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Geo Spatial Distribution of Population Density, Literacy and Some Diseases in Tribal Area in Visakhapatnam District, Andhra Pradesh, India

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Abstract: *A map demonstrated 1000 words, theme based maps can express their theme truly that's why I choose the total population density and literacy as well as some disease which alarming in tribal area in mandal wise to select. Maps make us aware of events, help us understand their contexts, and determine how such events will affect our futures*

Background: *In this paper we focused on to find out spatial variation in population density and their literacy conditions and some diseases (HIV/AIDS and Leprosy) in study area.*

Methodology*: We used Geographical information system for generating distinct geo spatial maps in the western hilly area (11 Mandals). In GIS we used the dot method and Jenks natural breaks method for spatial assessment of diseased incidence and SPSS for descriptive analysis in study area.*

Key Words: Population Density, Literacy, HIV//AIDS, Leprosy, Dengue, Malaria and Arc GIS 10.4.1.

1. INTRODUCTION

Visakhapatnam district is one of the districts in northern Andhra Pradesh on the Indian east coast which is undergoing rapid urbanization growth since the past decades. In this study the Visakhapatnam district is divided in to two regions like the Western hilly area and the coastal plain area. For this study we chosen only the western hilly area .HIV/AIDS and Leprosy are one of the foremost Infectious diseases. Infectious diseases may occur either during primary or secondary infection. The distribution of Aedes vector, it is found in tropical and subtropical areas (Minhas and Sekhon 2013). It is emerging and re-emerging in the tropics and currently poses the most significant arboviral threat to humans (Sivagnaname and Gunasekaran 2012). The spatial dynamics of vector-borne diseases and vector populations (Eisen and Eisen 2011). GIS technologies have been applied in epidemiological public health studies for many years (Ali et al. 2003; Wu et al. 2009; Rotela et al. 2007). GIS and spatial analysis are great tools in addressing epidemiologic issues, allowing the identification of critical areas and variables intimately related to the modulation of the disease dynamics (Mondini, and Chiaravalloti-Neto 2008; Twumasi and Merem 2005). Spatial analyses and statistics, such as spatial autocorrelation analysis, cluster analysis, temporal analysis, are commonly used to highlight spatial patterns of diseases and to analysis, whether there is a pattern of disease prevalence in a particular area (Brownstein et al. 2002; Tsai et al. 2009; Pace et al. 1998; Ping et al. 2004). The outbreak of dengue in Kanyakumari district in July 2003 proved the presence of dengue serotype 3 viruses in that area (Paramasivan et al. 2006). The earlier studies, shows the use of modern technologies, including GIS, remote sensing which has expanded in dynamic urban areas for mapping of land use land cover studies, especially for planning purposes. Demonstrated the potential of the remote sensing and GIS in accurate mapping of the urban areas of the major cities of Delhi (Sokhi et al., 1989), Mumbai (Pathan *et al*., 1989), Calcutta (Pathan *et al.*, 1991), Ahmedabad (Pathan *et al.*, 1991), Bangalore (2001), Madras (Pathan *et al*., 1988), Hyderabad (Madhavi *et al*., 2001), etc., in India. Current study took to understand of the spatial distribution of population density, literacy, and their influence on disease incidences such as HIV/AIDS, Leprosy in eleven mandals in tribal area.

2. Study Area

Visakhapatnam is the northern most districts in Andhra Pradesh State, which lies between the latitudes 17°58'N to 82°58'E latitudes and longitudes (Fig.1). Visakhapatnam district bounded by on the north Odisha State, on east Vizianagaram district, on the south bay of Bengal and on the west East Godavari. The Visakhapatnam district is administratively divided into four revenue divisions namely they are Anakapalle, Paderu, Narisipatnam and Visakhapatnam. The Visakhapatnam district contains 43 mandals and 1743 villages. And physiographically is divided in to two distinct regions such as hilly region (HR) and coastal region (CR). The coastal region covers an area of 4928 sq.km and lies below 100 m elevation and few hills are above 300m. The hilly region which lies in the Eastern Ghats rises above 600-1500 m elevation and it occupies an area of 6233 sq. km. The district covers an area of 11,161 Km^2. The total population of the district according to 2011 census is 4.29 million, out of total population the coastal region accounts for 3.69 million (86%). and the hilly region accounts for 0.66 million (14%) The average total population density of

Visakhapatnam is 343 per /sq.km, the coastal region has the highest density of 829 per /sq.km. Tribal population constitute 14.42% in Visakhapatnam, and 5.53% in Andhra Pradesh, and the sex ratio of Visakhapatnam is 1003 for every 1000 males and literacy rate is 67.7%. We could give the specific representative number (1 to 43) to all the 43 mandalas in study area; generally where the maximum and minimum values discovered there was used the specific representative number respectively.

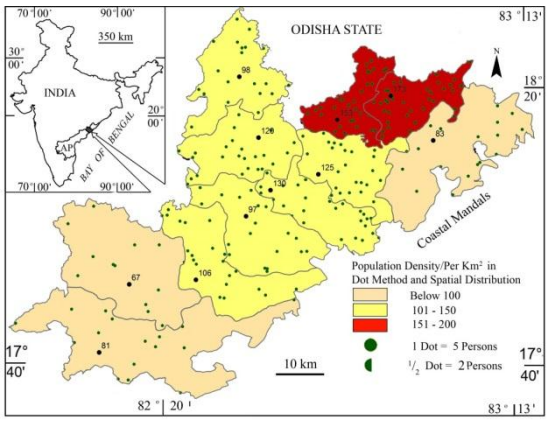


Fig.1 Map showing the 11 Mandals in tribal area. Dot Method and Spatial Distribution of Density, Inset shows Location of Visakhapatnam in Andhra Pradesh in India.

2.1 Objectives of the Study

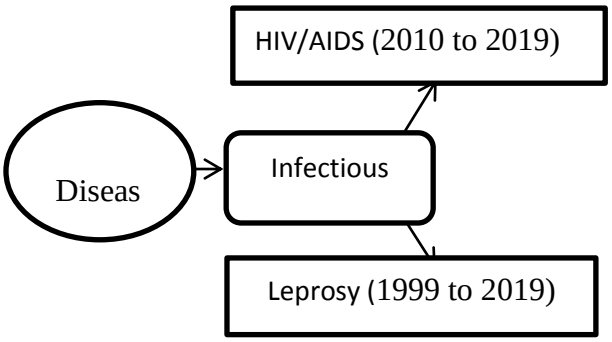
1. To assess the descriptive statistics of total population density and literacy in tribal Mandals.
2. To figure out the spatial distribution of density, literacy and Sex ratio through GIS environment.
3. Assessment of disease incidences and their distribution in in uneven terrain.

3. Data and Methodology

In this study, acquired the secondary data (2011 census) from population center, library and publications. In this study we used SPSS for descriptive analysis and Geographical information system for generating spatial maps like dot method which is a cartographic representation method to visualise discrete absolute values and their spatial distribution mandal wise in tribal area. Total population Data obtained from the Visakhapatnam handbook 2016 and the diseased data collected from the District Medical and Health office and Primary health canters in tribal area.

The data sets of diseases which we used in study they were.

- HIV/AIDS dataset used from 2010 to 2019.
- Leprosy dataset used from 1999 to 2019.



4. Total Population Density in Tribal Mandals

To achieve this, dots equal in size and represented value are used. According to the dot value, a certain number of dots are used to depict a data value. These dots usually form dot clusters. The data value needs to be rounded to a multiple of the dot value. It is possible to roughly determine the visualised data value by counting the dots and multiplying this number with the dot value. (Annette Hey & Ralf Bill (2014). In this paper presented a dot method to automatically create a dot representation of a dot map from given statistical data that needs GIS cartographic expertise. The dot representation may be combined with other elements, such as a topographic background, to form a complete map. Figure.1 states the spatial distribution of population density in 11 mandals of tribal area. Here we founded the eleven mandals population densities, densities could demonstrated through dot method by figure 1, the figure showing the 11 mandals among the tribal, the total average population density in tribal area is 112. The maximum densities recorded in two mandals namely Araku Valley (173) and Dumbriguda (153) then average tribal population density, which came under class V towns in tribal area. According to Figure 1 six mandals were between 101- 150 population density they are Paderu with 130, Hukumpeta with 125, 120 in Peda Bayalu, Chintapalle with 106, The northern most mandal Munching Puttu with 98. On the other hand only three mandals recorded below 100 population density in tribal mandals such as Ananthagiri with 83, Koyyuru with 81 and G.K.Veedhi with 67 which recorded very low population density in tribal area.

5. Total Population Literacy Rate

Education plays a key role in any nation's socio economic progress. According to the 2011 census India literacy rate is 69.1 as well as Andhra Pradesh contains 33rd rank with 67.4%. Visakhapatnam constitutes 66.91% in state.

The total literacy rate spatially interpreted in study based on secondary data (2011 Census). The classification shows its statistic's, it took eleven mandals, the maximum literacy of tribal area is 60.01% and minimum is 38.52% as well as mean is 44.39. Literacy range in tribal mandals is around 21.49% .When compare, maximum literacy is very close to the total literacy of Visakhapatnam district one of the mandals in tribal area. Standard deviation of literacy dataset with low standard deviation of 6.6; it meant all the values are very close to the literacy mean (44.39) in tribal area. On the map we represent the quantities of literacy with graduated symbols in various sizes which we used natural break method of Jenks GIS. The legend of map shows literacy graduated symbol size is 10 to 30 inches in Arc GIS. Figure.2 represents visualized literacy rates of Visakhapatnam tribal mandal. Maximum literacy rate noticed in Paderu with 60.01%, minimum literacy occurred in G.Madugula with 38.52%. Study area. Araku Valley stood second position with 53.45% and followed by Koyyuru with 48.83%, G.K.Veedhi with 43.08% Hukumpeta with 43.05%, and Munching Puttu and Peda Bayalu has 39.05 and 38.99% literacy. Ananthagiri with 38.86 %. Paderu was dominated in Male and female literacy than rest of the mandals in study, minimum female literacy recorded in Peda Bayalu mandal.

Very lowest literacy rate noticed mandals shown on the map, according to 2011 census cartographically visualized. They are G.Madugula, Ananthagiri, Peda Bayalu, and Munching Puttu; those were backward in literacy in tribal area. Dumbriguda, Hukumpeta, Chintapalle and G.K.Veedhi mandals between 40 % to 50% literacy range. Only one Araku Valley occurred between 51% to 60% and above sixty only Paderu identified. The spatial interpretation of literacy is very useful to tribal scenario in geographical perspective.

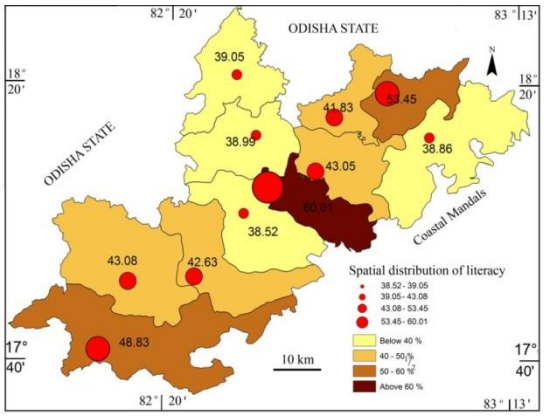


Fig. 2 showing the spatial distribution of literacy in tribal mandals.

6. Infectious diseases

In this paper we focused on two infectious diseases which mostly occurred in any region. They are HIV/AIDS and Leprosy. A disease is a particular abnormal condition that negatively affects the structure or function of all or part of an organism, and that is not due to any immediate external injury. ("Disease" at *Dorland's Medical Dictionary).* A condition of the living animal or plant body or of one of its parts that impairs normal functioning and is typically manifested by distinguishing signs and symptoms (WHO)

Infectious diseases are illnesses caused by beings - such as viruses, bacteria, parasites or fungi. Many organisms live in and on our bodies. They're normally harmless or even helpful. But under certain conditions, some organisms may cause disease.

Leprosy is a chronic, curable infectious disease mainly causing skin lesions and nerve damage. Leprosy is caused by infection with the bacterium Mycobacterium leprae. It mainly affects the skin, eyes, nose and peripheral nerves. Symptoms include light-colored or red skin patches with reduced sensation, numbness and weakness in hands and feet. Leprosy can be cured with 6-12 months of multi-drug therapy. Early treatment avoids disability.

HIV can be transmitted via the exchange of a variety of body fluids from infected people, such as blood, breast milk, semen and vaginal secretions. HIV can also be transmitted from a mother to her child during pregnancy and delivery. Individuals cannot become infected through ordinary day-to-day contact such as kissing, hugging, shaking hands, or sharing personal objects, food or water. The signs and symptoms of HIV vary depending on the stage of infection. Though people living with HIV tend to be most infectious in the first few months after being infected, many are unaware of their status until the later stages. In the first few weeks after initial infection people may experience no symptoms or an influenza-like illness including fever, headache, rash or sore throat.

The major global health issue, having claimed almost 33 million people at the end of 2019 (WHO). Due to gaps in HIV services, 690 000 people died from HIV-related causes in 2019 and 1.7 million people were newly infected. The age group 15-49 was 62% infected in 2019 according to W.H.O. 25.7 million People infected by HIV in African region at the end of 2019, an estimated 81% of people living with HIV knew their status. 67% were receiving antiretroviral therapy (ART) and 59% had achieved suppression of the HIV virus with no risk of infecting others. Antiretroviral therapy took by 25.4 million people at the end of 2019. Due to national HIV programmes supported by civil society, HIV-related deaths fell by 51% and new HIV infections fell by 39%,

15.3 million lives saved by ART Between 2000 and 2019 (Global health sector strategy on HIV, 2016-2021). HIV/AIDS is an epidemic in India. The National AIDS Control Organisation (NACO) estimated that 2.11 million people lived with HIV/AIDS in India in 2015.

Geo-spatial analysis of total HIV/AIDS incidences

Spatial distribution of disease provide information of areas which are more prone to the disease. Based on data availability. Spatial maps were generated in GIS environment based on the data derived from Primary Health

Centres of the district The total incidence of HIV/AIDS based on cases reported in PHC's of mandal in the tribal area of Visakhapatnam district indicates that Paderu was recorded highest number of HIV/AIDS cases in the tribal area. A total of 632 cases were reported. Paderu recorded maximum number of cases with 329 cases followed by Araku valley with 254 cases and Chintapalle with 12 cases. Munching Puttu and Koyyuru each having 10 cases. Dumbriguda and G.K.Veedhi each with five cases. Minimum cases were reported from Ananthagiri with 3 cases followed by G.Madugula With four cases. HIV/AIDS incidence was at its peak Paderu and Araku Valley these two mandals identified as HIV/AIDS prone mandals during 2010 to 2019.in the tribal area because of the Araku Valley and Paderu class V towns; however Araku Valley is the attracted tourists which have Borra Caves. So tourist places are showing high incidence of HIV/AIDS cases. In tribal area Pedda Bayalu and Hukumpeta did not reported even a HIV/AIDS cases during 2010 to 2019.

Figure 3.Aexplains clearly the incidence of HIV/AIDS in tribal Mandals. According to the standard deviation classification method. Classified in to four classes, like low (<-0.50), moderate (< -0.50 – 0.50), high (0.50 – 1.5) and very high (1.5 – 2.4). Based on standard deviation method statistics in GIS maximum cases recorded 632 and minimum cases 0. The mean is 57 and the median is 5. Similarly, the standard deviation is 111. Spatial distribution of HIV/AIDS incidences according to the classification Peda Bayalu and Hukumpeta could not record any cases.so those two Mandal in low incidence category. Around 7 mandals namely two northeast mandals (Ananthagiri and Dumbriguda) and the northernmost mandal Munching Puttu. show their incidence in the moderate category with -0.50 – 0.50. On the other hand Koyyuru, Chintapalle, G.K.Veedhi, and G.Madugula in the moderate category. No high category mandals identified in terms of HIV/AIDS incidence in the tribal area. Only two mandals were in the very high category they are Paderu and Araku Valley which were in class V towns in the tribal area. Paderu and Araku Valley are very high prone mandals in the tribal area.

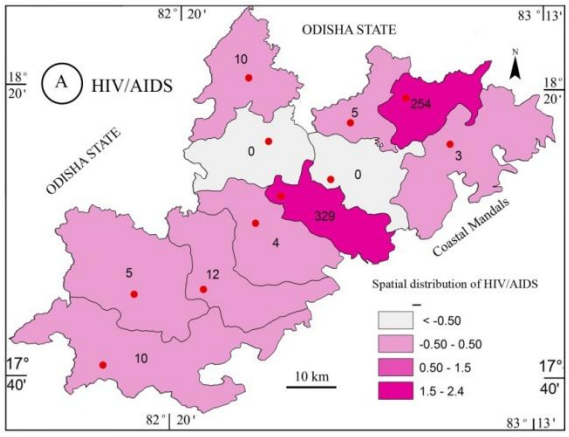


Fig.3 A. representing the incidences of HIV/AIDS in Tribal area.

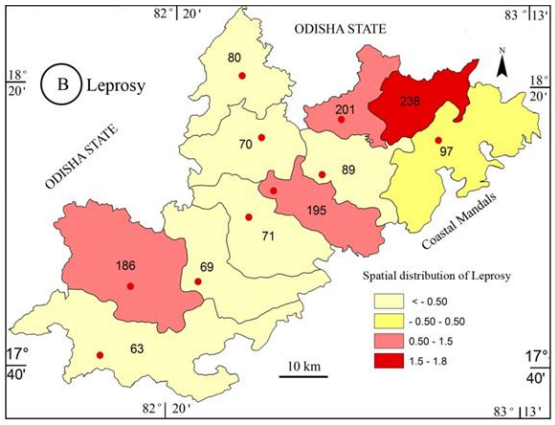


Fig.3 B. Representing the incidences of HIV/AIDS in Tribal area.

The above figure 3.B shows the Spatial distribution of leprosy disease information of areas which were more prone to the disease. Based on data availability. The total incidence of Leprosy based on cases reported in PHC's of mandal in the tribal area of Visakhapatnam district indicates that Araku Valley was recorded highest number of Leprosy cases in the tribal area. A total of 1359 cases were reported. Araku valley recorded maximum number of cases with 238 cases followed by Dumbriguda with 201 cases and Paderu stood in third position in leprosy incidence with 195 cases. The western most mandal of tribal area namely G.K.Veedhi stood in fourth place with 186 cases. Ananthagiri with 97 cases and Hukumpeta with 89 cases recorded. 80 cases reported in Munching Puttu, 70 and 71 cases were recorded in Peda Bayalu and G.Madugula, Chintapalle and Koyyuru contribute their share in incidences were 69 and 63 cases during 2010 to 2019 in tribal area.

Based on the standard deviation classification Leprosy also classified in four categories which classify spatially in tribal area. The Low category (< - 0.50), the low category cases absent in tribal region. It meant no mandal has free from leprosy. Moderate category (-0.50-

0.50) noticed in Ananthagiri. The high Category (0.50-1.5) incidence was noticed in Dumbriguda, G.Madugula and G.K.Veedhi. The very high (1.5-1.8) Category incidences found in Araku valley with 238 cases. The standard deviation classification reveals that very high prone mandal was Araku Valley and high prone mandals were Dumbriguda, G.Madugula and G.K.Veedhi from 1999 to 2019 period in tribal area.

7. Conclusion

In this study mainly focused on population density and literacy. Maximum population density founded in Araku Valley and Dumbriguda in tribal area. Araku valley population density and literacy stood in second position as well as very high prone category in HIV/AIDS and Leprosy incidences during study period. Dumbriguda stood moderate prone in HIV/AIDS and high prone category in leprosy. One more mandal Paderu identified as very high prone category in HIV/AIDS and in the case of leprosy it was in high prone category in tribal area. Rest of the mandals in study area was moderately prone in both the diseases, except Ped Bayalu and Hukumpeta free from the HIV/AIDS incidences during study period.

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References:

1. Minhas, S., & Sekhon, H. (2013). Entomological survey of Dengue vector in an institutional campus to determine whether potential of Dengue outbreak exists. International Journal of Medical and Applied Science, 2(4), 164. ISSN:2320-3137.

2. Sivagnaname, N., & Gunasekaran, K. (2012). Need for an efficient adult trap for the surveillance of dengue vectors. The Indian Journal of Medical Research, 136(5), 739.

3. Ali, M., Wagatsuma, Y., Emch, M., & Breiman, R. F. (2003). Use of a geographic information system for defining spatial risk for dengue transmission in Bangladesh: Role for Aedes albopictus in an urban outbreak. American Journal of Tropical Medicine and Hygiene, 69(6), 634–640. https:// doi.org/10.4269/ajtmh.2003.69.634

4. Eisen, L., & Eisen, R. J. (2011). Using geographic information systems and decision support systems for the prediction, prevention, and control of vector-borne diseases. Annual Review of Entomology, 56, 41–61. https://doi.org/10.1146/ annurev-ento-120709-144847.

5. Rotela, C., Fouque, F., Lamfri, M., Sabatier, P., Introini, V., Zaidenberg, M., et al. (2007). Space-time analysis of the dengue spreading dynamics in the 2004 Tartagel outbreak, Northern Argentina. Acta Tropica, 103, 1–13.

6. Wu, P. C., Lay, J. G., Guo, H. R., Lin, C. Y., Lung, S. C., & Su, H. J. (2009). Higher temperature and urbanization affect the spatial patterns of dengue fever transmission in subtropical Taiwan. Science of the Total Environment, 407(7), 2224–2233. https://doi.org/10.1016/j.scitotenv.2008.11. 034.

7. Mondini, A., & Chiaravalloti-Neto, F. (2008). Spatial correlation of incidence of dengue with socioeconomic, demographic and environmental variables in a Brazilian city. Science of the Total Environment, 393(2–3), 241–248. https://doi.org/10.1016/j.scitotenv.2008.01.01 0.

8. Twumasi, Y. A., & Merem, E. C. (2005). GIS applications in land management: The loss of high quality land to development in central Mississippi from 1987–2002. International Journal of Environmental Research and Public Health, 2(2), 234–244.

9. Brownstein, J. S., Rosen, H., Prudy, D., Miller, J. R., Merlino, M., Mostashari, F., et al. (2002). Spatial analysis of West Nile Virus: Rapid risk assessment of an introduced vectorborne zoonosis. Vector Borne Zoonotic Diseases, 2(3), 101–112. https://doi.org/10.1089/15303660260613729.

10. Pace, R. K., Barry, R., & Sirmans, C. F. (1998). Spatial statistics and real estate. The Journal of Real Estate Finance and Economics, 17(1), 5–13. https://doi.org/10.1023/A: 1007783811760

11. Ping, J. L., Green, C. J., Zartman, R. E., & Bronson, K. F. (2004). Exploring spatial dependence of cotton yield using global and local autocorrelation statistics. Field Crops Research, 89(2–3), 219–236. https://doi.org/10.1016/j.fcr. 2004.02.009.

12. Paramasivan, R., Thenmozhi, V., Hiriyan, J., Dhananjeyan, K. J., Tyagi, B. K., & Dash, A. P. (2006). Serological & entomological investigations of an outbreak of dengue fever in certain rural areas of Kanyakumari district,

Tamil Nadu. Indian Journal of Medical Research, 123(5), 697.

13. Paulo Fernandez, Sandra Mourato & Madalena Moreira (2016) Social vulnerability assessment of flood risk using GIS-based multicriteria decision analysis. A case study of Vila Nova de Gaia (Portugal), Geomatics, Natural Hazards and Risk, 7:4, 1367-1389,

14. Sokhi B.S., Sharma N.D and Uttawar P.S., 1989: Satellite Urban sprawl mapping and monitoring – a case study of Delhi, Photonirvachak, Journal of Indian society and Remote sensing, Vol...17, No.3.

15. ZPathan S.K., Jothmani P., Som N.N., and Kalyan Mukhrjee. 1989: Urban landuse studies of Calcutta Metropolitan development authority area using Remote sensing techniques, scientific report, Space Application Centre, Calcutta Metropolitan Development authority, pp. 1-71.

16. Pathan S.K., Jothimani P., Parikh, N.B., Shukla V.K., Patel R.G., Shah D.C., Patel B.R., and Mehta K.S 1991: Urban land use studies of Ahmedabad urban development authority area using Remote sensing techniques, scientific report, SAC, pp. 1-48.

17. Pathan S.K., and Jothimani P., 1988: Comparison of IRS – 1 A / LISS – II and Landsat/TM data for mapping different urban land features – a case study of Madras Metropolitan Region, NNRMS Bulletin, 11.

18. Madhavi Lata K., Krishna Prasad V., Badrinath K.V.S., Raghava Swamy V., and Sankar Rao Ch., 201: Measuring Urban Sprawl: A case study of Hyderabad, GIS Development, Vol.5, pp.1-2.

19. Hazel R Barrett, Angela Browne. (1993) Workloads of rural African women: The impact of economic adjustment in Sub-Saharan Africa. Journal of Occupational Science 1:2, pages 3-11.

20. M. Anne Hill & Elizabeth King (1995) Women's education and economic well-being, Feminist Economics, 1:2, 21-46, DOI: 10.1080/714042230.

21. Patel, I., & Dighe, A. (1997). Gender issues in literacy education. Journal of Educational Planning and Administration, *11*(2), April, 16.

22. Arun Kumar Ghosh., (2006) the gender gap in literacy and education. Pp.109-125.

23. Karlekar, Malavika. 2000 'Girls' access to schooling: An assessment', in Rekha Wazir (ed.): The gender gap in basic education: NGOs as agents of change (80-114). New Delhi: Sage Publications.

24. Desai, S. & Joshi, O. Indian Journal of Labour Economics. (2019) 62: 55. https://doi.org/10.1007/s41027-019-00162-z

25. The global economy.com.

26. Dasgupta, S., and S.S. Verick (Eds.). 2017. Transformation of women at work in Asia: An unfinished development agenda. Los Angeles: Sage.

27. Ashok Mathur (1994) Work participation, gender and economic development: A quantitative anatomy of the Indian scenario, The Journal of Development Studies, 30:2, 466-504.

28. Annette Hey & Ralf Bill (2014) Placing dots in dot maps, International Journal of Geographical Information Science, 28:12, 2417-2434, DOI: 10.1080/13658816.2014.928822.

29. (Global health sector strategy on HIV, 2016-2021).

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