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Analysis of Sex Ratio in Punjab India (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 Punjab 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.

Keywords: 0-6 sex ratio, rural and urban groups, districts, Punjab, Census 2011, the lexisearch method.

Introduction

According to the Census of 2011, overall sex ratio at the national level has increased by 7 points since the 2001 census to reach 940 females per 1000 males¸ this is lower than 1961 when the figure stood at 941 females per 1000 males.

Despite introducing several laws on female foeticide and schemes to encourage the families to have a girl child, the sex ratio in India has gone down[1]. The child sex ratio has gone to 914 females per 1000 males which is the lowest record since independence. These numbers clearly state that the Indian society still prefers boys over girls such that they could have a security for their future. The ratio has gone down to 914 from 927 when the last census was taken[1]. The monotonic decline in the sex ratio over the last decade, despite the improving socio economic characteristics reinforces the existence of gender discriminatory practices which starts even before birth; which requires the urgent attention of public policy, as improving literacy and economic value of women is necessary but not sufficient for enhancing the relative life chances of girl child[2].

The ratio has gone down to 914 from 927 when the last census was taken. This points to the fact that economic growth and human development seldom moves together, when it comes to improving gender relations. However, this figure conceals the wide variation across the states in India and a distinct geographical pattern[3]. The state of Mizoram has the highest child sex ratio with 971 females per 1000 males, while Meghalaya has 970 per 1000 males. Normally, the states like Punjab and Haryana have lower sex ratio, but in the recent years, an increasing trend has been seen in the states. Haryana has 830 females while Punjab has 846 females per 1000 males.

The 2011 census highlighted this issue by devoting a full section on this subject[4]. 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, analyzed 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[5]. With reference to this we have analysed the data on Punjab state for the 2011 census.

The analysis of results in Punjab district wise 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 Punjab state has 20 districts and this data is analysed and results are reported in the succeeding sections.

Child sex ratio district level: From Table 1 it is observed that none of the districts in the state has the 0-6 child sex ratio above 916. It seems to be alarming stage that state should recover comprehensively as per this index is concerned. The district level data on child sex ratio provides further insight into the pattern that exists at this level within a state[6].

Keeping this point in view we have analysed the Punjab district level data with urban and rural segregation and found that an alarming situation exists in the districts of Punjab 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 considerably 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 2 gives totals of 20 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 2011census data.

Tables 3, 5 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 2011census data is 2120.8 with 1 d.f from table 6. 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.

Tables 7, 8 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 2011census data is 15.67 with 1 d.f. From these values it can be concluded that there is a 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 2 we have calculated the proportion of female and female 0-6 population for all 20 districts of Punjab state is calculated which are given in table 9.

From this analysis we can understand that there is no difference between rural and urban areas with respect to male population, female population and male 0-6 population, female 0-6 population for 2011 censuses which is quite misleading.
To see whether there is any difference within the 20 districts of Punjab 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.

Thus, the data findings with respect to chi-square test are tabulated in Table 10 for all the districts of Punjab for 2011 census.

From table 10 for 2011 we observe that there are 12 (Gurdaspur, Kapurthala, Jalandhar, Hoshiarpur, Shahib Bhagat Singh Nagar, Ludhiana, Moga, Muktasar, Patiala, Amritsar, Tam Taran, Rupnagar) districts which are differ with respect to proportion of female 0-6 population in overall population.

Also there are 13 (Gurdaspur, Kapurthala, Jalandhar, Hoshiarpur, Shahib Bhagat Singh Nagar, Ludhiana, Moga, Patiala, Amritsar, Tam Taran, Rupnagar, Sahibzada Ajit Singh Nagar and Sangrur) districts which are different with respect to proportion of female 0-6 population in rural region.

While there are 9 (Gurdaspur, Kapurthala, Jalandhar, Shahib Bhagat Singh Nagar, Ludhiana, Muktasar, Mansa, Amritsar, and Sangrur) districts which are differing with respect to proportion of female 0-6 population in urban region.

And there are 16 (Kapurthala, Jalandhar, Hoshiarpur, Shahib Bhagat Singh Nagar, Fatehgarh Sahib, Ludhiana, Faridkot, Bathinda, Mansa, Patiala, Amritsar, Tam Taran, Rupnagar, Sahibzada Ajit Singh Nagar, Sangrur and Barnala) districts which differ with respect to proportion of female population in overall population.

All the districts which are differ with respect to proportion of female population in rural region. There are 17 (Gurdaspur, Jalandhar, Hoshiarpur, Shahib Bhagat Singh Nagar, Fatehgarh Sahib, Ludhiana, Moga, Firozpur, Muktasar, Bathinda, Mansa, Patiala, Tam Taran, Rupnagar, Sahibzada Ajit Singh Nagar, Sangrur and Barnala) districts which are differ with respect to proportion of female population in urban region.

We found that in case of overall 0-6 female population there are 12 districts in 2011 census which are different. And in case of overall female population 16 districts which are different.

Also, with respect to proportion of female 0-6 in the rural region for 2011 census data it was found that there ar13 districts which are different. And in case of proportion of female in the rural region 20 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 9 districts which are different. And in case of proportion of female in the urban region 17 districts which are different.

This justification can be seen in the figure 1 and figure 2 that is how the chi-square values are changing is displayed for 2011 census data.

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 Punjab.

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 20 districts by taking chi-square values as distance matrix, which is non-metric and Min-maxion technique is applied to the distance matrix[7, 8].

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 male population and overall female population

Hoshiarpur	→	Shahid Bhagat Singh Nagar	→	Rupnagar	→	Jalandhar	→
Kapurthala	→	Tarn Taran	→	Muktsar	→	Firozpur	→
Patiala	→	Amritsar	→	Moga	→	Faridkot	→
Sangrur	→	Mansa	→	Sahibzada Ajit Singh Nagar	→	Barnala	→
Fatehgrh Sahib	→	Ludhiana					

Path for rural male population and rural female population

Sahibzada Ajit Singh Nagar	→	Bathinda	→	Barnala	→	Mansa	→
Fatehgarh Sahib	→	Moga	→	Patiala	→	Ludhiana	→
Faridkot	→	Muktsar	→	Firozpur	→	Tarn Taran	→
Amritsar	→	Rupnagar	→	Kapurthala	→	Jalandhar	→
Shahid Bhagat Singh Nagar	→	Hoshiarpur					

Path for urban male population and urban female population

Fatehgarh Sahib	→	Gurdaspur	→	Bathinda	→	Barnala	→
Firozpur	→	Kapurthala	→	Faridkot	→	Amritsar	→
Jalandhar	→	Sangrur	→	Sahibzada Ajit Singh Nagar	→	Moga	→
Tarn Taran	→	Muktsar	→	Mansa	→	Rupnagar	→
Shahid Bhagat Singh Nagar	→	Hoshiarpur					

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

Shahid Bhagat Singh Nagar	→	Jalandhar	→	Kapurthala	→	Hoshiarpur	→
Rupnagar	→	Moga	→	Bathinda	→	Faridkot	→
Firozpur	→	Barnala	→	Fatehgarh Sahib	→	Sahibzada Ajit Singh Nagar	→
Sangrur	→	Mansa	→	Muktsar	→	Amritsar	→
Tarn Taran	→	Gurdaspur					

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

Jalandhar	→	Shahid Bhagat Singh Nagar	→	Hoshiarpur	→	Moga	→
Rupnagar	→	Faridkot	→	Bathinda	→	Barnala	→
Mansa	→	Fatehgarh Sahib	→	Muktsar	→	Patiala	→
Sangrur	→	Amritsar	→	Sahibzada Ajit Singh Nagar	→	Gurdaspur	

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

Kapurthala	→	Shahid Bhagat Singh Nagar	→	Rupnagar	→	Sangrur	→
Jalandhar	→	Hoshiarpur	→	Ludhiana	→	Sahibzada Ajit Singh Nagar	→
Fatehgarh Sahib	→	Moga	→	Firozpur	→	Faridkot	→
Tarn Taran	→	Barnala	→	Muktsar	→	Amritsar	→
Mansa	→	Gurdaspur					

Table-1
Distribution of districts by range of 0-6 child sex ratio of Punjab state: 1991, 2001, 2011

Child sex ratio (0-6)	**Number of Districts**		
	1991	**2001**	**2011**
880 & below	8	17	19
881-915	4	0	1
916-950	0	0	0
951-985	0	0	0
986 &above	0	0	0

* Data source: Data C. D's from Census India-1991, 2001 and 2011

Table-2
Totals of 20 districts for each of six groups (for 2011 data)

	Population	**Male**	**Female**	**Pop 0-6**	**Male 0-6**	**Female 0-6**
Total	27743338	14639465	13103873	3076219	1665994	1410225
Rural	17344192	9093476	8250716	1945502	1055297	890205
Urban	10399146	5545989	4853157	1130717	610697	520020

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

Table-3
Observed frequencies of overall population (for 2011 data)

	Male	**Female**
Rural	9093476	8250716
Urban	5545989	4853157

Calculation of Expected frequencies

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

For example: Expected frequency of the value 9093476 (from Table 4)

= (17344192 * 14639465)/27743338 = 9152096

Similarly the other Expected frequencies computed and are tabulated in Table 5.

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

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

Oi = Observed frequency of the given data, *Ei* = Expected frequency

r = Number of rows, s = Number of columns

Table-4
Observed frequencies of overall population (for 2011 data) along with row and column totals

	Male	Female	Row Total
Rural	9093476	8250716	17344192
Urban	5545989	4853157	10399146
Column Total	14639465	13103873	27743338

Table-5
Expected frequencies of overall population (for 2011 data)

	Male	Female
Rural	9152096	8192096
Urban	5487369	4911777

Table-6
Computation of Chi-square value for overall population (for 2011 data)

Observed frequency (*Oi*)	Expected frequency (*Ei*)	$\frac{(Oi-Ei)^2}{Ei}$
9093476	9152096	375.4659
8250716	8192096	419.4653
5545989	5487369	626.22
4853157	4911777	699.6043
		(Chi-square) $x^2 = \sum_{i=1}^{n} \frac{(Oi-Ei)^2}{Ei}$ = 2120.8

*Observed and Expected frequencies from Tables 3, 4

Table-7
Observed frequencies of overall 0-6 population (for 2011 data)

	Male	Female
Rural	1055297	890205
Urban	610697	520020

Table-8
Expected frequencies of overall 0-6 population (for 2011 data)

	Male	Female
Rural	1053629	891872.6
Urban	612364.6	518352.4

Table-9
Proportion of female, female 0-6 of 20 districts (for 2011 data)

	Male	Female	Male 0-6	Female 0-6
Total	0.5277	0.4723	0.5424	0.4576
Rural	0.5416	0.4584	0.5333	0.4667
Urban	0.5243	0.4757	0.5401	0.4599

Table-10
Chi-square values for the proportion of overall female population, female 0-6 population of 20 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
Gurdaspur	0	59.1*	30.6*	33.4*	165.4*	23.4*
Amritsar	27.8*	43.2*	4.6*	16.0*	1.2	33.1*
Firozpur	1.8	0	11.7*	1.1	4.0*	0.8
Ludhiana	536.0*	24.3*	49.7*	13.0*	217.0*	6.4*
Jalandhar	276.3*	58.9*	607.0*	59.7*	28.0*	7.7*
Kapurthala	72.3*	17.8*	85.1*	4.7*	1	18.7*
Hoshiarpur	2006.1*	18.7*	1517.8*	21.0*	197.3*	1.5
Rupnagar	83.5*	6.5*	21.1*	4.5*	46.2*	3
Patiala	10.4*	7.3*	91.6*	12.4*	58.9*	0
Sangrur	52.1*	2.6	191.4*	12.5*	25.1*	5.8*
Bathinda	319.0*	2.8	304.9*	2.1	49.3*	0.7
Faridkot	4.4*	0.4	6.8*	1.8	0.3	0.5
Fatehgarh Sahib	112.6*	0.4	67.1*	1	72.2*	0.2
Moga	1	7.1*	40.4*	10.4*	16.9*	0
Muktsar	0.4	8.5*	15.1*	3.2	18.5*	5.6*
Mansa	34.0*	3.5	127.1*	0.3	12.2*	6.5*
Shahid Bhagat Singh Nagar	630.6*	30.5*	421.9*	26.4*	94.0*	6.2*
Tarn Taran	7.3*	33.3*	11.2*	27.5*	9.3*	1.5
Sahibzada Ajit Singh Nagar	78.5*	1.1	226.5*	9.8*	35.0*	1.1
Barnala	72.4*	0.3	86.4*	0.2	8.0*	2.2

* indicates difference in the characteristics considered, in the table which are given in the above table.

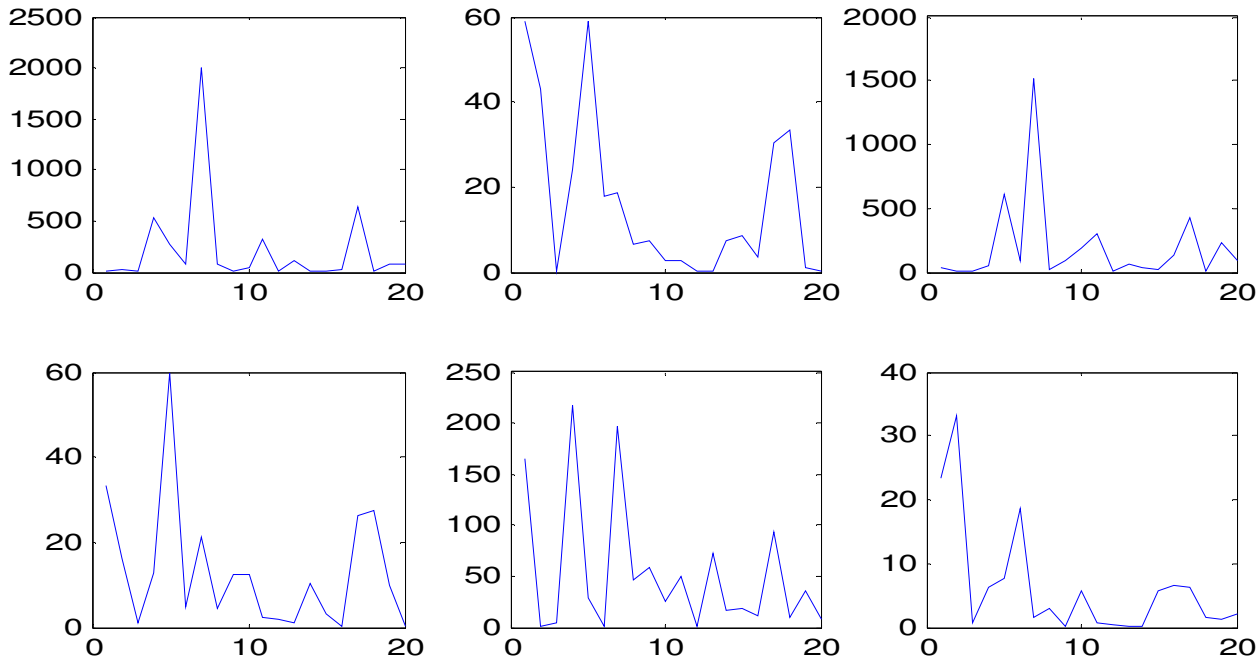

Figure-1
X – Axis: Districts, Y – Axis: Chi – square values (For 2011)

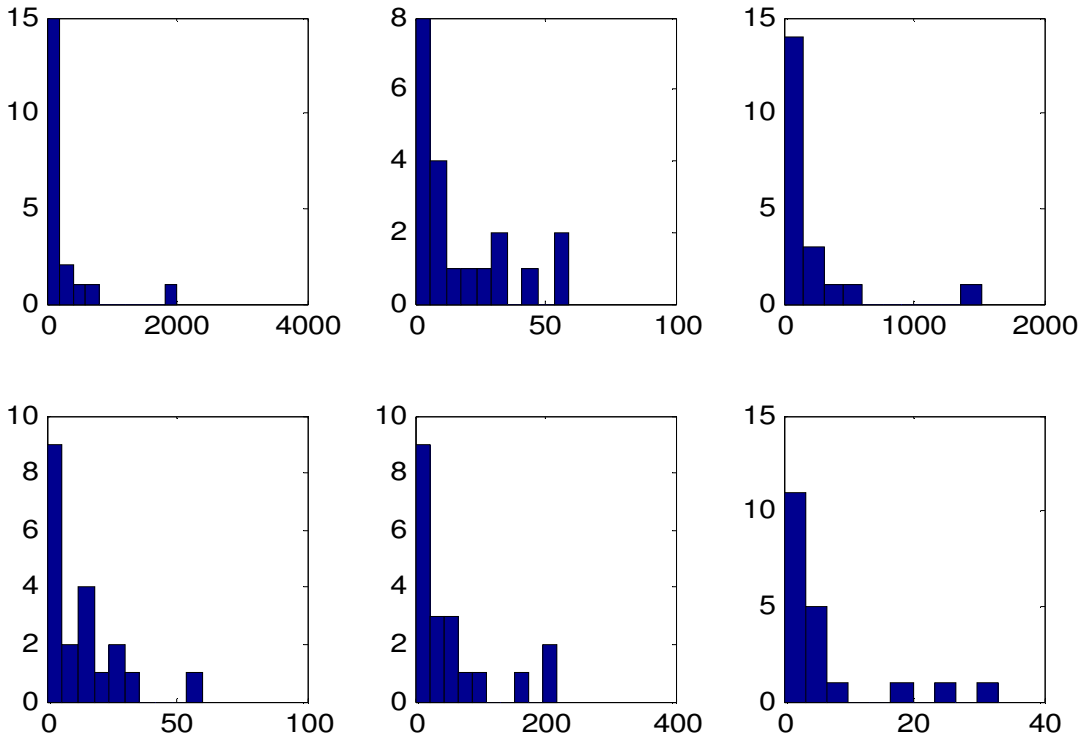

Figure-2
X – Axis: Chi – square values, Y – Axis: Districts, (For 2011)

Indicates the histograms of the values

Conclusion

From the analysis of the data for 2011 census of Punjab 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 the possible path for the district wise patterns with respect to the six characteristics.

From the analysis we could find that drastic changes have taken place in Punjab during 2011census 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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