Severity of Some Common Epidemics in Different Populations of Karachi in Relation to Age and Sex Groups

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Abstract: Severity of some common epidemics in ages and genders in five different populations of Karachi was determined. The present study was conducted based on a questionnaire form distributed to five different physicians of five different localities of Karachi. The criteria of site selection was based on the overall hygienic conditions, traffic density, poverty level and the life style of the people living in these localities. Analysis of variance (ANOVA), cluster analysis and principal component analysis (PCA) were used to assess the influence of different factors and to summarize the 3 years (36 months) data for comparison and grouping of the epidemics, sex and age factors of different areas of Karachi. The common epidemics were widely distributed but different areas were dominated by few epidemics with different combination. Gender was not important but the age group determined the severity of various epidemics. These common epidemics are widely distributed in Karachi regardless of different level of pollution and income of the residence.

Key words: Age groups · Cluster analysis · Epidemics · Karachi · Population health · Principal component analysis

INTRODUCTION

Epidemics are distributed worldwide and severely affect millions of people every month, especially in the third world and developing countries. According to a WHO survey which was carried out in 30 countries, out of 1.2 billion, 250 million (22%) people suffer from an allergic epidemic [1]. Another WHO report showed 16 to 33 million incidences globally of typhoid cases resulting in death of 500,000 to 600,000 individuals per year [2]. The published report of the same organization demonstrated that typhoid fever is a serious systemic infection spread by the faecal-oral route and closely associated with poor hygiene and insufficient sanitation. In these areas school children as well as young adults are most commonly affected [3]. A research study on asthma revealed that it is one of the most common chronic epidemics in the world [4]. In Pakistan 0.25 million casualties per year are due to water borne infections for which typhoid is the superseding cause [5]. Childhood diarrhoea is also widely reported in Pakistan and it is suggested that flies are vectors for these epidemics [6].

Karachi is highly congested, thickly populated and is the fifth largest city of the world. In various areas of Karachi different types of communities may be identified on the basis of population density and the poverty level. These communities or populations living in the extreme areas are severely affected by different epidemics or a combination of these common epidemics. Airborne fungalbiota of different areas of Karachi was investigated by Rao et al. [7] which owe its origin to hundreds of open garbage collection sites. They also pointed out the potential of airborne fungal spores causing various epidemics i.e. asthma, bronchitis, cough, sinusitis etc. Dynamics of twelve common epidemics from five different areas of Karachi was also described by Rao et al. [8], they suggested that poor hygienic situation, air pollution, contaminated food/water and poverty are responsible for

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the severity of common epidemics in Karachi city. Until recently no extensive scientific data was available to show which epidemics or group of epidemics are severely affecting the population of different age and gender in various localities of Karachi. Bearing these points in mind a detailed survey was conducted in 5 different areas of Karachi. The selection of study sites was based on overall hygienic situations of the area, population, traffic density and poverty level of the resident population.

MATERIALS AND METHODS

Study on twelve chronic epidemics in five different areas was conducted which are commonly distributed in Karachi city. The areas were selected on the basis of overall hygienic situation of the area, traffic density and the poverty level of the general population. Following are the characteristic feature of the different study areas. These areas are described in detail in Rao et al. [7].

Malir: Poor hygienic situation thickly populated with low income.

Korangi: Thick industrial area, thickly populated, high traffic, poor hygienic conditions and low income areas close to the coast.

Metroville: Close to Sindh industrial state with many industries, highly polluted middle to lower middle class population.

Maymar: Open residential area, low traffic, less polluted middle to upper middle class population.

Lines Area: Thickly populated, high traffic density, poor hygienic conditions and lower middle class population.

In each area a modified version of questionnaire of international union against tuberculosis and lung disease (IUATLD’s) supported by Burney et al. [9] was given to authorized medical practitioners. This recorded information of patients was collected on a weakly basis.

Statistical Analysis: The randomly selected data from five different locations was obtained for three years (36 months) and then subjected to analysis of variance (ANOVA) to detect the significance of differences between sexes, ages and epidemics [10]. Among the multivariate analyses, cluster analysis was used to ensure the significant grouping between the variable and factors [11]. The principal component analysis (PCA) was employed on data to reduce the dimensionality of data set in which there are a large number of interrelated variables and to retaining as much as possible of the variance present in the data [12].

RESULTS

The present paper was based on 3 years study in which information of 212842 male (83593 children, 58754 young and 70495 old) and 211809 female (82224 children, 60284 young and 69901 old) patients was obtained and subjected to different statistical analyses (Table 1).

The highest number of patients (about 100,000) visited health professional in Korangi and Lines area while the lowest numbers (53898) were recorded from Maymar area. In Malir and Metroville areas 82384 and 75655 people were affected by these epidemics during the 3 years of study period. It should be born in mind that this data was collected from one health professional from each study area. Table 1 indicates the percentage of male and female patients of three age groups that visited the health professionals of different study areas suffering with various epidemics. In general, no significant difference between the number of male and female patient was recorded, however it was observed at Korangi area that 77% of male children were suffering from bronchitis, while the number of female children suffering was significantly low (47%). Rhinitis and sinusitis were widely and almost equally distributed in all study sites, in 52 to 66% male and 53 to 63% female children. In Maymar and Metroville area diarrhoea is common in both types of children. A higher number (13 to 38%) of patients belonged to the old group while the young group was the least (10 to 35%) affected.

The results of analysis of variance of different areas are shown in table 2. Effects of epidemics were highly significant for each area. Age has no significant effect in Malir whereas each age group was almost equally affected by these epidemics. Gender shows significant effect in Malir and Korangi study areas only, whereas male and female patients were significantly different in number. Interactions between any two main factors were highly significant at Korangi area only.

Cluster analysis (Fig. 1) revealed three main similar groups (i.e children, young and old), without any consideration or importance of gender, in four out of five study areas. In Korangi area, the male and female children group formed two distinct groups.
Table 1: Percentages of Common Epidemics in Five Different Localities of Karachi, considering child, young and old Male and Female

<table>
<thead>
<tr>
<th>Location and Age group</th>
<th>Allergy (%)</th>
<th>Asthma (%)</th>
<th>Bronchitis (%)</th>
<th>Cough (%)</th>
<th>Diarrhoea (%)</th>
<th>Fever (%)</th>
<th>Flu (%)</th>
<th>Malaria (%)</th>
<th>Rhinitis (%)</th>
<th>Sinusitis (%)</th>
<th>S. Rashes (%)</th>
<th>Typhoid (%)</th>
<th>Total Patients Male/Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malir Child</td>
<td>8/8</td>
<td>3/2</td>
<td>1/2</td>
<td>11/10</td>
<td>1/1</td>
<td>5/5</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/3</td>
<td>1/1</td>
<td>15437/15816</td>
</tr>
<tr>
<td>Young</td>
<td>7/7</td>
<td>2/2</td>
<td>1/1</td>
<td>8/8</td>
<td>1/1</td>
<td>4/4</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>2/2</td>
<td>1/1</td>
<td>11542/12205</td>
</tr>
<tr>
<td>Old</td>
<td>8/8</td>
<td>2/2</td>
<td>1/1</td>
<td>9/10</td>
<td>1/1</td>
<td>5/5</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/2</td>
<td>1/1</td>
<td>13626/13758</td>
</tr>
<tr>
<td>Korangi Child</td>
<td>10/10</td>
<td>2/2</td>
<td>1/1</td>
<td>11/11</td>
<td>1/1</td>
<td>4/5</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/4</td>
<td>1/1</td>
<td>19811/19788</td>
</tr>
<tr>
<td>Young</td>
<td>8/8</td>
<td>1/1</td>
<td>1/1</td>
<td>9/9</td>
<td>1/1</td>
<td>3/3</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>2/3</td>
<td>1/1</td>
<td>14348/14160</td>
</tr>
<tr>
<td>Old</td>
<td>8/8</td>
<td>2/1</td>
<td>1/1</td>
<td>11/10</td>
<td>1/1</td>
<td>4/4</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/3</td>
<td>1/1</td>
<td>17083/15728</td>
</tr>
<tr>
<td>Metroville Child</td>
<td>8/7</td>
<td>3/3</td>
<td>1/2</td>
<td>9/9</td>
<td>1/1</td>
<td>5/5</td>
<td>3/3</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>4/3</td>
<td>1/1</td>
<td>14390/14452</td>
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<tr>
<td>Young</td>
<td>6/6</td>
<td>2/2</td>
<td>1/1</td>
<td>8/8</td>
<td>1/1</td>
<td>4/4</td>
<td>2/2</td>
<td>1/1</td>
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<td>1/1</td>
<td>2/2</td>
<td>1/1</td>
<td>10513/10709</td>
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<tr>
<td>Old</td>
<td>6/7</td>
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<td>1/1</td>
<td>10/9</td>
<td>1/1</td>
<td>4/4</td>
<td>3/3</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/3</td>
<td>1/1</td>
<td>12603/12919</td>
</tr>
<tr>
<td>Maymar Child</td>
<td>9/9</td>
<td>2/2</td>
<td>1/1</td>
<td>11/11</td>
<td>1/1</td>
<td>5/4</td>
<td>2/2</td>
<td>1/1</td>
<td>2/1</td>
<td>1/1</td>
<td>4/4</td>
<td>1/1</td>
<td>10775/10538</td>
</tr>
<tr>
<td>Young</td>
<td>6/7</td>
<td>1/1</td>
<td>1/1</td>
<td>9/9</td>
<td>1/1</td>
<td>3/3</td>
<td>1/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/3</td>
<td>1/1</td>
<td>7041/7404</td>
</tr>
<tr>
<td>Old</td>
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<td>2/2</td>
<td>1/1</td>
<td>11/10</td>
<td>1/1</td>
<td>4/4</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>4/4</td>
<td>1/1</td>
<td>8964/9176</td>
</tr>
<tr>
<td>Lines Area Child</td>
<td>10/10</td>
<td>2/2</td>
<td>1/1</td>
<td>12/11</td>
<td>1/1</td>
<td>4/5</td>
<td>2/2</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/4</td>
<td>1/1</td>
<td>21171/21630</td>
</tr>
<tr>
<td>Young</td>
<td>8/9</td>
<td>1/1</td>
<td>1/1</td>
<td>10/9</td>
<td>1/1</td>
<td>3/3</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/3</td>
<td>1/1</td>
<td>15310/15806</td>
</tr>
<tr>
<td>Old</td>
<td>9/9</td>
<td>1/1</td>
<td>1/1</td>
<td>11/11</td>
<td>1/1</td>
<td>4/5</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>1/1</td>
<td>3/3</td>
<td>1/1</td>
<td>18179/17720</td>
</tr>
</tbody>
</table>

*Rounded percentage of Male/Female patients are shown in each column respectively*

Table 2: Results of ANOVA of five different localities of Karachi

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>MALIR</th>
<th>KORANGI</th>
<th>METROVILLE</th>
<th>MAYMAR</th>
<th>LINES AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>df</td>
<td>F</td>
<td>p</td>
<td>LSD 0.05</td>
<td>df</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>14.07</td>
<td>***</td>
<td>121.32</td>
<td>1</td>
</tr>
<tr>
<td>Age</td>
<td>2</td>
<td>1.53</td>
<td>ms</td>
<td>148.59</td>
<td>2</td>
</tr>
<tr>
<td>Epidemics</td>
<td>11</td>
<td>25.23</td>
<td>***</td>
<td>297.18</td>
<td>11</td>
</tr>
</tbody>
</table>

*df= Degree of freedom, F= F ratio, P= p-value (***P<0.001, **P<0.01, ms=Non significant), LSD at P level of 0.05*

Fig. 1: Dendrograms derived from cluster analysis (Ward’s method) showing grouping in sexes and ages of five different sampling areas of Karachi
Fig. 2: Distribution of Sex and age on PCA diagram of five sampling areas of Karachi.

Principal component analysis described distribution of these common epidemics with different combination in three components. First component explained the highest percentage of total variance, while each study area eigenvector coefficients showed different groups of associated epidemics. Percentage of variance ranged from 81 to 89% in component one which determined the most dominant and widely distributed group of epidemics in different areas.

Percentage variance of 7 to 14% and 1 to 6% was recorded for second and third components of PCA, respectively. It is also showed that each study area has its own characteristics combination of widely spread epidemics and less spread epidemics. It is seen that widely spread epidemics of one area may be less important or less affected in low number of populations of another area. For example, asthma is widely distributed in all areas except in Metroville area. Bronchitis was severely dominated at Malir, Maymar and Lines area while it was relatively poorly distributed at Metroville and Korangi area.

Distribution of sex and age on two dimensional PCA (Fig. 2) configurations indicated the same three groups like the cluster analysis (Fig. 1). Like the previous analysis these groupings also ignored gender. On two axes old groups of male and female patient had a tendency to occupy the right lower left portion of x-y axis, while young male and female patients gathered on the upper right position of the diagram. Although the children group occupied the upper left portion of the x-y space at Malir, Metroville and Maymar area, male and female children at Lines area are separated middle and to the upper side of the y-axis. A maximum separation of male and female children group can be seen on y-axis at Korangi. These groups are also prominent in the dendrogram resulting from cluster analysis (Fig. 1).

**DISCUSSION**

The population of Karachi was highly affected to various epidemics which showed their severity in different months and seasons [8]. Children (39%) and old people (33%) were more affected than young people, which may be due to lesser resistance and a weaker immune system. Gender was not important except in Malir and Korangi which were the most congested, thickly populated and extremely unhygienic area due to a numbers of open garbage sites. Korangi area was more populated being an industrial area including tannery industries. It seemed that age has no effect in Malir, while gender is significantly important and plays a key role in being exposed to various epidemics in these areas. It is also anticipated that due to high pollution and poverty at Korangi, interaction of all main factors are equally and highly important for promotion and distribution of various epidemics.

In girls, nearly sixty percent of mortality risk was reported by Chen et al. [13]. According to Ahmed [14] respiratory infection, diarrhoea and malnutrition are the main cause of children death in Pakistan. Similarly several studies have indicated more acceptability of epidemics for any particular sex. Present studies show no such type of trend. However, at Korangi area male and female children
formed two distinct groups, indicating different potential to accept various epidemics in that particular area. It is likely that children of both sexes might have different exposure to various local factors while in other areas they have similar exposure to various epidemics. Similarities between cluster analysis and PCA diagram give additional support to these results. It may also be suggested that in general, children and old groups are more affected by these epidemics due to the poor immune systems of their bodies regardless of their gender. Analysis of variance, cluster analysis and PCA show no significant difference between the number of male and female patients except in Korangi.

According to Rao et al. [8] these epidemics are widely distributed in different areas of Karachi and each area has its own characteristic epidemics combination. The present investigation indicated that among these common epidemics six epidemics i.e. flu, asthma, skin rashes, fever allergy and cough are widely distributed in 5 different areas of Karachi in progressively increasing order.

Similarly among the other six epidemics, bronchitis was dominating at Malir and Metroville areas on the basis of number of patients visiting health professionals. Other five epidemics were almost equally spread in each study area. These epidemics are mostly airborne epidemics i.e. air pollution, dust, fungal spores and pollen grains (except diarrhoea, typhoid and malaria). Penicillium, Alternaria and Aspergillus fungal species are widely reported from atmospheric air of Karachi and are reported to cause asthma, wheezing, fever and cough [7,8]. Diarrhoea seems to be related with contaminated soil, water and diet while similar unhygienic situation in different area may be responsible for typhoid. In many areas of Karachi standing water is frequently found in many plots. This standing water and surrounding bushes are ideal places for the breeding of mosquitoes resulting in malaria epidemics. Maymar was considered well managed, open, less populated, contains less traffic, less polluted and inhabited by middle to high income population, but is still dominated by airborne or waterborne epidemics, though here fewer patients were recorded in comparison to other areas of Karachi. It was observed that high income population may reduce the intensity of epidemics by taking precautionary measures and by visiting health professionals more frequently and at the beginning of the problem. However there is no barrier for airborne agents in the atmosphere. They travel long distances and affect unpolluted areas. Therefore, proper scientific garbage collections and disposal systems should be introduced in each and every part of the city. Measures for air pollution control should be taken.

It may be concluded that though number of patients of a particular epidemic in various age groups in different areas of Karachi were considerably different, relatively all epidemics are severely spread regardless of overall conditions of different. Children and old people were effected by these epidemics, while upper middle class is relatively less effected due to proper care in due time.

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