

Spatial Analysis and Determinants of Number of Antenatal Health Care Visit Among Pregnant Women in Ethiopia: Application of Spatial Multilevel Count Regression Models

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Abstract : Background: Antenatal care (ANC) is an essential element in the continuum of reproductive health care for preventing preventable pregnancy-related morbidity and mortality. Objective: The aim of this study is to assess the spatial pattern and predictors of ANC visits in Ethiopia. Method: This study was done using Ethiopian Demographic and Health Survey data of 2016 among 7,174 pregnant women aged 15-49 years which was a nationwide community-based cross-sectional survey. Spatial analysis was done using Getis-Ord G_i^* statistics to identify hot and cold spot areas of ANC visits. Multilevel glmmTMB packages adjusted for spatial effects were used in R software. Spatial multilevel count regression was conducted to identify predictors of antenatal care visits for pregnant women, and proportional change in variance was done to uncover the effect of individual and community-level factors of ANC visits. Results: The distribution of ANC visits was spatially clustered Moran's $I = 0.271$, $p < 0.001$, ICC = 0.497, $p < 0.001$). The highest spatial outlier areas of ANC visit was found in Amhara (South Wollo, Weast Gojjam, North Shewa), Oromo (west Arsi and East Harariga), Tigray (Central Tigray) and Benishangul-Gumuz (Asosa and Metekel) regions. The data was found with excess zeros (34.6%) and over-dispersed. The expected ANC visit of pregnant women with pregnancy complications was higher at 0.7868 [ARR= 2.1964, 95% CI: 1.8605, 2.5928, p-value < 0.0001] compared to pregnant women who had no pregnancy complications. The expected ANC visit of a pregnant woman who lived in a rural area was 1.2254 times higher [ARR=3.4057, 95% CI: 2.1462, 5.4041, p-value < 0.0001] as compared to a pregnant woman who lived in an urban. The study found dissimilar clusters with a low number of zero counts for a mean number of ANC visits surrounded by clusters with a higher number of counts of an average number of ANC visits when other variables held constant. Conclusion: This study found that the number of ANC visits in Ethiopia had a spatial pattern associated with socioeconomic, demographic, and geographic risk factors. Spatial clustering of ANC visits exists in all regions of Ethiopia. The predictor age of the mother, religion, mother's education, husband's education, mother's occupation, husband's occupation, signs of pregnancy complication, wealth index and marital status had a strong association with the number of ANC visits by each individual. At the community level, place of residence, region, age of the mother, sex of the household head, signs of pregnancy complications and distance to health facility factors had a strong association with the number of ANC visits.

Keywords : Ethiopia, ANC, spatial, multilevel, zero inflated Poisson

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