

**ANALYSIS OF SEX RATIO IN HARYANA
(CENSUS 2011) – A DEMOGRAPHIC STUDY**

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ABSTRACT

The study on the sex ratio of overall population and of children in 0-6 age group for different districts in Haryana concentrates on the following:

- i) Is there any likely relationship between overall male population and overall female population with respect to rural and urban areas (in particular, are there any significant patterns?).*
- ii) Is there any significant difference between overall male 0-6 population, overall female 0-6 population with respect to rural and urban areas.*
- iii) Is there any significant difference between the proportion of female population and female 0-6 population with respect to all districts (in particular, are there any significant patterns?).*
- iv) Is there any significant difference among the districts with respect to overall male and overall female population (in particular, are there any significant patterns?).*
- v) Is there any significant difference among the districts with respect to overall male 0-6 and overall female 0-6 population (in particular, are there any significant patterns?).*

vi) Also a scientific arrangement of the district wise path is evaluated by lexisearch method for the first time for demographic data.

Key words: 0-6 sex ratio, rural and urban groups, districts, Haryana census 2011, the lexisearch method.

Introduction

The provisional results of census of India 2011 released by the census commissioner. India showed a substantial decline in sex ratio in the age group 0-6 years (child sex ratio) overall Indian states. The 2001 & 2011 census highlighted this issue by devoting a full section on this subject. This distressing state of affairs raised voice of grave concern across all sections of society. It set into motion serious debates and resulted in a series of action on several fronts to curb the menace of female foeticide in certain parts of the country.

In this direction, (Haragopal and Pandit, 2006) analysed the data for Andhra Pradesh and found that there is a substantial drop of 0-6 female sex ratio. This was noticed by analyzing the data on village wise/district wise. With reference to this we have analysed the data on Haryana state for the 2011 census.

The analysis of results in Haryana district level data revealed a significant insight into the problem at levels below the state at the national level particularly in certain parts of the country. The rural-urban differentials in the sex ratio in the age group 0-6 further sheds light on the spatial analysis of possible adverse impact on the female child due to the spread of the modernization and technological advancement in the villages and urban centers.

The number of states recording child sex ratio above thousand has also reduced from two to one. The pattern of this ratio in urban areas is more masculine as compared to rural areas. There is no state, which has child sex ratio of thousand or more. Conversely there has been an increase in the number of states having urban child sex ratio in the ranges during the 2001 & 2011 census, (Agnihotri, 2000) (Lakshman Rao and Haragopal, 2014).

Child sex ratio district level

The district level data on child sex ratio provides further insight into the pattern that exists at this level within a state/union territory. Keeping this in view we analysed the Haryana district level data with urban and rural segregation and found that an alarming situation exists in the districts of Haryana where there is a highest fall in the sex ratio is observed.

Results and Discussion

On the whole the sex ratio at the district level is below the ideal of 1000. However, as will be seen later in many districts variations in sex ratio are very considerable being quite low in some districts and relatively very high in some other districts.

Analysis for the present situation follows: in each district for each of the sub-districts the sex ratio of all children, rural children and urban children as well as entire population including the children and rural and urban separately also are available from Census India, 2011.

The following analysis is based on these figures:

Table 1. Totals of 21 districts for each of six groups (for 2011 data)

	Population	Male	Female	Pop 0-6	Male 0-6	Female 0-6
Total	25351462	13494734	11856728	3380721	1843109	1537612
Rural	16509359	8774006	7735353	2285112	1245090	1040022
Urban	8842103	4720728	4121375	1095609	598019	497590

* Data source: Data C. D's from Census India-2011

Table 1, gives totals of 21 districts for overall population, overall male population and overall female population, overall population 0-6, overall male 0-6 population and overall female 0-6 population with respect to rural and urban areas for 2011 census data.

Table 1(a). Observed frequencies of overall population (for 2011 data)

	Male	Female
Rural	8774006	7735353
Urban	4720728	4121375

Table 1(b). Observed frequencies of overall population (for 2011 data) along with row and column totals

	Male	Female	Row Total
Rural	8774006	7735353	16509359
Urban	4720728	4121375	8842103
Column Total	13494734	11856728	25351462

Calculation of Expected frequencies

$$\text{Expected frequency} = \frac{\text{Row total} * \text{Column total}}{\text{Overall total}}$$

For example: Expected frequency of the value 8774006 (from Table 1 (b))

$$= (16509359 * 13494734) / 253511462$$

$$= 8788030$$

Similarly the other Expected frequencies re computed and are tabulated in Table 1(c).

Table 1(c). Expected frequencies of overall population (for 2011 data)

	Male	Female
Rural	8788030	7721329
Urban	4706704	4135399

The Pearson Chi -square test statistic to summarize the difference between observed and expected counts is given by

$$x^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}, \text{ distributed as } x^2 \text{ with } (r - 1) * (s - 1) d. f.$$

O_i = Observed frequency of the given data

E_i = Expected frequency

r = Number of rows

s = Number of columns

Table 1(d). Computation of Chi-square value for overall population (for 2011 data)

Observed frequency (O_i)	Expected frequency (E_i)	$\frac{(O_i - E_i)^2}{E_i}$
8774006	8788030	22.4
7735353	7721329	25.5
4720728	4706704	41.8
4121375	4135399	47.6
		(Chi-square) $x^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i} = 137.2$

*Observed and Expected frequencies from Tables 1 (a), 1 (b)

Table 1 (a), (c) gives observed and expected frequencies of overall male population and overall female population with respect to rural and urban areas for 2011 census data.

Chi-square value for overall population for 2011 census data is 137.2 with 1 d.f (from Table 1 (d)). From these values it can be concluded that there is a significant difference between overall male population and overall female population with respect to rural and urban areas for 2011 census. Similarly for the other we calculate the Chi-square statistic.

Table 1(e). Observed frequencies of overall 0-6 population (for 2011 data)

	Male	Female
Rural	1245090	1040022
Urban	598019	497590

Table 1(f). Expected frequencies of overall 0-6 population (for 2011 data)

	Male	Female
Rural	1245802	1039310
Urban	597306.6	498302.4

Table 1 (e), (f) gives observed and expected frequencies of overall male 0-6 population and overall female 0-6 population with respect to rural and urban areas for 2011 census data.

Chi-square value for overall 0-6 population for 2011 census data is 2.8 with 1 d.f. From these values it can be concluded that there is no significant difference between overall male 0-6 population and overall female 0-6 population with respect to rural and urban areas for 2011 census.

Also, from Table 1 we have calculated the proportion of female and female 0-6 population for all 21 districts of Haryana state is calculated which are given in Table 1(g).

Table 1(g). Proportion of female, female 0-6 of 21 districts (for 2011 data)

	Male	Female	Male 0-6	Female 0-6
Total	0.5323	0.4677	0.5449	0.4551
Rural	0.5452	0.4548	0.5339	0.4661
Urban	0.5315	0.4685	0.5458	0.4542

From this analysis we can understand that there is no difference between rural and urban areas with respect to male population, female population for 2011 censuses which is quite misleading.

To see whether there is any difference within the 21 districts of Haryana we have analysed the data for 2011 census by considering the Chi-square test and observed that there is a difference within the districts with respect to proportion of females in the overall population, in the rural,

urban regions and proportion of 0-6 females in the overall population, in the rural, urban regions of the state, (Srinivasan, 1994).

Thus, the data analysed with respect to Chi -square test are tabulated in Table 2 for all the districts of Haryana.

Table 2. Chi-square values for the proportion of overall female population, female 0-6 population of 21 districts with respect to rural, urban areas (for 2011 data)

Districts	Proportion of females pop in the pop	Proportion of female 0-6 in the pop	Proportion of females in the rural region	Proportion of female 0-6 in the rural region	Proportion of females in the urban region	Proportion of female 0-6 in the urban region
Ambala	13.2*	27.2*	21.3*	45.4*	1.0	0.0
Yamunanagar	0.5	3.7	0.0	2.0	0.9	1.6
Kurukshetra	26.4*	10.7*	62.1*	9.6*	11.1*	1.6
Kaithal	2.7	2.0	0.8	1.7	14.8*	0.5
Karnal	34.2*	7.6*	5.4*	2.0	43.4*	9.4*
Panipat	90.0*	0.3	99.2*	2.7	5.3*	8.0*
Sonipat	247.6*	90.5*	332.3*	60.0*	2.2	31.2*
Jind	24.1*	0.8	58.8*	0.7	5.8*	0.0
Sirsa	145.7*	41.5*	83.1*	47.6*	52.3*	0.5
Hisar	24.4*	21.7*	7.3*	19.9*	26.8*	2.7
Bhiwani	27.6*	0.6	8.4*	0.0	14.9*	4.5*

Rohtak	48.9*	8.8*	174.3*	4.8	27.8*	3.8
Mahendragarh	75.7*	148.6*	48.4*	138.2*	11.7*	14.2*
Rewari	107.9*	96.5*	134.1*	88.3*	0.0	12.2*
Gurgaon	295.1*	1.2	2.3	29.7*	297.0*	8.1*
Faridabad	17.1*	7.5*	10.8*	0.1	0.1	14.1*
Panchkula	5.8*	19.3*	28.1*	14.1*	6.4*	6.9*
Fatehabad	157.5*	16.4*	101.1*	17.6*	39.9*	0.1
Jhajjar	85.0*	125.2*	98.7*	113.4*	4.7*	16.3*
Mewat	276.5*	423.9*	195.4*	390.1*	45.3*	26.0*
Palwal	1.1	60.7*	1.1	74.4*	8.3*	0.0

* indicates difference in the characteristics considered, in the tables which are given in the following tables.

From Table 2 we observe that there are 15 districts (Ambala, Kurukshetra, Karnal, Sonipat, Sirsa, Hisar, Rohtak, Mahendragarh, Rewari, Faridabad, Panchkula, Fatehabad, Jhajjar, Mewat and Palwal) in 2011 census which are different with respect to proportion of female 0-6 population in the overall population.

There are 13 districts (Ambala, Kurukshetra, Sonipat, Sirsa, Hisar, Mahendragarh, Rewari, Gurgaon, Panchkula, Fatehabad, Jhajjar, Mewat and Palwal) which are different with respect to the proportion of female 0-6 population in the rural region.

There are 11 districts (Karnal, Panipat, Sonipat, Bhiwani, Mahendragarh, Rewari, Gurgaon, Faridabad, Panchkula, Jhajjar and Mewat) which are different with respect to the proportion of female 0-6 population in the urban region.

All districts are different expect 3 districts (Yamunanagar, Kaithal and Palwal) with respect to the proportion of females in the overall population.

All districts are different expect 4 districts (Yamunanagar, Kaithal, Gurgaon and Palwal) with respect to the proportion of females in rural region.

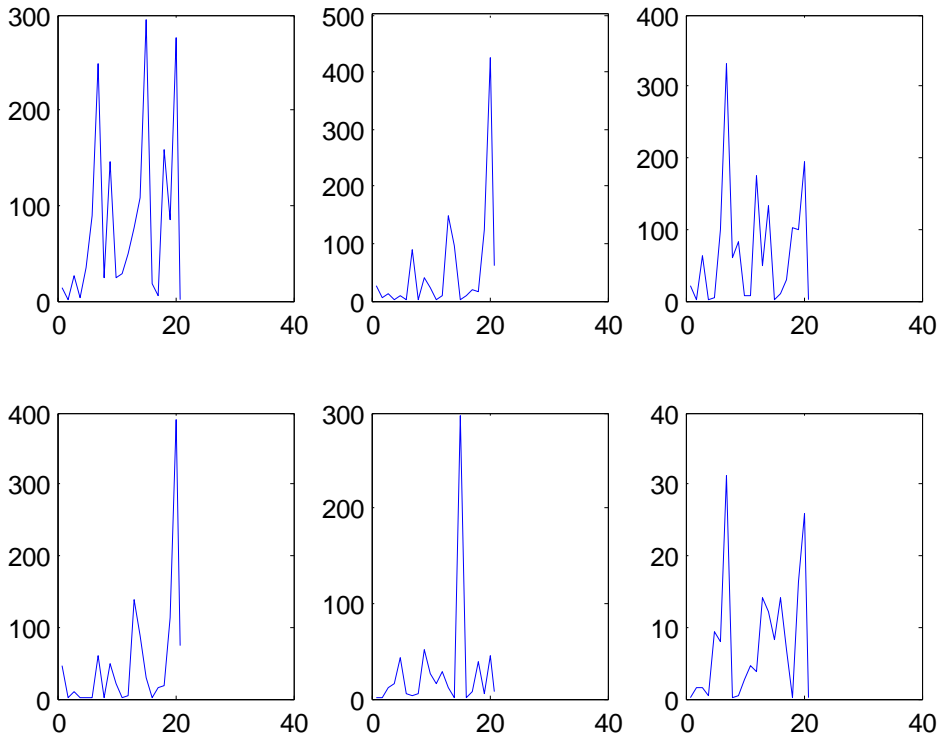
All districts are different expect 5 districts (Ambala, Yamunanagar, Sonipat, Rewari and Faridabad) with respect to the proportion of females in urban region.

We found that in case of overall 0-6 female population there are 15 districts in 2011 census which are different. And in case of overall female population 18 districts which are different.

Also, with respect to proportion of female 0-6 in the rural region for the data it was found that there are 13 districts which are different. And in case of proportion of female in the rural region 17 districts which are different.

Whereas, with respect to proportion of female 0-6 population in the urban region for 2011 census data it was found that there are 11 districts which are different. And in case of proportion of female in the urban region 16 districts which are different.

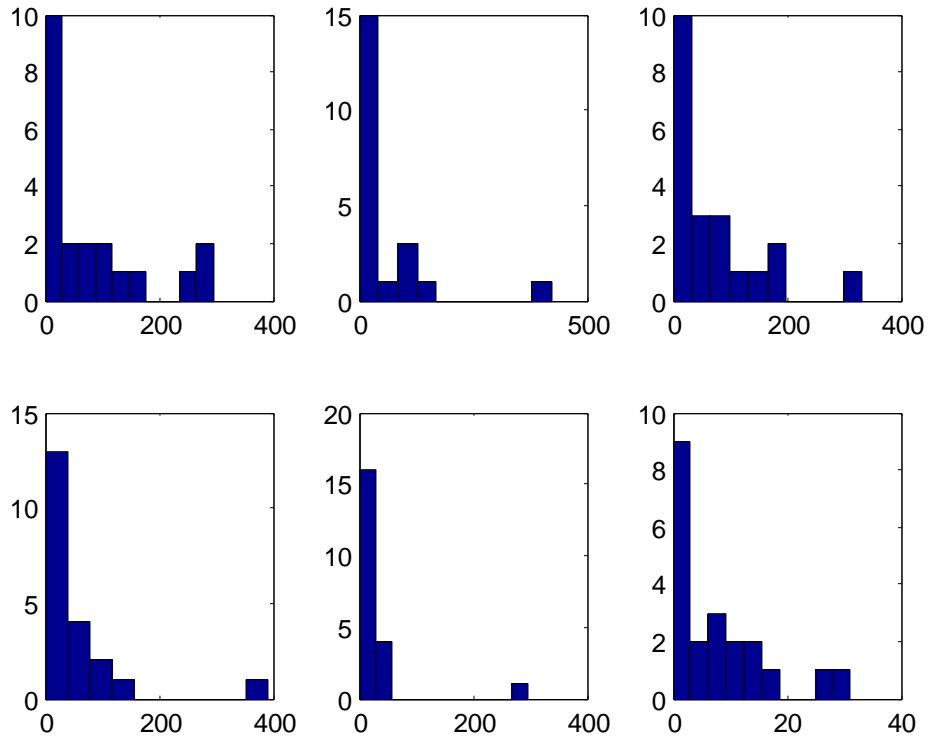
This justification can be seen in the Figure 1& 2 that is how the chi-square values are changing is displayed for the data.



X – Axis: Districts

Y – Axis: Chi – square values

Figure 1 (for 2011)



X – Axis: Chi – square values

Y – Axis: Districts

Figure 2 (for 2011)

Further, to know which district differs significantly with respect to all the other districts is analysed by considering the district data for 2011 census. The chi – square values have been calculated for six characteristics of the population for 2011 census and found that all the districts are different keeping some districts left with no difference. That is, this analysis shows that there is no improvement over these six characteristics from 2011 census.

We can understand that the 0-6 child sex ratio is quite different in almost all the districts of Haryana.

In the next section we want to study that whether these districts are similar or not with respect to 0-6 sex ratio etc is explored by the technique of clustering.

Cluster analysis is computed for finding the districts similarities for 2011 census with respect to six characteristics of the population separately and found that there is a difference within the districts and among the districts with respect to the six characteristics.

As there is no meaningful similarity obtained through the clustering approach, the data is analysed by a technique called Min-Maxion method to evaluate the data for the possible path with respect to the six characteristics of the population of 21 districts by taking chi-square values as distance matrix, which is non-metric and Min-maxion technique is applied to the distance matrix, (Pandit, 1961).

The path obtained is the optimal one in arranging them as changes of sex ratio. This can help in trying to link the possible causes of difference in sex ratio with those factors which change in similar way among the districts. For example Education, Transportation facilities, Industrialization etc. Thus, it is an exploratory tool which arranges districts according to gradual changes in sex ratios and suggesting to explore whether any other characteristics (like education, welfare groups etc) about the districts show a similar ordering. Also, by comparing all the paths it is observed that all the paths differ drastically with each other. Thus, the causes operating on the sex ratios may not be the same but differ from path to path for the 2011 data.

Path for overall adult male and overall adult female

Gurgaon → Sonipat → Panipat → Panchkula → Hisar →
Jind → Faridabad → Palwal → Yamunanagar → Kaithal →
Ambala → Karnal → Kurukshetra → Sirsa → Mewat →
Fatehabad → Mahendragarh → Rewari

Path for rural adult male and rural adult female

Rewari → Mahendragarh → Kurukshetra → Fatehabad → Mewat →
Ambala → Sirsa → Karnal → Bhiwani → Gurgaon →
Yamunanagar → Kaithal → Faridabad → Jhajjar → Jind →
Panipat → Panchkula → Sonipat → Rohtak

Path for urban adult male and urban adult female

Mewat → Fatehabad → Mahendragarh → Sirsa → Karnal →
Kaithal → Bhiwani → Palwal → Jind → Rewari →
Panchkula → Ambala → Sonipat → Faridabad → Yamunanagar →
Jhajjar → Panipat → Kurukshetra → Hisar

Path for overall 0-6 child male and overall 0-6 child female

Mahendragarh → Jhajjar → Rewari → Sonipat → Ambala →
Kurukshetra → Rohtak → Karnal → Yamunanagar → Kaithal →
Gurgaon → Bhiwani → Panipat → Jind → Faridabad →
Hisar → Fatehabad → Panchkula → Sirsa

Path for rural 0-6 child male and rural 0-6 child female

Mahendragarh → Jhajjar → Rewari → Ambala → Gurgaon →
Rohtak → Panipat → Yamunanagar → Kaithal → Karnal →
Faridabad → Bhiwani → Jind → Hisar → Fatehabad →
Panchkula → Sirsa

Path for urban 0-6 child male and urban 0-6 child female

Mewat → Panchkula → Panipat → Faridabad → Gurgaon →
Hisar → Sirsa → Fatehabad → Jind → Ambala →
Palwal → Kaithal → Yamunanagar → Kurukshetra → Rohtak →
Bhiwani → Karnal → Rewari → Jhajjar → Sonipat

Conclusion:

From the present analysis of the data for 2011 census of Haryana state, we could find that there is a difference between the six characteristics by applying chi-square test. Through cluster analysis we could find the similarities among the districts with respect to the six characteristics for 2011 census. We have explored by applying min-maxion technique for obtaining the possible path for the district wise patterns with respect to the six characteristics.

From this analysis we could find that drastic changes have taken place in Haryana during 2011 census and specifically we found that alarming changes has occurred in 0-6 child sex ratio during 2011 census.

Since in overall comparisons 0-6 child sex ratio is found to be lower in rural areas than in urban communities, reason for this anomaly needs looking in to. Does it imply larger female infant mortality in rural areas or is there a selective migration of families from rural to urban setting over a period of time.

An investigation about possible different mortality ratio of girl – infants in the rural and urban areas is perhaps in order. Also, the distribution of ‘last child’s sex and of the birth sequence, by sex in the families, and socio economic status of families may throw some light on this matter.

Therefore, continued monitoring of sex ratio can be of help in formulating and implementing policies to overcome the adverseness in the sex ratio. Hence, a five year sample survey for this sort of data should also be undertaken to take the stock of the situation for corrective action.

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