Research Article

Assessment and seasonal variations of communicable diseases: 3 year study

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ABSTRACT

Background: Communicable diseases remain the leading cause of mortality and morbidity in developing countries as the disease patterns change constantly due to seasonal variation. The mechanisms responsible for the epidemiological consequences of this seasonal variation are poorly understood. Analysis of proper data of communicable diseases is required to determine the current burden as well as seasonality. The objectives of this study are to assess the current burden of various communicable diseases at Sir Ronald Ross Institute of Tropical and Communicable diseases (SRRIT&CD), to know the seasonal variations and to suggest preventive and curative measures.
Methods: All patients who were admitted at this hospital over a period of three years (January 2011 to December 2013) have been studied. The patient data was documented for each case and further categorized into viral fevers, acute diarrheal diseases, enteric fever, malaria, rabies, measles, mumps, chickenpox, diphtheria, food poisoning, tetanus and pertussis. The incidence and seasonal variations for these diseases were analyzed.
Results: Results showed that a total of 34,981 had been treated at the inpatient departments from the year 2011 to 2013. It was observed that communicable diseases constituted about 85% (30,082) of the total disease burden with viral infections being the commonest. Most of the diseases were observed to have a seasonal variation. The most common disease identified was viral fever 8713 (28.96%), secondly acute diarrheal diseases 7965(26.52%) followed by enteric fever 2958 (9.83%) and malaria 2443(8.12%). The least common were Rabies 80 (0.26 %) and pertussis 37 (0.12%). Outbreaks of Measles and Diphtheria were also noted in this study.
Conclusions: Many diseases have a seasonal variation and the burden of these diseases could be reduced if we device measures to detect the changes in their trend through the implementation of surveillance programs. The knowledge of the burden of these would also assist the health administrators in allocation of the resources.

Keywords: Communicable diseases, Seasonal variation, Disease outbreaks, Prevention

INTRODUCTION

Despite of economic growth and development, most countries still have a high burden of communicable diseases that raises some urgent concerns. The main reason for this is lack of proper data regarding the current burden and seasonality of various communicable diseases.[1,2] Seasonality, a periodic surge in disease incidence characterizes many communicable diseases of public health importance. But mechanisms underlying seasonality of these diseases are not well understood.[3] These diseases can turn into epidemics that need early diagnosis and timely management.

The aim and objectives of this study were to study the overall incidence of communicable diseases, to find out the seasonal variation of these diseases and to suggest preventive and curative measures.

METHODS

This is a hospital based study and was carried out among the patients admitted at Sir Ronald Ross Institute of Tropical and communicable diseases (SRRIT & CD), Hyderabad. All confirmed cases of communicable diseases (clinical and laboratory) who were admitted at (SRRITCD), Hyderabad during the period of three years (January 2011 - December 2013) were included in this study. Cases which are not confirmed patients who died before any therapeutic measure was done and the patients who left the hospital against medical advice were excluded.

Clinical data was documented for each case which included symptoms like fever, severe body pains, rash, headache, vomiting and any other specific symptoms related to these diseases. The patients were clinically examined for the presence of relevant signs to arrive at the provisional diagnosis. Routine investigations like complete blood picture, complete urine examination, smear for malarial parasite, biochemical tests and widal tests etc. were done for all cases. Certain investigations were also done based on the clinical suspicion of specific diseases and also as a part of screening of various communicable diseases. Based on these investigations the diseases were sub classified. The incidence, age and gender distribution as well as seasonal variation of different diseases were analysed. These cases were treated effectively with supportive therapy, specific antibiotic therapy, immunoglobulins and antidiphtheritic serum etc. Whenever patient developed systemic complications like myocarditis, aspiration pneumonia, stridor, nephritis, sepsis and opinion from respective departments were taken and when needed patients were transferred to the respective referral centres.

RESULTS

There were 34,981 admissions during a period of three year (2011 to 2013) at SRRITCD, Hyderabad. Among these, 30,083 cases were diagnosed as communicable diseases. Year wise distribution and incidences of various communicable diseases (2011-2013) were seen in Table 1 & Graph 1. Age wise distribution of the diseases was shown in Table 2, 3 & 4, whereas Gender wise distribution was shown in Graph 2, 3& 4. Seasonal variation of the year 2011, 2012 & 2013 were described in Graphs 5, 6, 7; Graphs 8, 9 &10 and Graphs 11, 12& 13 respectively.

Table 1: Year wise distribution of communicable diseases in the patients at SRRIT&CD, Hyderabad, India.

Year wise distribution of cases of communicable diseases at SRRITCD (Number of cases)															
Yr	Viral fever	ADD	Diphtheria	Enteric fever	Malaria	Measles	Mumps	Chickenpox	Hepatitis	Dengue	Rabies	Pertussis	Cholera	Food poisoning	Tetanus
2011	3296	2996	853	948	918	587	920	450	362	28	35	8	66	108	39
2012	3129	2735	441	1145	956	71	613	383	335	145	21	18	83	64	37
2013	2288	2234	294	865	569	762	572	281	257	16	24	11	32	48	39
Total	8713	7965	1588	2958	2443	1420	2105	1114	954	189	80	37	181	220	115

Table 2: Age wise distribution of cases in the year 2011.

Age wise distribution of cases of communicable diseases at SRRITCD for the year 2011															
	Viral fever	ADD	Diphtheria	Enteric fever	Malaria	Measles	Mumps	Chickenpox	Hepatitis	Dengue	Rabies	Pertussis	Cholera	Food poisoning	Tetanus
0 to 10	700	749	293	141	131	545	770	255	97	7	12	8	8	76	12
11 to 20	1034	1540	175	478	135	33	130	185	248	14	18	0	40	20	20
21 to 30	435	316	109	75	230	0	1	0	12	2	3	0	8	8	4
31 to 40	465	208	90	95	152	4	9	5	2	2	1	0	4	2	2
41 to 50	480	96	92	109	148	4	5	4	2	2	1	-	4	2	1
51 to 60	162	84	93	48	122	1	5	1	1	1	0	0	1	0	0
>61	20	3	1	2	0	0	0	0	0	0	0	0	1	0	0
Total	3296	2296	853	948	918	587	920	450	362	28	35	8	66	108	39

Table 3: Age wise distribution of cases in the year 2012.

Age wise distribution of cases of communicable diseases at SRRITCD for the year 2012														
	Viral fever	ADD	Diphtheria	Enteric fever	Malaria	Measles	Mumps	Chickenpox	Hepatitis	Dengue	Rabies	woofing cough	Cholera	Food poisoning	Tetanus
0 to 10	447	731	143	267	136	66	226	170	89	264	6	15	16	29	20
11 to 20	1082	541	270	732	334	5	216	213	207	80	13	3	45	6	10
21 to 30	580	420	14	73	335	0	126	0	24	18	1	0	14	2	4
31 to 40	394	218	12	31	62	-	20	-	6	18	1	-	4	9	1
41 to 50	384	232	1	22	85	-	8	-	5	2	-	-	2	9	1
51 to 60	234	531	1	20	2	-	9	-	4	1	-	-	2	9	1
>61	8	62	-	-	2	-	-	-	-	-	-	-	-	-	-
Total	3129	2735	441	1145	956	71	614	383	335	145	21	18	83	64	37

Table 4: Age wise Distribution of cases in the year 2013.

Age wise distribution of cases of communicable diseases at SRRITCD for the year 2013														
	Viral fever	ADD	Diphtheria	Enteric fever	Malaria	Measles	Mumps	Chickenpox	Hepatitis	Dengue	Rabies	woofing cough	Cholera	Food poisoning	Tetanus
0 to 10	450	468	158	216	62	722	460	157	50	1	8	11	8	17	20
11 to 20	892	1033	130	588	182	40	110	123	181	15	15	0	24	12	13
21 to 30	209	330	3	31	115	0	1	1	14	0	1	0	0	9	3
31 to 40	327	145	1	11	89	0	0	0	5	0	0	0	0	5	1
41 to 50	303	138	1	10	86	0	1	0	4	0	0	0	0	2	1
51 to 60	107	100	1	9	32	0	0	0	3	0	0	0	0	3	1
>61	-	20	-	-	3	-	-	-	-	-	-	-	-	-	-
Total	2288	2234	294	865	569	762	572	281	257	16	24	11	32	48	39

The most common disease seen in all three years was viral fever with 8713 cases (28.96%) followed by acute diarrheal diseases with 7965 cases (26.52%) and with enteric fevers in 2958 cases (9.83%) and Malaria in 2443 (8.12%) cases. Rabies was least commonly seen only in 80 (0.26%) cases and followed by Pertussis 37 (0.12%). Outbreak of measles was seen in the year 2013 with 762 cases. In children, measles, chicken pox and mumps were common, whereas in adults, acute diarrheal diseases, enteric fever and mumps were commonly seen. All the diseases showed almost equal sex distribution except in acute diarrheal diseases and diphtheria where slight female predominance was seen. Most of the communicable diseases in this study showed seasonal variation. In the year 2011, the plot for the seasonal variation of fifteen communicable diseases revealed an increase in number of viral fevers and its gradual rise beginning in September, October, the plateau in Aril, May and June, the decline in January and February and succeeding months whereas the low incidence during March, July and December. Acute diarrheal diseases showed an increase in the months of March and July and plateau was seen in March, April, May, and June whereas the decline in December. A similar upsurge of Hepatitis, Rabies, tetanus, Cholera, Food poisoning was seen. In other infectious diseases Measles peak was seen in January, February, Mumps in April and Chicken pox in March. Measles and Mumps had a seasonal variation with second peaks in the month of March. Variation for Diphtheria is more evident in January, plateau in June, July and decline in December. For Malaria, increase in number in September, Plateau in January, February and decline in December. Whereas for Dengue, peak in September, plateau in June and August and no cases were reported in the months of January, February, March, April and May. More number of cases of Pertussis were

seen in March to June. No cases were reported in January February, April, July, August and October. In the year 2012, seasonal variation of viral fevers, acute diarrheal diseases, Diphtheria and enteric fevers was similar to that in the year 2011. The other diseases like Hepatitis, Rabies showed increased number in the months of March and May. Among the diseases like measles, mumps and chicken pox were maximally diagnosed in the month of March. Mumps had two peaks first one in the month of March while second peak in the months of February and April. The diseases like Malaria and Dengue were seen in the months of September, Cholera in April and May, Food poisoning in the month of February and Tetanus in January. An attempt to study the seasonal variation of communicable diseases in the year 2013 revealed a strange seasonal variation with an increase in the number of cases of Measles occurring in the months of November and December. Diphtheria and enteric fevers were more common in the month of September. Viral fevers, Acute Diarrheal Disease, Chicken pox, Dengue showed similar seasonal variation as in the year 2011. Among the other diseases, Mumps was maximally diagnosed in the month of December. Rabies had two peaks in the month of March and May, Pertussis in November, Cholera in July and Food poisoning in May. Patients suffering with Tetanus also had a seasonal variation, but it was not very clearly evident due to the lesser number of cases.
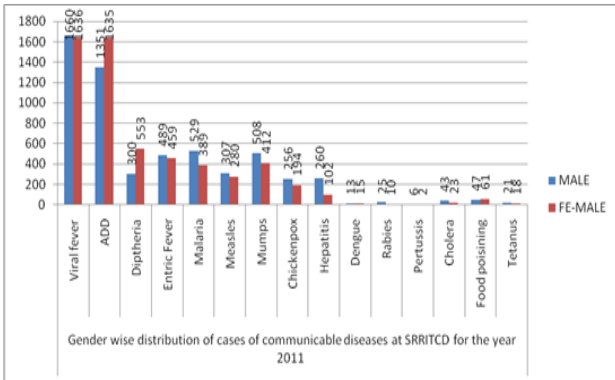
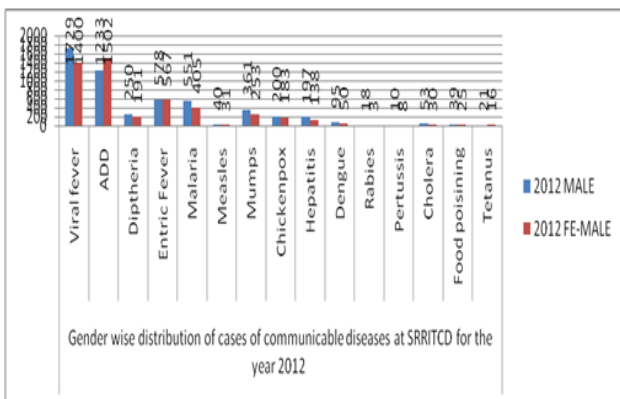**Figure 1: Gender wise distribution of cases in the year 2011.**

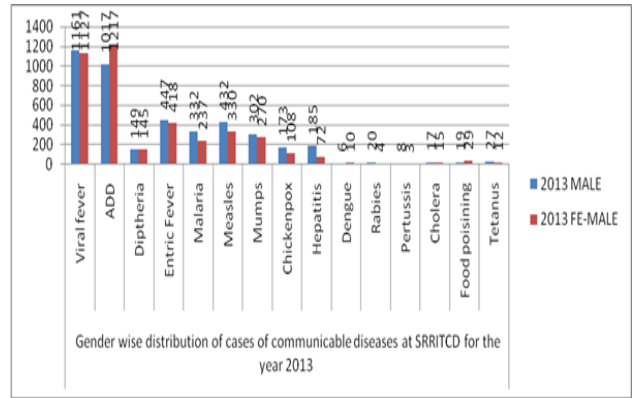**Figure 2: Gender wise distribution of cases in the year 2012.**

Figure 3: Gender wise distribution of cases in the year 2013.
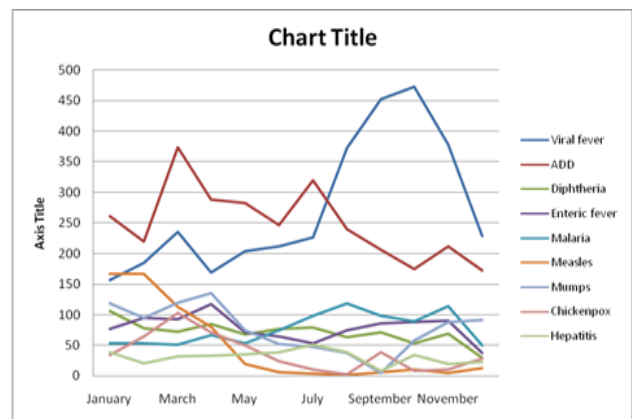

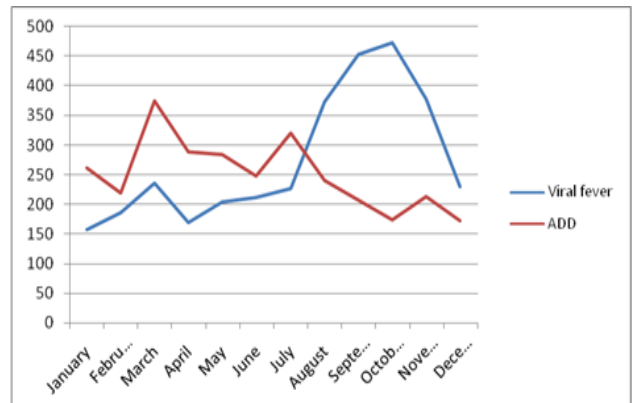**Figure 4: Seasonal distribution of communicable diseases of 2011.**

Figure 5: Month wise distribution of cases of 2011 to show the seasonality variation.

DISCUSSION

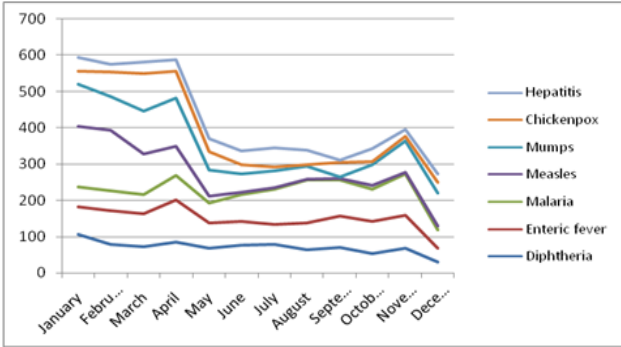Communicable disease is a great challenge to the development of the countries especially countries like India.[4]

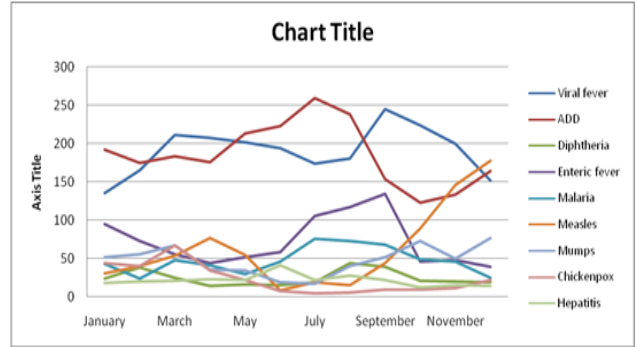**Figure 6: Month wise distribution of cases of 2011 to show the seasonality variation.**
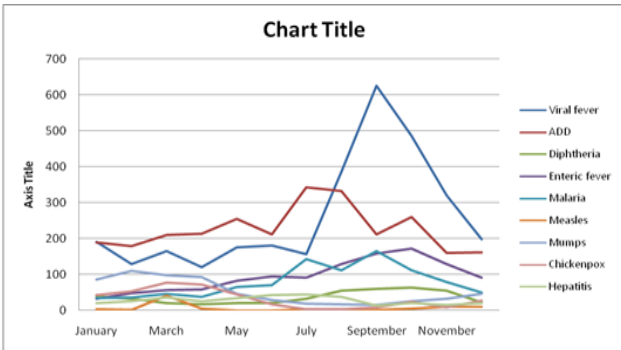

Figure 7: Seasonal distribution of cases of 2012 to show the seasonality variation.
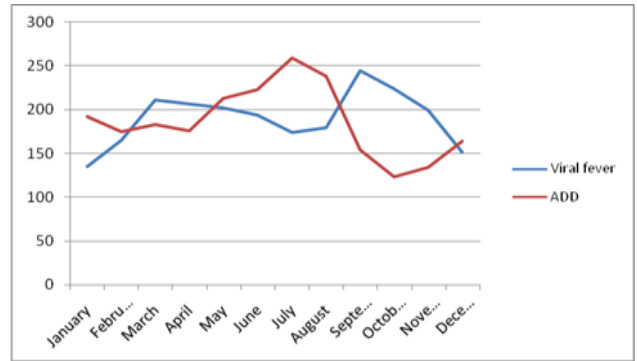

Figure 8: Month wise distribution of cases of 2012 to show the seasonality variation.
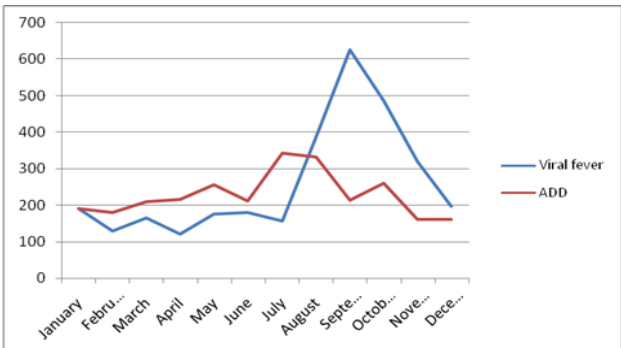

Figure 9: Month wise distribution of cases of 2012 to show the seasonality variation.

Figure 10: Seasonal wise distribution of cases in the year 2013.

Figure 11: Month wise distribution of cases of 2013 to show the seasonality variation.

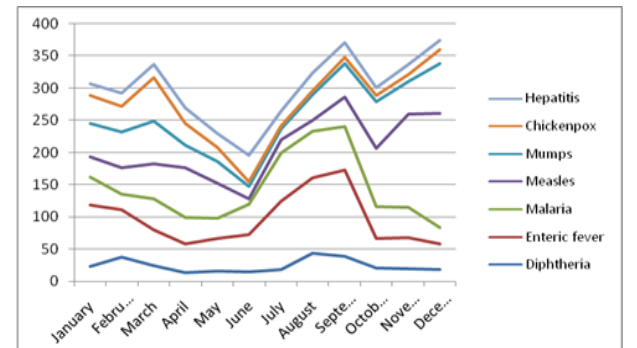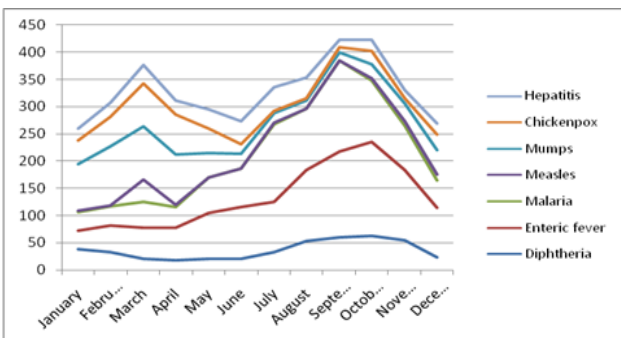**Figure 12: Month wise distribution of cases of 2013 to show the seasonality variation.**

According to WHO, these diseases are divided into three groups such as diseases with a large-scale impact on mortality, morbidity and disability like malaria, diseases that can potentially cause epidemics, such as influenza and cholera, and diseases that can be effectively controlled with available cost-effective interventions, such as diarrhoeal diseases.[5]

In this study with a variety of them falling under all three categories mentioned above. In spite of introduction of disease control programs like immunization programme etc, communicable diseases constitute major public health issues.[6] Hence as proper analysis of the

epidemiological pattern of diseases helps the physicians with the necessary information and also provides the information to the policy makers and administrators for the formulation of policies to outfit the effect of the morbidity and mortality and also the outbreaks.[7]

The most frequent reportable diseases in our hospital were viral fever (28.96%) followed by acute diarrheal diseases (26.52%), enteric fever (9.83%) and Malaria (8.12%). Outbreaks of Measles and Diphtheria were noted in our study. These diseases vary among various age groups and with slight variation in gender distribution. In our study similar findings were observed. In spite of all therapeutic and preventive measures, few deaths were noted in Dengue, Diphtheria, Measles etc, especially during the epidemics. Similar studies were reported.[8-13]

Most of the diseases showed seasonal variation irrespective of other factors whereas few diseases like enteric fever, rabies, pertussis, food poisoning and tetanus which were common in all seasons similar to other studies.[14-17] Seasonal variations mainly results from the differences in the environmental as well as the host factors in the like temperature, humidity, ultraviolet radiation, flora that change with season and also the immune status of the individual. The maximum burden of all communicable diseases in the present study was found in the monsoon months of June, July, followed by winter seasons, September to December. This could be due to greater opportunities for transmission during schooling, indoor crowding and reduced host immunity during the winter, dried mucous membranes in certain seasons that leads invasion of organisms, increased pathogen survival in particular conditions of humidity and temperature.

The reason for the upsurge of the diseases in the months of May to July could be probably the transition phase of the season from summer to rainy which makes the adjustment of the host to the changed weather difficult, thus increasing their susceptibility. The other reasons may be conditions favourable for the breeding of the vectors and the survival of the agents of the diseases. Seasonal increase in the population of vectors for transmission of the diseases are seen in especially water-borne diseases such as diarrheal diseases in the end of summer and the start of rainy season. The congregation of children during school terms is the most common cause for these infections like measles, mumps, chickenpox, diphtheria and pertussis. Many diseases like viral fevers, acute diarrheal diseases and cholera spreads by sewage, aerosol, droplets, etc. especially in rainy season. Peak in cholera depends on temperature, salinity and overall levels of water in the environment. Thus incidence of cholera may peak once or twice a year depending on the local environment. Seasonal variations in vector abundance, including mosquitoes, ticks, fleas and flies, are well-documented causes of seasonality for vector-borne infections like Malaria and also Diarrhoea due to flies. Apart from the above mentioned causes Host

immune function also contributes seasonal variation. Seasonal patterns are one major pathway for the potentially drastic effects of climate change on disease dynamics which lead to seasonal outbreaks. Thus, identifying the specific environmental factors underlying seasonal transmission is a critical step towards the impact on human health.

SRRIT & CD, an IDSP network hospital is a centre for communicable diseases at the tertiary level with sufficient diagnostic and treatment modalities. We have made an attempt to provide a good surveillance system and to understand whether the current focus of disease prevention is appropriate as well to ascertain the necessary changes to deal more effectively with the communicable diseases. We also recommend the following measures for prevention and control of communicable diseases.

1. Routine surveillance and quality assurance of disease by physicians, hospitals and laboratories helps in detect trends of the diseases as well as to develop of strategies, policies to prevent the spread of diseases and also the outbreaks.
2. Prevention of the communicable diseases is only possible by elimination of the risk factors causing them. So proper education of the patients is mandatory by public health staff, improvement of the public health infrastructure, immunizations, screenings, case finding and therapy including management of veterinary public health issues, such as control and prevention of rabies and other diseases of animal origin that can affect humans.
3. The rampant and unjustifiable use of antibiotics contributes in raising the number of infections caused by pathogens resistant to the medicines. Thus, it is mandatory to follow protocols of using the antibiotics rationally, so that the diagnosis and treatment of some common infections can be improved. Specialization in communicable disease for doctors and more specialists are needed to handle different communicable diseases and to prevent the epidemics and emerging diseases. Otherwise most of the people develop drug resistance due to the wrong treatment or misuse of antibiotics.
4. N.J. State Department of Health and Senior Services (NJDHSS) developed Communicable Disease Reporting System (CDRS), which is a state-wide sophisticated system of data collection, to capture emerging and other notifiable diseases and to analyse reportable diseases more effectively. All doctors, nursing staff and other medical staff can access CDRS data to collaborate on disease prevention activities.
5. Alerts and timely information about emerging or seasonal communicable disease events, such as flu, food-borne illness, or the occurrence of a new communicable disease are mandatory as small seasonal changes in host or pathogen factors may be sufficient to create large seasonal increase in disease incidence.

CONCLUSION

Regardless of the various problems existing at present in tertiary hospitals, communicable diseases are still dominant and constitute major health issues. Many diseases have a seasonal variation and the burden of these diseases could be reduced if we take measures to detect the changes in their trend through the implementation of surveillance programs. The analysis of various communicable diseases, their seasonality attempted by this study highlights the need for further implementation of preventive measures like vaccination programme, need for good surveillance system, interpretation of disease outbreak data, education of the patients about the seasonality and preventive measures.

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