Diagonal Reference Modeling of Effects of Couple's Educational Differences on Women's Health-Care Utilisation in SubSaharan Africa*

Gebrenegus Ghilagaber† and Sofia Herrström‡

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Abstract

Studies on associations between education and demographic- or health-outcome have traditionally used woman's education (alone or in combination with partner's education) as regressors in models relating covariates to the outcome. In this study, we adapt models developed in the social mobility litearture to examine effects of differences between couples' educational levels on women's propensity to utilise facilities (specically deliver in health facilities). Diagonal Reference Modeling (DRM) which accounts for origin (woman's education), destination (partner's education), and 'mobility' (differences between couples' educational levels) is applied on data from Demographic and Health Surveys (DHS) in five African countries (Angola, Ethiopia, Kenya, Namibia, and Nigeria). The results reveal strong effects of educational differences on women's decision to deliver at health facilities. More importantly, such strong effects would be concealed if data is analyzed using standard modeling approaches. Use of Diagonal Reference Models is strongly recommended if correct policy interventions are to be implemented.

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†Corresponding author: Dept. of Stat., Stockholm Univ., Sweden. Gebre@stat.su.se

‡Department of Statistics, Stockholm University, Sweden. Sofia.Herrstrom@gmail.com

1 Introduction

Prenatal care and institutional delivery have been some of the main recommendations of the World Health Organization (WHO) in order to decrease maternal morbidity and mortality in developing countries. However, since there are no formal randomized experiments oh health care utilisation, it is difficult to evaluate its benefits without accounting for potential selection in health care utlization especialy in countries where health care centres may not be uniformly distributed across geographic areas (such as urand and rural). To address this issue, investigators have often controlled for some of women's characteristics such as residence and education (alöone or together with partner's education) in models relating health inputs and outcome such as maternal health. But, the role of educational difference between partners has been ignored - especially in investigations based on data from Demographic and Health Surveys (DHS). In this study, we attempt to fill this gap in knowledge and adapt models developed in the social mobility litearture to examine effects of differences between couples' educational levels on women's propensity to utilise facilities (specically deliver in health facilities). These models, know as Diagonal Reference Modeling (DRM), account for woman's education, her partner's education, as well as differences between their educational levels. The model is applied on data from Demographic and Health Surveys (DHS) in five African countries (Angola, Ethiopia, Kenya, Namibia, and Nigeria). The results reveal strong effects of educational differences on women's decision to deliver at health facilities. More importantly, such strong effects would be concealed if data is analyzed using standard modeling approaches such as logistic regression. Use of Diagonal Reference Models is strongly recommended if correct policy interventions are to be implemented.

2 Data

Data analysed in the present study from the most recent Demographic and Health Surveys (DHS) in five African countries (Angola, Ethiopia, Kenya, Namibia, and Nigeria). Relevant information is extracted from the Individual (woman's) records and Couples' records in respective surveys. Perecentages of hospital delivery across woman's educational levels are shown in Table below:

Table 1: Delivery at health facilities (%) across education

	Woman's educational level			
Country	**None**	**Primary**	**Secondary+**	**Overall**
Angola	29.14	38.88	31.98	48.61
Ethiopia	21.45	39.77	86.74	31.48
Kenya	32.16	61.14	87.27	67.64
Namibia	59.57	77.44	94.12	86.96
Nigeria	11.60	39.41	70.58	35.44

3 Diagonal Reference Models

The diagonal reference model (Sobel, 1981; 1985) treats origin (woman's education), destination (her partner's education), and the indicators for upward and downward mobility (differences between couple's educational levels) differently. The model is designed for contingency tables classified by factors with the same levels. The cell means are modelled as a function of the diagonal effects, i.e., the mean responses of the 'diagonal' cells in which the levels of the row and column factors are the same. In our case, we have a three-way square arrangement defined by the three educational levels shown in the data section above (None, Primary, Secondary or above). If we denote the mean response in cell (i, j) by μ_{ij}, then the DRM expresses is as

$$\mu_{ij} = \omega\mu_{ii} + (1 - \omega)\,\mu_{jj}$$

where ω $(0 < \omega < 1)$ is a weight associated with the origin (woman's education) and reflects the degree of importance of her education in couples with different educational values. The notion is that women in cell (i, i) and their partners in cell (j, j) represent "pure" i and j effects, respectively, whereas individuals in cells (i, j) have partners with lower or higher educational levels than themselves and, hence, and represent some intermediate category.

According to Turner and Firth (2015), a diagonal reference term comprises an additive component for each factor. The component for factor f is given by

$$\omega = \frac{\exp(\delta_i)}{\sum_i \exp(\delta_i)}$$

where the sum is over the levels of the factor and δ_i is a parameter to be estimated.

Thus, in a diagonal reference model (DRM) for a contingency table classified by the row factor o (origin = woman's education) and the column factor d (destination = partner's educations), the mean response in cell (i, j) is given by

$$\mu_{od} = \omega_1 \gamma_o + \omega_2 \gamma_d = \left(\frac{\exp(\delta_1)}{\exp(\delta_1) + \exp(\delta_2)} \right) \gamma_o + \left(\frac{\exp(\delta_2)}{\exp(\delta_1) + \exp(\delta_2)} \right) \gamma_d$$

where $\omega_1 + \omega_2 = 1$, γ_o and γ_d are mean responses of orogina o and destimation d (here corresponding to, say, o^{th} education level of woman and d^{th} education level of the partner, respectively), and δ_1 and δ_2 are parameters to bes estimated.

4 Preliminary Results (weighted DRM:)

Percentage distributions across couple's educational levels (fractions of total cell frequencies):

Angola	**Man-Educ**		
Women-Educ	None	Primary	Second+
None	14.8	17.2	36.6
Primary	9.6	37.7	50.6
Second+	80.0	70.6	82.5

Ethiopia	**Man-Educ**		
Women-Educ	None	Primary	Second+
None	20.1	22.0	40.8
Primary	30.2	36.9	60.0
Second+	82.1	76.9	89.4

Kenya	**Man-Educ**		
Women-Educ	None	Primary	Second+
None	19.6	41.8	59.1
Primary	23.3	57.8	73.1
Second+	85.7	81.3	89.6

Namibia	**Man-Educ**		
Women-Educ	None	Primary	Second+
None	38.9	64.7	81.8
Primary	84.6	68.4	84.3
Second+	81.0	90.0	95.7

Nigeria	**Man-Educ**		
Women-Educ	None	Primary	Second+
None	7.1	14.3	24.9
Primary	24.8	36.5	45.7
Second+	25.4	62.7	73.6