**FOR REVIEWER CONSIDERATION**

**Statistical Supplement**

**Statistical Analyses**

Statistical analyses were conducted with SAS® statistical software package Version 9.3.25 To examine the relationship between PCP density and the proportion uninsured, nationally and for each of four regions and two Medicaid Expansion (ME) conditions, a logit model was used. The units of observation were the 1013 CBSAs (aggregated MSAs). Modeling the log-odds of PCP density used maximum likelihood estimation and the SAS® GLIMMIX procedure.

**Model Details**

To determine if the relationship between PCP density and proportion uninsured differed between regions, or differed between Medicaid expansion status either nationally or within each region, the following logit model (Equation (1)) used was:

where:

1. response denotes the proportion of the population, in the *k*th of the CBSAs in region *i* and ME status *j*, that were PCPs;
2. represents the (main) effect parameter for region *i* = 1,…,4;
3. represents the (main) effect of Medicaid Expansion (ME) status j = 1, 2 (for no expansion and expansion, respectively);
4. is the proportion uninsured in region *i*, ME status *j*, and CBSA *k*, with regression slope parameter ;
5. is the interaction effect of Region i with proportion uninsured, with corresponding slope parameter ;
6. is the interaction on ME status j with proportion uninsured with corresponding slope parameter ;
7. is the interaction effect of Region i and ME status j with proportion uninsured with corresponding slope parameter .

Using this model structure, the slope for Region *i* and ME status *j* is obtained as

where a negative (estimated) value of this slope indicates that PCP density decreases (linearly on the logit scale) with increasing proportion uninsured, and the intercept for Region *i* and ME status *j* is

The difference in the relationship between PCP density and proportion uninsured between ME status *j*=1 (no Medicaid expansion) and *j*=2 (Medicaid expansion) within Region *i* is

and a positive value for this slope difference indicates that PCP density decreased more rapidly with increasing proportion uninsured in CBSAs without Medicaid expansion than those with Medicaid expansion.

 This model predicts PCP density in each of the 1013 CBSAs on a per-capita basis. These predictions were re-scaled to predict PCP density per 10,000 of population by multiplying the initial per-capita prediction by (CBSA population/10000). This provides predicted PCP density (per 10,000 of population) values between about 4 and 10 for most CBSAs. Standard errors (SEs) were re-scaled similarly for inference purposes.

**Model Goodness of Fit and Over-dispersion**

Goodness of fit statistics (residual deviance and Akaike’s Information Criterion (AIC)\*) indicated over-dispersion was present. This was corrected using the Pearson χ2-statistic to estimate the over-dispersion parameter, resulting in increased standard errors that better reflected the underlying variation in the response (McCullagh and Nelder, (1983)\*\*).

**Predicted Change in PCP Density Between 25th and 75th and 10th and 90th Percentiles of Percent Uninsured**.

The relative change in predicted PCP density, between each of the 75th - 25th and 90th - 10th percentiles of the proportion uninsured was computed for each of the eight combinations of Region and ME status, and nationally. This was done in order to further ascertain if the association between percent uninsured with PCP density (per 10,000 population) differed by region and Medicaid expansion status. Approximate *t*-tests were performed for the national and regional models to test for differences in slope parameters by Medicaid expansion status.

**Comparing PCP Density and Percent Uninsured Between No Medicaid Expansion and Medicaid Expansion Status**

Because the distributions of PCP density and the proportion of the uninsured demonstrated a non-normal distribution in some combinations of Region and ME status, a non-parametric one-way ANOVA model (SAS procedure NPAR1WAY) was used to test for median differences between Medicaid Expansion (ME) status within each Region and nationally, and between regions with the same ME status and also for both ME conditions combined. To test for these differences, a pairwise two-sided Dwass, Steel, Critchlow-Fligner\*\*\* comparison was used as a k-sample generalization of the median test. Because the data were stratified by both U.S. Census Regions and Medicaid expansion status, a Bonferroni multiple comparisons approach was used to account for the probability that associations would be observed by chance.

**References**:

\* Akaike, H. (1973) Information theory and an extension of the maximum likelihood principle, *Second International Symposium on Information Theory*, (eds. Petrov, B.N. and Czaki, F.), Budapest, pp. 267-281.

\*\* McCullagh P. and Nelder J.A. (1983) Generalized Linear Models, 2nd Ed., Chapman and Hall, New York, NY.

\*\*\* Critchlow, D. E., and Fligner, M. A. (1991). “On Distribution-Free Multiple Comparisons in the One-Way Analysis of Variance.” *Communications in Statistics—Theory and Methods* 20:127–139.