

Dynamics of some common epidemics in Karachi, Pakistan

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Abstract

Objective: To examine the severity, frequency, monthly variability and grouping of some common epidemics and its relation to hygienic conditions and life style of the people in Karachi.

Methods: This ecological study was conducted from 2006 to 2009. Data was obtained from five different localities of Karachi. In each area, physician clinics were selected and questionnaire forms filled by professionals at the clinics, regarding health problems of patients. Multivariate analyses were used to summarize the data, for comparison and grouping the spread of epidemics.

Results: The severity of different epidemics varied among months and localities. The effective diseases potential areas with decreasing order were: Lines Area, Korangi, Malir, Metroville and Maymar. In all these areas cough, allergy, asthma, flu, fever and skin rashes were the widely distributed epidemics while the prevalence of other six epidemics prevailed to a lesser extent. Lines Area/Korangi and Malir/ Metroville differed considerably with respect to prevalence of epidemics ($P < 0.05$) into a lesser, while Gulshan-e-Maymar was significantly different ($P < 0.001$) from the other four areas. Among four distinct groups i.e. 1) allergy/cough, 2) asthma/flu, 3) fever/skin rashes, 4) bronchitis, malaria, typhoid, diarrhoea, rhinitis and sinusitis, the first three groups were widely distributed.

Conclusion: January was the most crucial month with highest number of patients. Certain epidemics were parallel in different areas with almost similar population size. Multivariate analysis disclosed the four distinct groups of epidemics in which first three groups were widely distributed.

Keywords: Karachi, Epidemics, Cluster analysis, Hygiene (JPMA 61: 1072; 2011).

Introduction

Karachi is an extremely congested and the fifth largest city of the world. Since the last 60 years, the city expanded tremendously, without any proper planning. The city has an inadequate large scale garbage collection system. Although the city government is working hard for the betterment of the city, due to lack of proper resources, there are still hundreds of open garbage locations with humid and warm environmental conditions. These are the production sites for billions of microbes, germs, foul smell and bacteria. Burning of these garbage locations which contain rubber, plastic, polyethylene bags, tyres, organic materials and together with automobiles' exhaust the levels of smoke and poisonous gases in the city and in the surrounding atmosphere has increased. In addition, due to the lack of scientific landfill sites, some of the city garbage and industrial wastes are dumped at government recognized open sites, from where leachates of these mixed garbage contaminates the soil, seasonal streams and underground water, which are detrimental to our coastal biodiversity. Due to this polluted environment, thousands of people encounter various epidemics and visit the health professionals and hospitals of the city everyday.

According to an unpublished report of the United

Nations in Pakistan, 18,000 people die every year from air pollution.¹ The populations of microbes from the two areas of Karachi were studied and conclusion was drawn that the hot summer and humid climate from March to October generally promote the growth of numerous microbes.² After an extensive survey lasting three years, it was concluded that nasal allergy was more common in Karachi.³ It was also described that the different environmental factors were highly potential for spread of asthma.⁴ Special attention was also paid to find out the diagnosis and management of allergic rhinitis in the Karachi population.⁵ However, no data were available to examine the dynamics and epidemiology of common chronic epidemics in Karachi. Some research workers stressed on the need to carry out some more investigations regarding the epidemics in various areas of the city.⁶ Since epidemics have significant impact on the daily quality of life of the population. Therefore, an extensive survey based on a questionnaire form was conducted in five different locations of Karachi in which the monthly distribution, prevalence and severity data of patients with the twelve common chronic epidemics were obtained. It is anticipated that the present results will help to understand the dynamics of common epidemics in Karachi city.

Methods

This ecological study was conducted from November 2006 to November 2009. The twelve common chronic epidemics were selected which were normally caused by air, soil and water pollution to examine the monthly variations in five different areas of Karachi. The areas were selected on the basis of the level of poverty, density of population, daily traffic flow, hygienic conditions, level of income and life style of the population. The areas selected included Malir Extension colony, Korangi Area, Metroville S.I.T.E., Gulshan-e-Maymar and Lines Area. The conditions of the areas have already been described in detail by Rao et al.⁷ However, some of the salient features of these areas are described here briefly. Malir extension colony was an open, but thickly populated area close to the Malir agriculture fields. The population of this location was of middle class with low income. The overall hygienic condition of the area is poor. Korangi is close to the coastal area, with various types of industries such as tanneries, oil, food, beverage, cosmetics, glasses, plastics, marbles, tiles, garments, textiles and pharmaceuticals. In addition, the location has also residential population. The population comprises of poor and lower middle classes. Due to burgeoning population and location of different types of industries and especially the tanneries, this area remains heavily polluted throughout the year. Metroville residential area is close to the Sindh Industrial Estate. This location has also different types of industries, such as pharmaceuticals, textiles, dyeing, chemicals, flour mills and rubber industries. This area is open but thickly populated with middle and lower middle classes. Due to dense population and industries, the pollution level is also very high in this locality. Gulshan-e-Maymar is the suburb of the city and located near the Super highway. This is an open residential area with low population, less traffic emissions and with no industry. The population of the locality is of middle and upper middle classes. The sanitary and garbage dumping conditions are better in contrast to the other four locations of the city. However, the location is dusty with high wind speed. Sometimes the velocity of the dusty wind remains very high and the dust covers over forming patches on all objects. Lines area sampling site is congested, thickly populated and with high traffic due to its location in the center of the city. Large population, high traffic emission, residential waste, inadequate sewerage system and garbage dumps make the locality highly polluted. In addition, the perilous gases and metallic particles of the exhaust from the automobiles also affect the natural environmental conditions of the locality. The population of the locality comprises of lower middle class and the low income eventually creates unhygienic environment and health hazards.

In each area physician clinics were selected and questionnaire forms were given to the health professionals,

who recorded the health problems of a number of different patients who visited the clinic on daily basis. This randomly collected weekly data from each location were obtained until three years. Data of 140433 patients per year was obtained from all five locations of Karachi. Since the seasonal variations are not distinct in Karachi (personal observation), therefore it was summarized and recorded on monthly basis. In general, data of each location was subjected to multivariate analysis (cluster analysis and ordination).

To investigate the overall picture of epidemics of the city, three years data of all five locations were pooled together and also subjected to multivariate analysis. Two dimensional epidemics ordination (Non-parametric multidimensional scaling) was used.⁸⁻¹⁰ For cluster analysis, Ward's method with Euclidean distance as resemblance function was employed.¹¹ Both ordination and cluster analysis were performed using the package of PC-ORD Version 5.10.¹²

Results

Malir Extension Colony:

Figure-1(a) shows the three years monthly distribution of various epidemics in Malir area. Cough was the dominant epidemic in the population. The month of December (779 ± 44) and January (776 ± 30) were the extreme months of the year. Minimum numbers of cough patients were recorded in May (443 ± 22) with a gradual increase up to October. Allergy was the second dominant epidemic in the area, which prevailed throughout the whole year round with more or less similar level of distribution except in December (400 ± 28) when it declined considerably. The third widely distributed disease was fever which rose to highest figure in October with 449 ± 16 patients, while the lowest number (118 ± 8) of people suffered from it in February. Skin rashes approached a maximum (239 ± 9 people) in March and the lowest (105 ± 7) in February. Maximum number of persons (188 ± 7) in this area suffered from flu in July and minimum (67 ± 13) in the month of February. Asthma attacked 336 ± 17 people in January and 77 ± 8 people in November. Bronchitis, malaria, rhinitis, sinusitis, typhoid and diarrhoea were also distributed in this area, but sufferings of the patient were lesser in number (25 ± 3 to 105 ± 18) as compared to the other six epidemics. These epidemics did not show any prominent peak or depression in any month of the year. However, the three years data showed that in this area nearly 27461 people per year were affected by the above mentioned twelve epidemics. It was also observed that most of the epidemics declined in the month of February in the area studied. Individual cluster diagram showed allergy/ cough, asthma/flu and skin rashes/fever fell in the main prominent groups (Figure-2a), while the remaining, less distributed six epidemics fell under another group of the survey.

Table-1: "Mean values of the number of patients (suffering from different epidemics) who visited the Doctors clinics during the various months of the year."

Epidemics	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Allergy	1481±237	1406±317	1648±279	1632±292	1926±306	1997±268	1849±268	2000±362	1847±267	1790±204	1557±235	1486±269
Asthma	766±133	535±114	502±110	328±49	315±15	312±42	392±103	329±32	287±37	316±63	322±45	342±37
Bronchitis	273±35	280±20	246±35	213±33	221±17	219±31	210±30	215±27	181±14	170±23	207±16	230±29
Cough	2426±276	2044±302	2163±293	2009±327	1966±363	1977±283	1933±254	2050±309	2107±258	1962±203	1990±276	2282±355
Fever	1225±241	787±151	900±178	840±148	906±56	844±105	779±89	866±134	676±77	755±187	854±98	954±152
Flu	607±155	495±102	404±89	426±60	386±61	325±45	317±64	266±42	280±49	282±62	388±54	499±92
Malaria	186±55	182±47	141±23	137±20	164±32	162±23	188±38	164±21	185±25	126±18	110±15	114±20
Rhinitis	196±31	171±21	174±18	143±13	131±17	154±36	135±20	141±14	137±17	123±10	179±32	159±16
Sinusitis	184±24	138±22	173±29	146±26	133±17	130±18	125±21	115±13	112±13	126±17	134±15	131±15
Skin Rashes	749±121	626±104	758±106	601±105	634±132	574±57	712±107	526±66	703±85	578±60	636±60	625±72
Typhoid	185±36	150±31	135±22	137±25	149±25	162±34	151±27	158±21	148±28	132±18	121±22	125±23
Diarrhoea	124±18	118±19	122±20	114±19	155±23	146±28	169±34	180±30	157±25	112±14	89±12	100±14

"Values are the monthly average of three years of all the five sites of Karachi city."

Korangi Area:

In this area the most widely distributed epidemics was cough which appeared in August with maximum (979±22) strength. The months of January to April and August to October showed decreasing trend in this area (Figure-1b). The second dominant epidemic allergy showed its intensity from August to December. Maximum number of people (448±22) suffered from fever in January, while the minimum (141±8) was in April. January (352±16) and July (351±8) were the sensitive months for skin rashes. The higher numbers of people were affected with flu, from 214±42 to 218±41 suffered from January to March with a minimum (80±8) in May. Flu gradually increased up to December. January to March were the sensitive months for asthma, when 224±8 to 270±15 people suffered from this disease. However, it appeared as minimum (87±12) in the month of October. Other six epidemics were distributed more or less equally throughout the whole year and did not show any prominent seasonal or monthly variation. This area occupied the second position on the basis of number of overall patients (33609/year) recorded. It was evident from Fig. 1b that April was the declining month of various epidemics in this area. Figure-2b indicated allergy/cough, asthma/flu and Fever/skin rashes which appeared as prominent groups, while bronchitis, malaria, diarrhoea, rhinitis, sinusitis and typhoid formed one distinct group.

Metroville S.I.T.E. Area:

In this area, February showed considerable decrease of cough, allergy, fever, flu, asthma and skin rashes when compared to January and March (Figure-1c). Allergy reached its peak (593±86) in June and October with 485±60 patients. The highest number of people suffered in January with fever, flu and asthma, while the minimum people suffered with fever in the month of October (Figure-1c). Intensity of asthma increased in July, while the lowest numbers of

patients (91±12) were recorded in August. In general, overall less than 100 patients were recorded with bronchitis, malaria, rhinitis, sinusitis, typhoid and diarrhoea. The averages of 25128 patients per year were recorded from this area. Figure-1c shows that in February many epidemics attacked a minimum number of people in Metroville Area. Cluster diagram disclosed different combinations of epidemics in various groups. Here allergy formed a group with fever, asthma was with flu and skin rashes/cough appeared as a separate group.

Gulshan-e-Maymar:

At this least polluted area, the maximum cough patients (534±109) were recorded in January and the minimum (403±72) were observed in November (Figure-1d). The second, widely spread disease was allergy, which appeared from May (444±64) to October (428±69). However, 202±36 people were found suffering from this disease in the month of February. Fever peaked (269±50) in May, while dropped to minimum (96±20) in October. Asthma and flu showed almost similar distributions. However, flu reached its peak in January while asthma in May (Figure-1d). Other five epidemics showed similar distributions with low numbers. The lowest number of patients (17971/year) suffered from above mentioned epidemics in this area. The cluster diagram, Figure-2d disclosed similar groups as described earlier for Korangi Area.

Lines Area:

Three sets of epidemics were distributed in this area 1). Cough/allergy, 2). fever/skin rashes and 3). Rest of the 8 epidemics. More than one thousand people suffered with cough in December and January, while the lowest 802±67 in October. Allergy was encountered by 669±62 people in January with gradual increase until August, when the maximum people (988±82) were attacked by these epidemics. The highest number of people (611±50) with

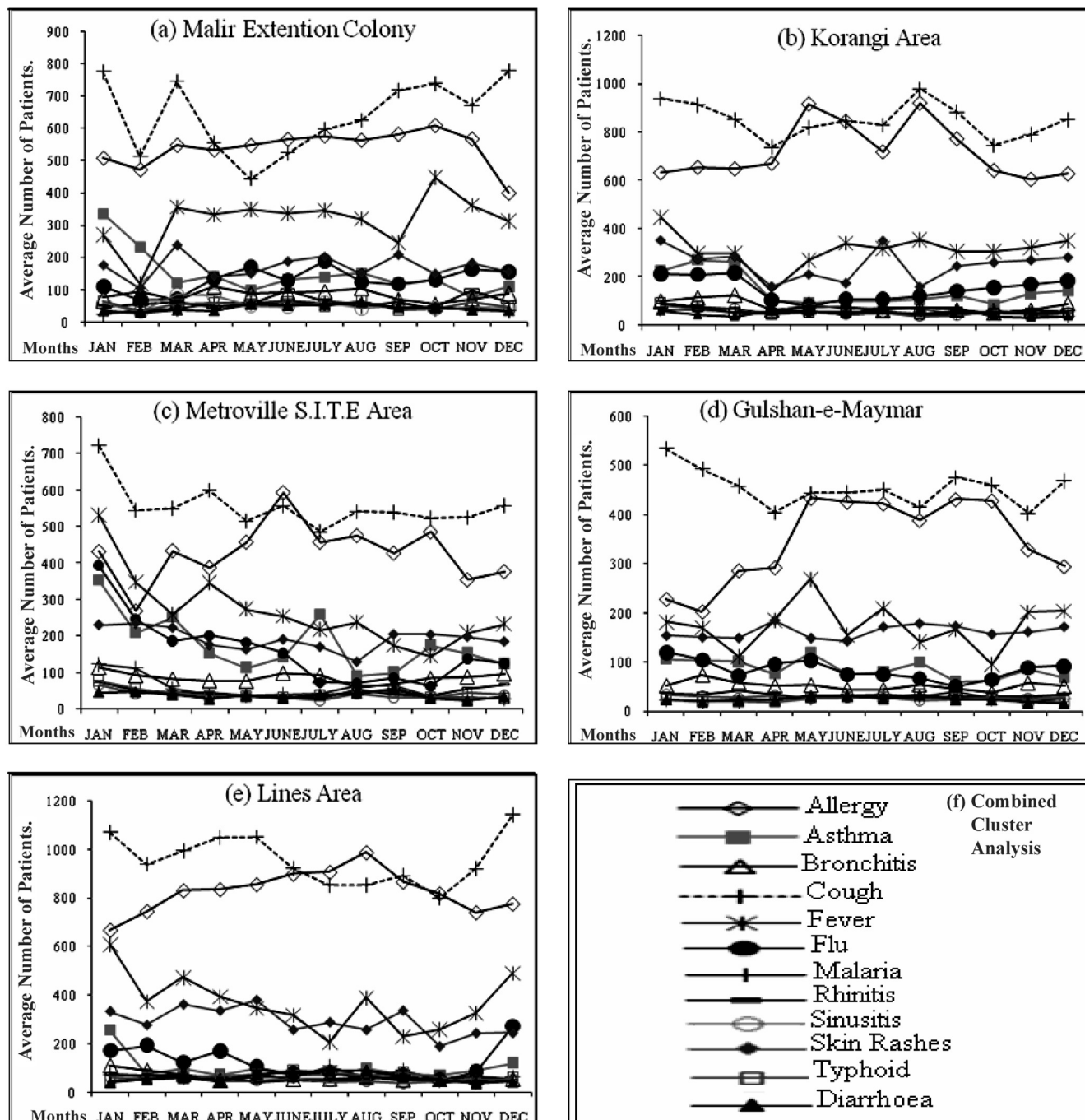


Figure-1: Monthly distribution of 12 common epidemics in the five different areas of Karachi city based on the three years average data.

fever were recorded in January and the lowest (208 ± 17) in the month of July. Maximum people (381 ± 34) with skin rashes appeared in May. These numbers considerably decreased to 191 ± 72 in October. Maximum flu (273 ± 30) spread in December and minimum (53 ± 8) in October. Asthma reached a peak (257 ± 22) in January and stayed under 100 patients in most of the months. Other six epidemics showed almost

similar distribution. This area indicated the similar groups as described for Gulshan-e-Maymar and Korangi during the individual cluster analysis.

Table-1 showed the overall monthly distribution of twelve common epidemics of Karachi areas regardless of any particular site. The data was a monthly average of three years. Combined cluster analysis (Figure-2f) showed similar

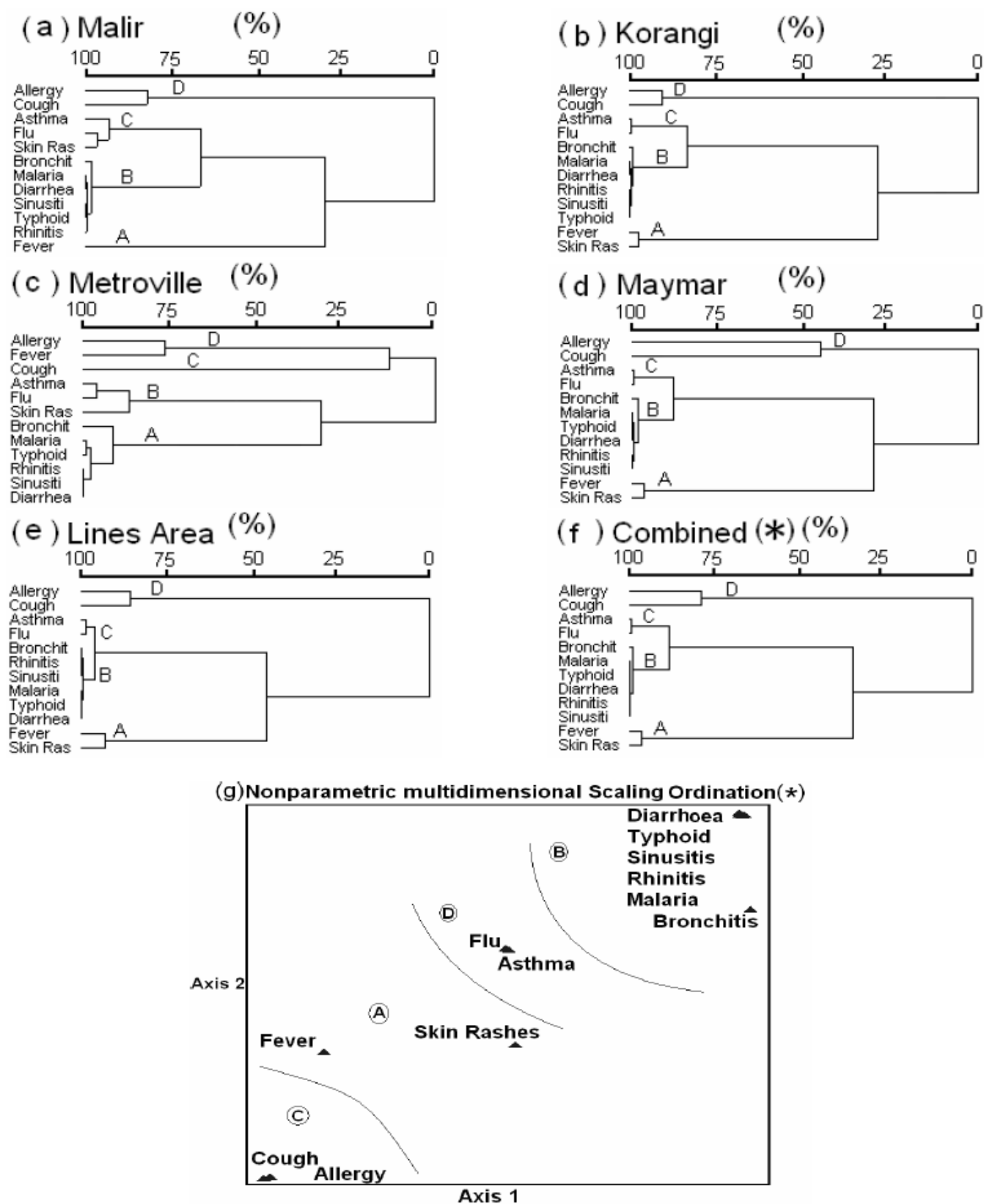


Figure-2: Cluster analysis of epidemics from five different areas of Karachi City with combined cluster analysis and epidemics on two dimensional NMS ordination of Karachi.

distribution of twelve epidemics in various groups as shown in Korangi, Maymar, Malir and Lines Area. For Metroville area the categorizing of various groups were based on different combination of epidemics (Figure-2d). In this case cough appeared as an independent group. Fever with allergy and asthma and flu group also included skin rashes. Distribution of these epidemics can also be seen in Figure-1 and also on 2- dimensional epidemics ordination (Figure-2g). The two dimensional solution of the NMDS ordination was achieved as stress factor of 0.038, instability value of 0.00001 and at 239 iterations. It was evident that the most widely distributed group comprised of allergy/cough which occupied the extreme lower left side, while the least distributed disease group was located on extreme upper right side of the ordination. The number of the patients of different epidemics or groups showed gradual descending gradient from lower left to upper right side of the ordination plane (Figure-2g).

Discussion

In general, the distribution of various epidemics showed formation of different peaks and depressions in the various months in the different areas. At Korangi, allergy reached the peak in May and August. Similarly, at Metroville in June, Lines Area in August and Gulshan-e-Maymar was high in May, September and October. It was also observed that the maximum population of Korangi suffered with cough in August, at Malir, Metroville and Maymar in January, while in December at Lines Area. The highest number of people suffered with Fever in January at Korangi, Metroville and Lines Area, in October at Malir and in May at Maymar area. Skin rashes appeared to be maximum in January and July at Korangi, March at Malir, February at Metroville, May in Lines Area and April at Maymar area. At Korangi, Metroville, Maymar and Lines Area flu spread from January to February, while at Malir, it appeared to be maximum in July. At Malir, Metroville and Lines Area asthma was maximum in January, at Korangi in February, while in May at Maymar Area. The highest numbers of patients visited the clinic were 36507/year from Lines Area. This was followed by 33609, 27461, 25128 and 17971 from Korangi, Malir, Metroville and Gulshan-e-Maymar areas, respectively.

Asthma, bronchitis and flu are widely distributed in Metroville area, while the highest patients of rhinitis were recorded from Malir. Out of twelve, 7 epidemics i.e. cough, allergy, fever, skin rashes, typhoid, malaria and diarrhoea are leading dominating epidemics in Lines Area. Highest numbers of sinusitis patients were recorded from Korangi Area.

Overall environmental conditions of five studied sites were different, based on population density, traffic smoke, level of humidity, level of dust, amount of garbage, sanitary situation and dampness of old broken pipes of multistory buildings.

Therefore, the present quantitative study was in compliance with the findings of other workers,^{3,6} who demonstrated that epidemics distribution differed from area to area.

Lines Area with Korangi and Malir with Metroville showed no significant difference in number of diseased population while, Lines Area/Korangi area and Malir/Metroville area were significantly different ($P < 0.05$). However, Maymar showed highly significant difference ($P < 0.001$) with respect to other areas. It may be due to the better hygienic situation and life style of the population of the Maymar area. Lines Area and Korangi area were the most congested, thickly populated, with the highest traffic, unhygienic and the lowest income areas. Malir and Metroville have slightly better facilities as compared to above mentioned two localities. Therefore, diseased population reflected the overall condition of the area and the status of people living there.

It was found that cough, allergy, fever and skin rashes were widely distributed in all five sampling locations with decreasing order. Asthma, flu were number 5 and 6 epidemics at Malir and Metroville area, while bronchitis occupied seventh position in all study areas. Malaria was the eighth important epidemic in Korangi, Lines Area and Metroville area, while it occupied 10th and 11th position at Maymar and Malir respectively. Typhoid was the 7th important disease in Lines Area, while placed 10th position at Korangi, Malir and Metroville. Diarrhoea showed 9th place at Lines Area, while 12th place in rest of the four study areas.

It was found that January was the most crucial month in all five studied areas in which maximum patients visited doctors. In this month, low numbers of atmospheric fungal spores were recorded.⁷ However, mycotoxins and aflatoxins, produced by open garbage, open damp places and contaminated dust particles may cause cough, headache, fatigue, fever, infection in skin, eye and respiratory tract even in small amount.¹³

Studies have shown that *Aspergillus*, *Alternaria*, *Penicillium* and *Cladosporium* were responsible for allergic reaction.^{14,15} The above mentioned first three species were widely distributed throughout the whole year in Karachi atmosphere and were also reported by other workers.¹² Study showed that *Aspergillus* caused cough, fever, wheezing and asthma.¹⁶ *Aspergillus* species was saprophytic mold distributed throughout the world, producing mycotoxins which cause acute and chronic health problems in human population i.e. many pulmonary epidemics, pulmonary aspergilloma and allergic bronchopulmonary aspergillosis.¹⁷

In dry areas, like Karachi, dust was a natural phenomenon, besides due to the high speed traffic, during the construction of buildings, digging roads/streets and unmanaged

garbage, the city environment was dominated by a large amount of dust for the whole year. High level of aflatoxins B1 was reported in these dust particles, which increased in damp moist and warm condition, especially around water damaged buildings. Many agents were considered to be responsible like dust, dust mites, mixed threshing, straw dust, mixed feathers, cat fur, cotton floss, trees or grass pollen were the common environmental allergens.¹⁸ Open chicken slaughter shops were common almost in each street of Karachi, while domestic and wild cats were also widely present. Seasonal allergy was caused by pollen and city was planted with millions of introduced exotic plants without any assessment of environmental and health impact of these plants.

Since Karachi does not have any proper landfill site, most of the garbage is dumped at government recognized open places. The leachates of this garbage with broken sewage water, destroy the biodiversity of our coastal system. At many places the sewage water was being used for vegetable cultivation, resulting in heavy metals and microbial contamination of food materials and drinking water, causing various intestinal epidemics and diseases.

Cluster analysis of different areas showed that allergy/cough and asthma/ flu were the most prominent group of four areas, except in Metroville area. Fever/skin rashes were prominent group of Korangi, Gulshan-e-Maymar and Lines Area along with upper described groups both in combined and individual cluster analysis. Two dimensional ordination diagrams also identified four similar groups with same epidemics combination as shown by combined cluster analysis. Monthly distribution of epidemics showed that certain epidemics were spread side by side in almost similar number of population. Similar epidemics combination in four main groups in cluster and ordination analyses gave additional support to this opinion. Twelve common epidemics attacked significantly a lesser number of people in Gulshan-e-Maymar population may be due to the less congested, less traffic flow, better hygienic situation of area, more income and better life style of the people. Nevertheless, similar epidemics with same combination and grouped were also distributed in this area. It is reported that a large number of children suffered with upper respiratory infection in February, March and April while diarrhoea frequency was highest in June and August.¹⁹ These results also agreed with our finding. Since no boundary or any barrier can be placed in atmosphere and airborne microorganisms, microbes, fungi, bacteria and other toxic particles produced in one place may travel long distances and may cause epidemics even in better planned area too. Therefore, there should be technically suitable landfill sites with proper garbage collection system in the city. Smoke spreading or discharging vehicles should be totally banned. Water damaged buildings should be optimally repaired. Sewerage system should be monitored for overspill.

More incineration places should be provided, particularly near hospitals. Garbage burning inside Karachi city and dumping in open areas should be banned. These are the possible measure that can be taken to control or minimize these epidemics in Karachi city.

Conclusion

It is concluded that pollution in any part of the city is a great threat to the population health of whole city. However, overall hygienic condition of an area and life style of the people makes considerable difference. Most of the Karachi population suffered from these epidemics generally in the month of January, since this is the most prominent month of winter. It was also suggested that these twelve epidemics which were distributed in the four distinct groupings may be controlled by taking proper environmental and health care measures.

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