Appendix: Mathematical Model in Multivariate Analysis

The first (individual) level of the multilevel logistic regression model is specified in equation (1) below and the second (facility) level model is specified in (2) below. Y_{ij} is the binary patient satisfaction measure for the i[th] individual in the j[th] facility. β_{1j} is the facility effect of location (1=rural versus 0=urban) on the log-odds of occurrence of the patient satisfaction measure (e.g. Y_{ij}=1 if resident i in facility j reported cleanliness in the environment; Y_{ij}=0 if not). $\beta_{2j}^{t} X_{ij}$ represents the linear product of a vector of individual covariate characteristics and their corresponding beta coefficients in the j[th] facility.

$$\log\left(p_{ij}/(1-p_{ij})\right) = \beta_{0j} + \beta_{1j}\, RURAL_{ij} + \beta_{2j}^{t} X_{ij}$$
$$\text{where,} \quad p_{ij} = \text{Prob}(Y_{ij}=1) \qquad (1)$$

In the 2[nd] (facility level) of the model specified below, β_{oj}, the intercept in (1) is assumed to be normally distributed (since random effect u_{oj} is) across facilities. Hence, each facility has its own intercept effecting overall probability of, for example, a resident reporting cleanliness. Z_{1j} and Z_{2j} are dummy variables serving to indicate the facility characteristics (e.g. teaching hospital, drug allergy alets). $\gamma_{03}^{t} Z_{3j}$ represents the linear product of a vector of facility-level covariate characteristics and their corresponding beta coefficients in the j[th] facility. All of the various γ effects in (2) are assumed fixed across the population of facilities.

$$\begin{aligned} \beta_{oj} &= \gamma_{00} + \gamma_{01} Z_{1j} + \gamma_{02} Z_{2j} + \gamma_{03}^{t} Z_{3j} + u_{oj} \\ \beta_{1j} &= \gamma_{10} \\ \beta_{2j}^{t} &= \gamma_{20}^{t} \end{aligned} \qquad (2)$$