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Age Structure Changes in Nepal: An Illustration Through Trifactor Graph

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Abstract

There are various ways to illustrate age structures and changes therein, the most common illustration being age pyramids. Besides, trifactor graphs can also be used to demonstrate age structure changes over time and space. Though a trifactor graph is not as simple to interpret as other two-dimensional graphs, it has the advantage of providing visual summary of several places over several time periods, which is not possible in many other illustrations. This paper attempts to illustrate the use of such graph in population analysis. It takes Nepal as the unit of analysis and uses census data available from Central Bureau of Statistics for the period 1952/54-2001.

Introduction

This paper attempts to show how a trifactor graph can be used to demonstrate age structure changes over time and over space. It takes Nepal as the unit of analysis and uses data available from Central Bureau of Statistics (CBS) for the time period 1952/54- 2001. CBS is the agency responsible for collection, compilation and publication of population data pertaining to the territory of Nepal. Although the first population count in Nepal covering entire territory was taken in 1911 A.D., the Population Census 1952/54 is considered the first "scientific" census giving details of age and sex composition of population in the country. The second such census was conducted in 1961. Thereafter, population censuses have been conducted at every 10 years interval and 22nd June (8th Ashadh) of the census year has been set as the census day.

By 2001 six scientific censuses (decennial) have been conducted in Nepal. Census operations are generally carried out in two stages. In the first stage the supervisors engage in the preparation of household list as comprehensively and accurately as possible. The actual enumeration takes place in the second stage. The gap between these two activities is maintained as short as possible. This paper uses data from six decennial censuses carried out between 1950 and 2001 in the country.

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The Definition of Age and Age Structure Changes

In population analysis the term "age" is defined in terms of completed years, which means age of the person at his/her last birthday. In much of the traditional societies such as ours the normal tendency is to report running age and not the completed age. In the Western sense this means age in the next birthday. But age reporting in the national censuses is based on completed age and Nepal is no exception. Accordingly, based on United Nations recommendation, "age" is defined as the estimated or calculated interval of time between the date of birth and the date of census, expressed in completed solar years (UN 1967, 41).

Data on age are obtained by *asking a question on date of birth*, or *by asking a direct question on age*, or *by asking both questions*. In developing countries such as Nepal a common way of obtaining age data is by asking a direct question on age whereas in developed countries it is obtained by asking a question on date of birth is common. Data obtained through direct question on ages are easier to process but are likely to be less accurate than the ones obtained through date of birth (Shryock, Siegel and Associates 1976). Despite these limitations census data are the only data available in Nepal covering the entire country and referring to the same date.

Age structure changes refer to changes in the proportional share of various age and age groups in the total population. Analysis of these changes becomes meaningful when reference points (periods) are many and the duration is reasonably longer. From changes in age distribution emanate various consequences for the educational, economic and political life of the community. Changes in the proportion of various age groups mean different things to different sectors of population. In a growing population, an increase in the proportion of young population (below 15 years of age) means a strain in the educational facilities to provide places in the educational system. This situation warrants more schools, more teachers and more educational materials in elementary education. Likewise, an increase in the proportion of late teens and twenties has implications in the provision of college level education, job market and social plus political unrest. Nepalese contemporary age structure change suggests that 1990s and 2000s could be considered as the decades of elementary school children while the 2010s could be considered as the decade of young workers and college students.

In a growing population the age structure changes (i.e., positive) in the young adults is likely to make employers happy since they will have abundance of workers with varieties of skills. But to the young-adults themselves, they must compete for limited jobs and finding a job in the preferred region will not be easy. They have to find job in the limited job market and in the emerging system of labor market. Enrollment in the colleges increases all at once in a situation where education facilities are poorly equipped to accommodate.

Decennial censuses in Nepal report data on age of the total country population. Age data are tabulated in single years of age, 5-year age groups or broader groups. Each of these tabulations has its own significance and use for planning of social provisions in the community and in the region. These numbers themselves convey messages but often times when these numbers are illustrated in graphs or figures and visually displayed they convey message/s more readily and convincingly.

The Age Pyramid: A Common Way to Illustrate Age Structure

There are various ways to illustrate age structure and changes therein. The most common illustration is through age pyramid. The pyramids consist of bars representing age distribution either in single years or 5-year groups in ascending order from the lowest to the highest and are pyramided horizontally on one another. In constructing age (population) pyramid there is a general convention to present number or proportion of men on the left hand side and women on the right hand side. Horizontal bars starting from the central axis represent the number of men and women. The vertical scale of the pyramid is roughly two-thirds of the horizontal scale. The age groups represented must have the same class interval and each bar must have the same thickness. However, in the older age groups where the number men and women run thin, pyramids are truncated and the age interval is left open, e.g. 85 years and over. Age intervals are shown either on the central axis or at the right or left of the pyramid. Pyramids can be constructed on the basis of absolute number or percentage share. When a percent pyramid is constructed, the percent must be calculated on the basis of *grand* total. Otherwise the absolute pyramid and percent pyramid do not match in shape thereby in the geometric sense. Since the methods of construction and use of age pyramids are available in most books dealing with population composition, the readers are requested to consult standard books (e.g., Shryock, Siegel and Associates 1976).

Illustrating Age Structure Changes Through Trifactor Graph

Although age pyramid is the most common graph used to illustrate age structure of population, it is a poor illustration in order to show differences between two or more populations. A trifactor graph is considered a better technique to illustrate age structure changes of an area over time or differences between two or more areas in a single diagram. Unlike several bars in population pyramid, this technique uses a single dot to represent each population. The advantages of trifactor graph in the analysis of age-structure changes are as follows: i) group of populations can be plotted quickly, ii) in a limited space, visual comparison of two or more populations can be done with ease, and iii) the populations can be grouped (clustered) and classified in a precise manner.

Despite its comparative advantage, its use is not very common in population literature. This infrequent use is probably because it is a three-dimensional graph, which requires more interpretive skill than frequently used two-dimensional graphs such as age pyramids (see Fuller 1978). Trifactor graph is an equilateral triangle enclosing a grid pattern consisting equidistant lines running parallel to each of the three sides. At any point in the triangle where three lines that represent percentages intersect, their values sum to 100 percent. Three sides of the triangle represent three separate age groups of population. The percent share of each of the three age groups namely 0-14 years, 15-59 years, and 60 & over are represented by "young," "mature," and "aged" labels respectively. To indicate the age groups they refer, the scales along each of the three sides are numbered and coded with "y," "m," and "a" (details follow).

In the following section the age structure changes in Nepal has been illustrated through trifactor graph. Before interpreting the graph it is helpful to know the population size of the

country in the respective censuses so that the proportions can be translated into respective population sizes if necessary. The first scientific census in Nepal i.e., 1952/54 recorded a total population of 82.56 million, which increased to 94.12 million by 1961. By 1971 the total figure crossed 8 digit reaching 11.56 million (Table 1). The pace of increase continued and by 2001 the total population in Nepal reached 23.15 million. This is definitely a sign of rapid increase. Between 1952/54 and 2001 the total population in the country increased by 2.8 times. Intercensal growth rates (in percent) over the last five censuses vary but on the whole the rates are consistently over 2.0 percent per annum. In particular, over the last 48 years the population has increased at the overall rate of 2.17 percent per annum.

Table 1. Nepal: Total Population and Growth Rates in Various Censuses

Census year	Population		Census year	Population	
	Total	Growth rate		Total	Growth rate
1952/54	8,256,625	-	1981	15,022,839	2.66
1961	9,412,996	1.65	1991	18,491,097	2.10
1971	11,555,983	2.07	2001	23,151,423	2.27

Source: Various population censuses of Nepal.

Whereas the total population increased, a change in its age composition is evident. This age structure change is not unusual since the country has witnessed a significant progress in the field of public health, education and behavioral change communication (BCC) during these years. All these factors have collectively contributed to the age structure changes in Nepal. Lately, the proportion of young population has begun to decline and those of others to increase.

Age Structure Changes Over Time: National Scenario

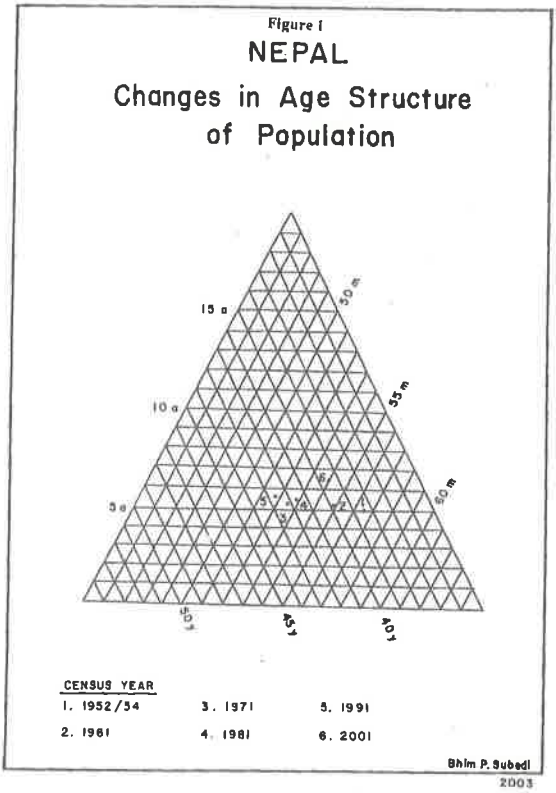
Figure 1 illustrates the changes in age structure of population over the six census periods. In the figure the points are numbered as 1, 2, 3, 4, 5, and 6 referring to census years where '1' refers to 1952/54 census, '2' refers to 1961 census and so on. The distance of points in the graph indicates the dissimilarity of age structure over time or over space being compared. Since this figure shows the same population at different times (Table 2), the distance between points denoted by numbers indicate change in the age structure over the census periods. The proportion of young population i.e., below 15 years of age, is expressed in the value of line running northwest to southeast and is symbolized as '*y*'. Likewise, the proportion of mature population is expressed in the value of the line running southwest to northeast and symbolically denoted as '*m*'. Furthermore, the horizontal lines running west to east and symbolically expressed as '*a*' represent the proportion of aged population. The values in all the lines in the trifactor graph increase clock wise.

Table 2. Nepal: Age Structure Changes By Broad Age Groups

Census year	Percent Distribution of		
	Young	Mature	Aged
1952/54	38.4	56.6	5.0
1961	39.9	54.9	5.2
1971	42.1	52.5	5.4
1981	41.4	52.9	5.7
1991	42.4	51.8	5.8
2001	39.4	54.1	6.5

Source: Various population censuses of Nepal.

The point denoted by '1' represents a population composed of 38.4 percent 'young,' 56.6 percent 'mature' and 5.0 percent 'aged.' Similarly, the point denoted by '2' represents a case where the values of '*y*' is 39.9, that of '*m*' 54.9 and of '*a*' 5.2 percent. The three values of point '3' is 42.1 for '*y*', 52.5 for '*m*' and 5.4 for '*a*'. This is the proportion of population by broad age groups in 1971. The distance between '2' and '3' is far greater than the distance between '1' and '2'. This means the age structure change between 1961 and 1971 is far greater than the change between 1952/54 and 1961.



As points '3' and '4' are very close in the figure, age structure in these two reference periods is rather similar. The widest gap in the consecutive points is apparent between point '5' and '6'. The distance apart through a shift of point towards right and up on the ladder suggests that the reference population is headed towards maturity from a predominantly young population.

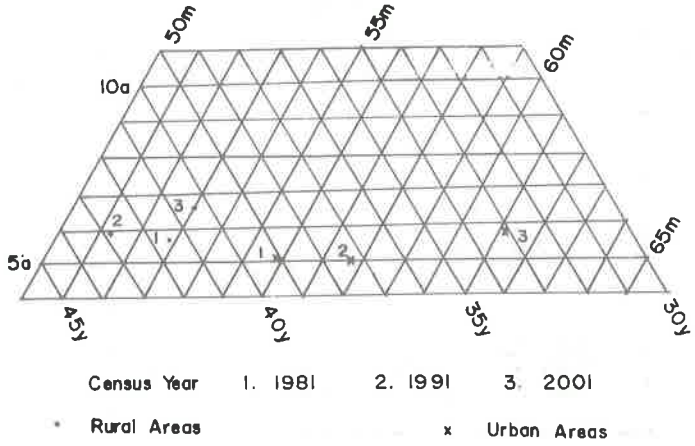
Age Structure Changes Over Space: The Rural Urban Differences

It is quite natural for developing countries to have obvious rural urban differences in the age structure of population. Whereas the rural areas demonstrate more youthful age structure, the urban areas demonstrate relatively mature structure. Thus, the proportion of young population is lower in urban areas than in rural areas. On the contrary, urban areas usually comprise higher proportion of mature population and lower proportion of aged population. A general observation in the developing countries is the presence of higher proportion of aged population in rural areas. Large flow of young adults from rural areas to urban areas has direct reflection on this situation. In short, urban areas demonstrate large proportion of mature population while rural areas demonstrate larger proportion of aged and children.

Figure 2 illustrates age structure changes between rural and urban areas. Data from three population censuses namely 1981, 1991 and 2001, are used for the illustration. The numbers such as 1, 2, and 3 in the figure refer the three population census years 1981, 1991 and 2001. Age structure in rural areas are represented by the dots (.) whereas the cross signs (x) are used to represent the same in urban area. For example, the dot (.) numbered as '1' represents a population composed of 41.5 percent 'young,' 52.8 percent mature' and 5.8 percent 'aged,' a situation of rural Nepal in 1981. Similarly, the cross sign (x) numbered as '1' denotes 39.1 percent 'young,' 55.8 percent 'mature' and 5.1 percent 'aged,' a situation of urban Nepal in 1981.

Figure 2

Nepal : Age Structure Changes in Rural and Urban Areas (1981-2001)



The dot numbered '2' represents 42.9 percent young, 51.2 percent mature and 5.9 percent aged population. The corresponding figures for urban area that is symbolized by cross mark (x) indicates 37.3 percent young, 57.7 percent mature and 5.0 percent aged population. Finally, the dot numbered '3' represents 40.4 percent young, 53.0 percent mature and 6.6 percent aged population in 2001 for rural area. The corresponding urban proportion symbolized by cross mark (x) is 33.1 percent young, 61.2 percent mature and 5.7 percent aged population.

The visual summary provided by the figure (Figure 2) suggests several things. Three observations are notable about rural age structure i.e., those symbolized by the dots. First, the points are closer showing a good deal of similarity over successive periods. Second, from 1981 to 1991 the population shows a tendency of getting younger since dot '2' has moved towards left with virtually no upward movement. Third, the distance between dot '2' and '3' is farther showing greater change in the age structure by 2001 over 1991.

Urban areas demonstrate equally important situations. First, the points (cross marks) are not as closer as that of rural areas suggesting rapid change in the age structure. Second, the direction of change is uniform over three censuses meaning the marks have gradually moved towards right. This movement demonstrates a rapid increase of mature population. Third, the distance between '2' and '3' are farthest of all. This means the age structure (composition) is rapidly changing and the increase in the proportion of mature population in urban area is far higher than the others. This change is also a reflection of increasing rural urban migration that brings young adults into urban areas.

Conclusion

Age is an important variable in population analysis and a change in age structure has several implications to the society and to the institutions responsible for providing services of social provisions such as education, public health, employment and so on. In Nepal in general age structure changes in total population has taken place over half a century but rather erratically and slowly. Change in the proportion of young and adult population is inconsistent but despite its small share the change in the proportion of aged population is consistent i.e., towards an increase. The shift in the last decade appears rather noticeable than the earlier decades. While there is little difference between national and rural situation, age structure changes in the urban areas shows a clear shift towards a domination of mature population. A clear shift (decrease) in the proportion of young population in urban area is evident.

This paper has attempted to demonstrate the use of trifactor graph in the population analysis. The purpose here is more on illustration than in its implications. This is deliberate primarily due to the overlook of such a powerful tool in the population analysis (as an exception see Subedi 1996). This is especially true among population geographers and social demographers, who are primarily interested in broad patterns of population and its interrelations in the society. Trifactor graph is in fact a very useful tool to compare age structure changes in many areas and/or over several time periods. This is the main advantage of trifactor graph over many other two-dimensional graphs. It is not as simple to interpret as other two-

dimensional graphs are but it has the advantage of providing visual summary of several places over several time periods not possible in many other illustrations. More importantly, the trifactor graph can also be used to analyze the change in occupational structure and other socio-economic composition of population in more than one area and over various time periods.

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