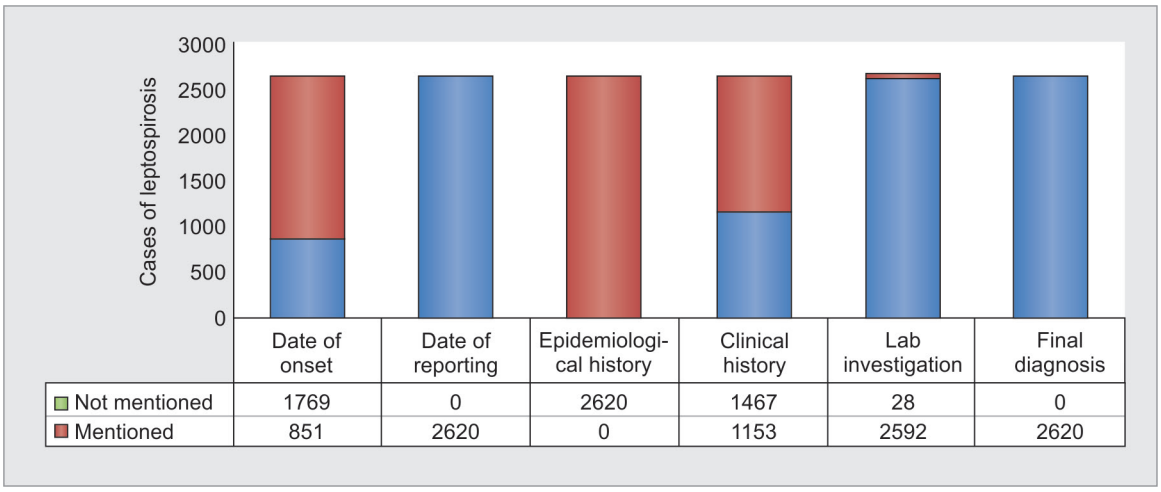
Timeliness (n = 2620)

About 12% of the cases are reported within 24 hours (Table 3). About 40% of the cases are reported within 24 to 48 hours of admission. Around 13% of the cases are reported beyond 72 hours. In 20% cases (508), there



	Name	Age	Address	Phone No	Occupation
Not mentioned	0	9	25	1622	2072
Incomplete	0	0	976	0	0
Complete	2620	2611	1619	998	548

Graph 2: Completeness of data for sociodemographic profile



Graph 3: Completeness of clinical profile

Table 3: Interval between time of admission and reporting of cases of leptospirosis

Interval (hours)	*2015*	*2016*	*Total*	*Percentage*
0–24	133	192	325	12
24–48	451	597	1048	40
48–72	150	239	389	15
>72	106	246	352	13
Total	840	1274	2114	80

was no mention of date of admission; hence, timeliness interval could not be calculated.

Adequacy (n = 2620)

Administrative wards were not mentioned in many cases. Thus, address of the patients had to be matched with the respective administrative wards for analysis. Time of admission was not mentioned in many cases. Type of lab investigation test done was not mentioned appropriately in many entries. There is no provision for mention of final treatment outcome like transfer/cured/death in the line-list format.

Consistency (n = 2620)

A standard uniform pattern of writing the names of reporting units, patient's address, and lab investigation report are not observed. Multiple duplicate records were observed in the line-listing of daily reports. Linkages of daily line-listing with the L form and P form were somewhat inconsistent and some gaps could be filled. However, a great deal of inconsistency in terms of counts existed. Hence, data could not be fully analyzed for all parameters.

Private Hospital Reporting

About 45 private nursing homes out of a total of 67 report to the City Epidemiology cell. Out of these, 14 private nursing homes were regular in reporting. Reporting appears more consistent during July to September. Totally, 83 cases of leptospirosis were reported in the year 2015, out of which 8 cases belonged to areas outside Mumbai. Totally, 164 cases of leptospirosis were reported in the year 2016, out of which one case belonged to the area outside Mumbai. Two cases of death were reported out of which, one was a referred case from outside Mumbai. There was no mention of occupation or epidemiological history in any of these cases. Details of age, sex, lab investigation, duration of hospital stay, and complete address were present in all cases. Average duration of stay for all patients was 6 days (4–9 days). Lepto IgM Elisa and Rapid IgM tests were mainly used for diagnosis and no cases were confirmed by polymerase chain reaction. Diagnosis was mentioned in all cases. Three private labs, i.e., Metropolis, SRL diagnostics, and Sub Urban diagnostics report to the epidemiology cell with L- form as per the IDSP guidelines.

DISCUSSION

This is a cross-sectional, record-based study. Detailed analysis of data of 2 years (2015 and 2016) highlights the epidemiological perspectives of leptospirosis in a metropolitan city with focus on quality of disease surveillance data reporting.

There is an increase in the cases of leptospirosis from the year 2015 to 2016. Leptospirosis cases are present round the year, but the intensity increases significantly during July to October. Maximum numbers of deaths also occurred during the monsoon, when the disease burden was high. Many similar studies have been conducted since leptospirosis is emerging as a major public health concern. A similar study by Gamage et al[6] reports that in the last two decades, the number of leptospirosis notifications in Sri Lanka has been increasing. The individuals in most of the suspected cases were men (83.5%). Nearly half (45.6%) of the individuals belonged to two aggregated age categories (i.e., 30–39 and 40–49 years).

In our study, it was found that leptospirosis affected male population (69%) more than females (31%). Leptospirosis is generally seen in populations working in paddy fields, sewers , or who have history of wading through water,[7] but children as young as 29 days and adults as old as 100 years were also found to be positive for leptospirosis. Maximum (i.e., 59%) cases are seen in the age group of 16 to 40, especially, 26 to 40 years (31%). Least affected is 0 to 6 years of age. In a study in Malaysia, the mean age of participants was 31.4 (standard deviation 9.7, 18–65 years); 84.6% of those affected were males and 15.4% were females.[8] These findings are similar to our study and reflect the predisposition of the male sex and the young adult age group for leptospirosis.

We found that data were complete in only 1.5% cases. In the rest, viz., 98.5% the data were incomplete in some or the other aspects, indicating the need for strengthening of IDSP mechanisms with stringent supervision and monitoring at all levels. Major reporting is done by the municipal medical colleges, the peripheral municipal hospitals, and Kasturba hospital (91%). Private sector reports only 8.5% of the total cases. A study by Singh et al[9] also found that the participation from private sector is low. A systematic review by Keramarou and Evans[10] found that reporting completeness varied from 3 to 95% and was most strongly correlated with the disease being reported. They concluded by saying that reporting completeness had not improved over the past three decades. It remains suboptimal even for diseases that are under enhanced surveillance or are of significant public health importance.

Quality of the data collected is not uniform from all sectors. Gaps in the reporting are found in terms of completeness in both sociodemographic profile and clinicoepidemiological history. There are also issues in the adequacy and consistency of data. About 12% of cases were reported within 24 hours. About 30% of the cases are still being reported beyond a time lag of 48 hours. This is similar to the findings by Jajosky and Groseclose[11] emphasizing on a long reporting lag and the variability across states, which limits the usefulness of the data. The study by Venkatarao et al[12] and Kumar et al[13] also highlights a similar problem.

Surveillance, therefore, demands active managerial intervention focusing on regularity, timeliness, completeness, consistency, and accuracy of reporting. Further, availability of laboratory diagnostic facilities for confirmation of cases is an indispensable factor.[14]

CONCLUSION

The incidence of leptospirosis shows an increasing trend in Mumbai with the maximum cases during the monsoon in the past two years. Case fatality rate is low, but there is a possibility of under-reporting, especially, from the private sector. Males are more susceptible to *Leptospira* infection, possibly owing to the outdoor nature of their work than females. The maximum number of cases are seen in the age group of 16 to 40 years. Totally, 27 reporting units consisting of four municipal medical colleges (KEM, Sion, Nair, and Cooper), 4 Sir JJ Group of Hospitals, 18 peripheral municipal hospitals, and Kasturba Hospital for Infectious Diseases report regularly to the epidemiology cell on a daily basis. Reporting from private sector is neither adequate nor consistent. Standard case definitions given by NCDC are followed. Gaps in the report are found in terms of completeness in both sociodemographic profile and clinicoepidemiological history.

RECOMMENDATIONS

Based on our study findings, we recommend that microguidelines/statement of purpose can be prepared for uniformity of reporting by reporting units. The job responsibilities of each staff of IDSP unit need to be specified and quality control of data reporting must be monitored by in-charges of the IDSP units.

Daily cases, which are indeterminate, should be followed up to ensure how many suspected/probable were subsequently confirmed. This may be reported on a weekly basis with reference to the line-list of IDSP cases. Codes can be assigned to reporting units to avoid confusion during data entry. Scope for further involvement of the private sector has to be explored in a phased manner.

Sensitization and training should be conducted at all levels from the data entry operator to the supervisory cadre to improve the quality of data. The training content should include problem-solving exercises based on actual wrongly reported formats submitted to City Epidemiology Cell (without any bias) as a "hands on" training exercise.

Data cleaning and updating should be undertaken on a weekly basis by supervisors. Detailed analysis of the epidemiological perspectives of all diseases reported to the IDSP needs to be done at least 6 monthly, especially in death cases. Completeness, adequacy, and consistency should be ensured in reporting at all levels for all parameters daily.

Areas of operational research should be identified and community medicine departments of medical colleges should be involved in the same in collaboration with the public health department.

The detailed address with landmarks and contact numbers of admitted cases must be recorded, which will enable the IDSP units to track follow-up cases. The concerned staff of the hospital/health center (in most cases, the medical records department) need to be oriented to ensure recording of basic case data on the indoor case papers/outpatient department case papers at the entry point during issuance of indoor case papers.

ACKNOWLEDGMENT

Authors would like to thank Dr Avinash Supe, Director (ME and MH), Municipal Corporation of Greater Mumbai, and the Executive Health Officer, Dr Padmaja Keskar, Municipal Corporation of Greater Mumbai, for facilitating this study.

REFERENCES

1. Levett PN. Leptospirosis. Clin Microbiol Rev 2001 Apr;14(2): 296-326.
2. World Health Organization. Leptospirosis worldwide, 1999. Wkly Epidemiol Rec 1999 Jul;74(29):237-242.
3. National Centre for Disease Control. Programme for prevention and control of leptospirosis-national guidelines: diagnosis, case management prevention and control of leptospirosis (Directorate General of Health Services). New Delhi: National Centre for Disease Control; 2015. [cited 2017 Sep 9]. Available from: http://www.ncdc.gov.in/writereaddata/mainlinkfile/File558.pdf.
4. Integrated Disease Surveillance Programme. Data management. New Delhi: Integrated Disease Surveillance Programme. 2009. [cited 2017 Sep 9]. Available from: http://www.idsp.nic.in/index4.php?lang=1&level=0&linkid=412&lid=3695.
5. Integrated Disease Surveillance Project. Data from epidemiology cell, Kasturba hospital, Mumbai, Maharashtra.
6. Gamage CD, Amarasekera J, Palihawadana P, Samaraweera S, Mendis D, Janakan N, Lee RB, Obayashi Y, Tamashiro H. Analysis of hospital-based sentinel surveillance data on leptospirosis in Sri Lanka, 2005-2008. Jpn J Infect Dis 2012 Mar;65(2):157-161.
7. World Health Organization. Diseases: leptospirosis. Geneva: WHO; 2013. [cited 2017 May 10]. Available from: http://www.who.int/zoonoses/diseases/leptospirosis/en/.
8. Mohd Ridzuan J, Aziah BD, Zahiruddin WM. Work environment-related risk factors for leptospirosis among plantation workers in tropical countries: evidence from Malaysia. Int J Occup Environ Med 2016 Jul;7(3):156-163.
9. Singh V, Mohan J, Rao UP, Dandona L, Heymann D. An Evaluation of the key indicator based surveillance system for International Health Regulations (IHR) - 2005 Core Capacity Requirements in India. Online J Public Health Inform 2014;6(1):121.
10. Keramarou M, Evans MR. Completeness of infectious disease notification in the United Kingdom: a systematic review. J Infect 2012 Jun;64(6):555-564.
11. Jajosky RA, Groseclose SL. Evaluation of reporting timeliness of public health surveillance systems for infectious diseases. BMC Public Health 2004 Aug;4:29.
12. Venkatarao E, Rajan, Patil R, Prasad D, Anita Anasuya RS. Monitoring data quality in syndromic surveillance: learnings from a resource limited setting. J Glob Infect Dis 2012 Apr;4(2):120-127.
13. Kumar A, Goel MK, Jain RB, Khanna P. Tracking the Implementation to identify gaps in integrated disease surveillance program in a block of district Jhajjar (Haryana). J Fam Med Prim Care 2014 Jul-Sep;3(3):213-215.
14. Phalkey RK, Shukla S, Shardul S, Ashtekar N, Valsa S, Awate P, Marx M. Assessment of the core and support functions of the Integrated Disease Surveillance system in Maharashtra, India. BMC Public Health 2013 Jun;13:575.