Health Insurance and Contraceptive Use in Jordan

Stat 529 - Project

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Introduction

In developing countries, it is estimated that there are more than 700 million women between the ages of 15 and 49, with an estimated 225 million women who would like to limit the number of children they have, but are unable to do so due to unmet contraceptive need.[7,17] Reproductive health, including contraceptive use, is an important topic due to the impact it has on women's lives, and thus on the lives of their children. In fact, two of the 17 Sustainable Development Goals created by the United Nations (UN) include reproductive health and contraceptive use, with Goals 3 and 5 both including the goal to have universal access to reproductive health.[18]

Contraceptive use impacts a woman's physical health, maternal morbidity and mortality rates, infant and child mortality, and economic well-being, in addition to preventing pregnancy. It is estimated that over 50% of treatable/preventable disease in women (aged of 15 to 44) within developing countries, come from reproductive health and sexually transmitted diseases (including HIV).[7] However, various contraceptive methods can help improve heavy menstrual bleeding and associated anemia, premenstrual syndrome/premenstrual dysphoric disorder, dysmenorrhea, endometriosis, and polycystic ovary syndrome symptoms.[10] In regards to maternal mortality, it is estimated that almost 600,000 women die every year around the world from issues related to pregnancy, with 90% occurring in developing countries.[7] With an estimated 200,000 maternal deaths each year resulting from the absence or failure of contraceptives.[7] Short birth intervals (less than 24 months between births recommended by the World Health Organization) are a known risk factor for both maternal, infant, and child mortality, but it is estimated that in low- and middle-income countries as many as 25% of all birth intervals are less than 24 months.[7,11] Restricting births also impacts how large a household is, which affects how much resources are available, impacting a household's economic well-being.[7] An estimated 85% of sexually active women who are not currently using contraception will become pregnant, compared to around 7-8% of sexually active women using oral contraceptives.[3,9]

The contraception method is also important; the failure rates of modern methods is much lower than those of traditional methods. Modern methods include female (0.5%) and male sterilization (0.15%), oral contraceptive (7%), intrauterine device (0.1-0.8%), injectables (4%), implants (0.1%), male (13%) and female condom (21%), emergency contraception, and lactational amenorrhea (2%, but typical use may be higher).[3,13] Traditional methods include the rhythm method (2-23%) and withdrawal (4-22%).[3,13]

While an estimated 57% of developing countries used modern contraceptives in 2012, in that same year and estimated 18% still had an unmet need for it.[16] That rate of contraceptive use is estimated to have prevented over 200 million unplanned pregnancies in developing countries, but if the women who wanted to use modern methods of contraception were using it, an estimated 54 million more unplanned pregnancies would have been avoided.[16]

The decision to use contraception and which method to use is complex and has many different factors, but one of the factors which can be more easily impacted is cost. A Kaiser Family Foundation poll from the late 1990s found that 75% of adult women listed cost as a determining factor for choosing a method of contraception, and may not choose a method that would have worked best for them if it was not covered.[9] A women may choose to wait to obtain another refill or dose of contraception, or may choose a less expensive method, which may be less effective, if the costs were too high.[2,9] However, delaying the time between contraceptive doses reduces their effects, so that unplanned pregnancies can occur.[9] Three other studies also found that women without health insurance coverage were less likely to say they were using prescription contraceptives when compared to women with coverage.[1,4,5] In addition, a study using DHS data from 55 countries found that the countries with large gap between wealthy and poor also saw a large difference in modern contraceptive use, with the poor women using contraception less than an average woman in the same country.[8]

Since 1984, the Demographic and Health Surveys (DHS) Program has helped plan and collect data for over 400 surveys in more than 90 countries globally. The DHS survey has been completed 7 times since 1990 in Jordan (including one interim survey). Using the 2017-18 Jordan DHS survey, I would like to investigate health insurance coverage and contraception use by governorate in the country of Jordan. I will also use small area estimation to obtain estimates of both contraceptive use and health insurance coverage at the governorate level. In addition, I will investigate whether health insurance coverage is related to modern contraceptive use, even after controlling for other covariates.

Methods

Data Description

The data is from the 2017-2018 Jordan Population and Family Health Survey (DHS VII), which is made available by the Demographic and Health Surveys (DHS) Program, after registering for access, at https://www.dhsprogram.com/data/dataset/Jordan_Standard-DHS_2017.cfm?flag=0.

The data sets also included shapefiles which contained GIS data for each cluster in the survey, with cluster locations jittered, although the DHS attempts to keep the jittered data within the same district (Admin 2 level) as the true location. The GIS data must be registered for in addition to the regular datasets.

I also obtained boundary shapefiles of the governorates (for the 2017-18 DHS survey) from https://spatialdata.dhsprogram.com/boundaries/#view=table&countryId=JO.

Survey Design

The sample for this survey is a stratified sample from the 2015 Jordan Population and Housing Census (JPHC), and is selected in two stages. To obtain the strata, each of Jordan's 12 governorates are divided into urban and rural (24 levels), plus two additional levels are added for two Syrian camps (located in Zarqa and Mafraq), for a total of 26 strata.

In the first stage, 970 clusters (PSUs) were sampled. To create the PSUs, Jordan's 12 governorates are divided into districts, and each district is divided into sub-districts, which are divided into localities. The localities are then divided into areas and sub-areas, which are divided into areas called census blocks for the JPHC. The census blocks are then regrouped into clusters. The PSUs are the clusters of residential households formed from regrouping the census blocks. The probability of selecting each cluster is proportional to the cluster size (which is the number of residential households from the 2015 JHPC), with a goal of a minimum sample of 980 women surveyed per governorate. This was done to account for very small populations in the governorates of Tafiela and Ma'an, and the very large populations in governorates like Amman.

In the second stage, 20 households per cluster were selected from a household listing (which was put together for each cluster) using equal probability systematic selection. Women were surveyed in each household, where the women eligible to be questioned either had to be residents of the household or had to have stayed overnight in the household the previous night. No substitutions of households were allowed.

The sampling frame is a list of residential households from the 2015 JHPC. The sampling unit is a residential household. The observation unit is a person. The target population is all persons in Jordan aged 15-49. The planned sample size was 13,639 ever-married women aged 15-49 (with 1,607 from Syrian women, 1,743 from women of nationalities other than Jordanian and Syrian, and the remaining coming from Jordanian women) and 6,132 men aged 15-59 from a total of 19,400 households (15,380 from urban areas and 4,020 from rural areas). There was a total of 14,689 ever-married women (aged 15-49) in the completed survey. The survey is nationally representative, as well as at the governorate, regional (North, Central, South), urban/rural, and nationality (Jordanian, Syrian, and other nationalities) levels.

In the Individual (Women) file, the cluster variable is v021, the strata variable is v023, and the weights variable (after division by 1,000,000) is wt.

Sampling Weights

The following description of the calculation of sampling weights is provided by the DHS.[6]

The first probability is from the first-stage, and is the sampling probability of selecting the ith cluster in stratum k, denoted as P_{2ik}. If we have k strata, then let n_k be the number of clusters chosen in stratum k, M_{ik} be the number of households in the sampling frame in the ith cluster, and the result of summing all of the M_{ik}s be equal to the total number of households in stratum k. Then, we can calculate the first probability from the first stage as: $P_{1ik} = \frac{n_k M_{ik}}{\sum M_{ik}}$. The second probability is from the second stage, and is the sampling probability of selecting household j from within cluster i, denoted as P_{2ik}. Let H_{ik} be the number

of households in cluster i and stratum k, and h_{ik} be the number of households selected in cluster i. The, we can calculate the second probability from the second stage as:

$P_{2ik} = \frac{h_{ik}}{H_{ik}}$. So, the probability of selecting household h from cluster i and stratum k is $P_{hik} = P_{1ik}P_{2ik}$.

To obtain the sampling weight for household h in cluster i and stratum k, we take the inverse of the probability of selecting household h from cluster i and stratum k: $w_{hik} = \frac{1}{P_{hik}}$.

These weights are adjusted for household and individual nonresponse, and were normalized by the DHS (normalized by dividing each weight by the average of the initial weights). Because they are normalized, they are not valid for estimating population totals. I will be using the weights for the women's individual survey. This variable is given in the v005 column of the individual file, but it must be divided by 1,000,000 before use.

Data Analysis

I am using the survey package for R by Thomas Lumley.[12] The direct estimates from the survey data are using the Horvitz-Thompson estimator in the svymean and svyby functions. I calculated the proportion of ever-married women who are using health insurance (breaking apart traditional method and modern method use), as well as the proportion of ever-married women using each type of contraction, and the contraceptive use by governorate using these functions. Similarly, I calculated the proportion of ever-married women who has health insurance, as well as the proportion of health insurance type, and coverage by governorate using these functions.

I also did small area estimation (SAE) using the Smooth Direct method contained in the SUMMER package smoothSurvey function with the BYM2 model for the Governorate (Admin 1) level.[20]

We let Y_i represent the number of ever-married women who are using modern contraception in governorate i in Jordan, and p_i be the true prevalence of ever-married women who are using modern contraception in governorate i in Jordan. $Y_i \sim Bin(N_i, p_i)$.

The direct estimates and standard errors of the prevalence of modern contraceptive use are calculated using the svymean function in the survey package. These direct estimates are then used with the smoothSurvey function in the SUMMER package to obtain area-level smoothed estimates. I obtained the smoothed direct estimates of the proportion of contraceptive use at the governorate level for both the model which contained no covariates, the model which contained only health insurance, and the model with the additional covariates (age, education, and employment). I attempted to do SAE at the district level, however, the direct estimates of 6 districts had standard errors that were essentially 0. So, I decided not to go further with that analysis.

Finally, I ran a binary logistic regression to look at the effect of health insurance on modern contraceptive use using the svyglm function in the survey package. I computed two models, one which only included health insurance as the predictor, and a second model which included age, education, and employment as additional covariates to see if the effect of health insurance on modern contraceptive use changed after accounting for the additional covariates.

Results

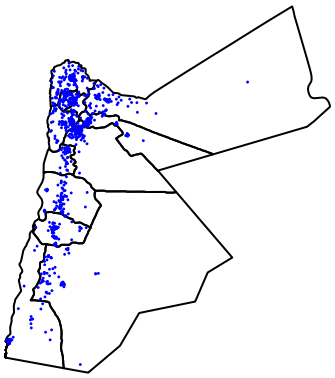

Figure 1: Map of Jordan showing governorate borders in black, district borders in red, and survey cluster points in purple.

The Jordan 2017-18 DHS survey had a total of 970 clusters, the locations of which are shown in the map in Figure 1. As we can see, there are large areas without any cluster sampling within many of the governorates that are larger in size (area), and many of the cluster samples appear very closely grouped together.

Horvitz-Thompson Estimators - Contraception

As seen in Table 1, under 50% of all ever-married women in Jordan are estimated to be using some form contraception, with a larger portion (34.8%) using modern methods compared to traditional methods (13.3%). The most common type of contraception is the intrauterine device (IUD) at 19.3%, with withdrawl being the second-most popular method at 12.1%. Male sterilization and the female condom are the least used methods. The governorate of Jerash has the highest proportion of ever-married women using contraception (40.3%), but it is still under 50%; with the governorate of Maan having the lowest proportion, at under 25% (Figure 2).

Horvitz-Thompson Estimators - Health Insurance

As seen in Table 2, over 58% of all ever-married women in Jordan are estimated to be have health insurance coverage, with the largest portion provided by the Ministry of Health (24.5%). A close second is the Royal/Military insurance at 20.5%, and the least common is provided by the non-governmental organizations (NGO). The governorate of Aljoun has the

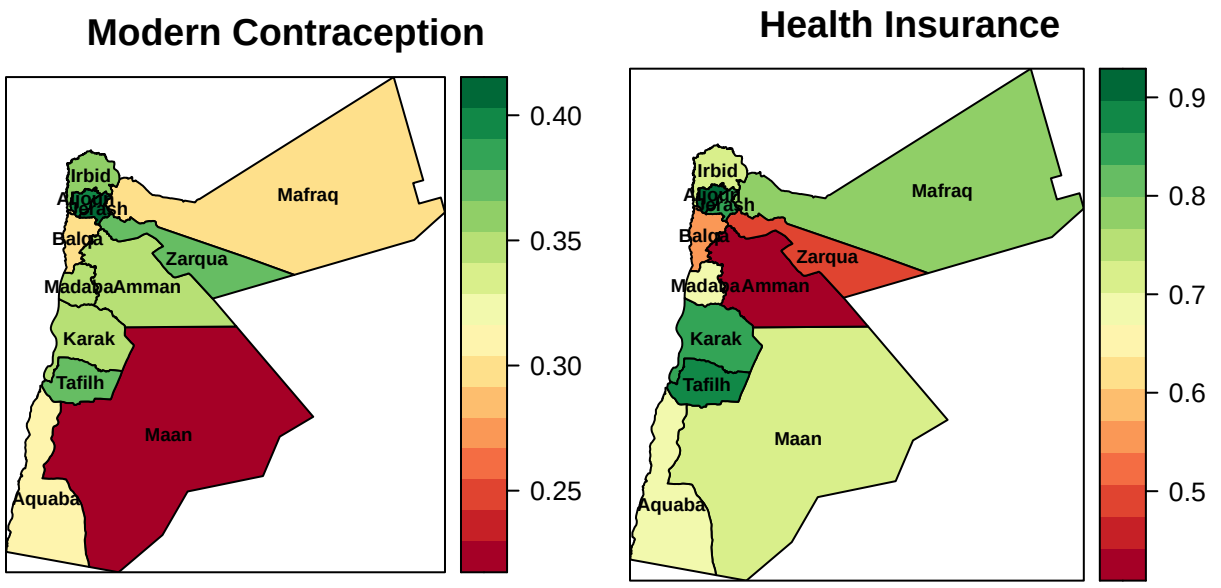

Figure 2: Map of Jordan showing proportion of modern contraceptive use (left) and health insurance coverage (right) in each governorate.

highest proportion of ever-married women with health insurance coverage (89.7%), with the governorate of Tafilh being at close second at 89.1%. The governorate of Amman has the lowest proportion, at 44.1% (Figure 2).

Small Area Estimates - Smooth Direct

Three separate models were fit with the smoothSurvey function in the SUMMER package in all, all with the BYM2 model. The first model included no covariates, the second model added the health insurance coverage variable, and the thrid model included three additional covariates. To choose these additional covariates, I did some literature review and found two studies which found that age, race, marital status, education, and employment were high predictors of birth control usage.[4,19] However, because the survey has a very high proportion of women who are currently married (over 92%), and a high proportion who are Jordanian (over 86%, with the next largest group comprising only about 8%), I decided not to include these two variables as covariates in the model, and only included Age, Education, and Employment as additional covariates.

The proportion of the total variance of the spatial random effects are close in all three models, and we see no evidence that the covariates explain any spatial dependence. None of the 95% confidence intervals for the covariates odds ratios contain zero, although Employed is very close to 0, so it appears to have little to no effect on contraceptive use. Health insurance has the highest effect, but age also has a strong effect, with 1 unit increase in age increasing the proportion of contraceptive use by almost 37%.

	Prevalence	SE	2.5 %	97.5 %
Not Using	0.519	0.0081	0.503	0.535
Any Traditional Method	0.133	0.0047	0.124	0.143
Any Modern Method	0.348	0.0070	0.334	0.362
Not Using	0.519	0.0081	0.503	0.535
Pill	0.073	0.0035	0.066	0.080
IUD	0.193	0.0052	0.183	0.203
Injections	0.007	0.0011	0.005	0.009
Male condom	0.048	0.0032	0.042	0.054
Female Sterilization	0.014	0.0015	0.011	0.017
Male Sterilization	0.000	0.000	-0.000	0.000
Periodic Abstinence (Rhythm)	0.012	0.0015	0.009	0.015
Withdrawal	0.121	0.0045	0.112	0.130
Implants	0.003	0.0007	0.001	0.004
Lactational amenorrhea (LAM)	0.010	0.0011	0.008	0.012
Female condom	0.000	0.0002	-0.000	0.001
Amman	0.351	0.0139	0.324	0.378
Balqa	0.294	0.0181	0.258	0.329
Zarqua	0.371	0.0159	0.340	0.402
Madaba	0.341	0.0155	0.311	0.372
Irbid	0.357	0.0173	0.323	0.391
Mafraq	0.302	0.0144	0.274	0.330
Jerash	0.403	0.0153	0.373	0.433
Aljoun	0.392	0.0140	0.364	0.419
Karak	0.347	0.0189	0.309	0.384
Tafilh	0.369	0.0164	0.336	0.401
Maan	0.230	0.0192	0.192	0.267
Aquaba	0.308	0.0181	0.273	0.344

Table 1: Current contraception use for ever-married women (age 15-49), including breakdown by type of contraception and by governorate. Reporting the prevalence rate, standard error, and 95% confidence interval.

Binary Logistic Regression

Two separate binary logistic regression models were fit, the first includes only health insurance as the predictor, and the second model adds age, education, and employment as additional covariates. Again, for the reasons mentioned above, I only included Age, Education, and Employment as additional covariates.

In the first model, health insurance coverage is a significant predictor of contraceptive use, at the alpha=0.05 level (Table 6). When we add the additional three covariates, age, education, and employment, we see that all of the covariates are significant at the alpha=0.05 level (Table 7). So, the effect of health insurance coverage on contraceptive use is still present, even after accounting for age, education, and employment. As seen in Tables 6 and 7, the odds ratio increases from 1.155 (exp(0.144)) to 1.161 (exp(0.149)) between the first and

	Prevalence	SE	2.5 %	97.5 %
Has coverage	0.583	0.0086	0.566	0.600
Privately purchased	0.088	0.0053	0.078	0.099
MOH	0.245	0.0060	0.233	0.257
Royal/Military	0.205	0.0073	0.191	0.220
University Hospital	0.020	0.0026	0.015	0.025
UNRWA	0.008	0.0011	0.006	0.010
UNHCR	0.030	0.0023	0.026	0.035
NGO	0.006	0.0012	0.003	0.008
Amman	0.441	0.0164	0.409	0.473
Balqa	0.567	0.0209	0.526	0.608
Zarqua	0.489	0.0206	0.448	0.529
Madaba	0.681	0.0210	0.640	0.723
Irbid	0.728	0.0199	0.689	0.767
Mafraq	0.782	0.0138	0.755	0.809
Jerash	0.832	0.0136	0.806	0.859
Aljoun	0.897	0.0120	0.874	0.921
Karak	0.863	0.0127	0.838	0.888
Tafilh	0.891	0.0127	0.867	0.916
Maan	0.707	0.0366	0.635	0.779
Aquaba	0.685	0.0233	0.639	0.731

Table 2: Current health insurance coverage for ever-married women (age 15-49), including by type of insurance and by governorate. Reporting the prevalence rate, standard error, and 95% confidence interval.

second model. Therefore, an one unit increase in health insurance coverage increases the contraceptive prevalence by 16.1%.

I conducted these analyses using R version 4.0.2 (R Core Team 2020).

Discussion

As seen in Figure 2, it is interesting the the Maan governorate has a moderate health insurance coverage rate (over 70%), but has the lowest contracetion prevalence rate. Clearly, something outside of health insurance coverage is having a large impact the women's decision to use contraception. A more in-depth analysis of this governorate around contraception use would be interesting to explore what other factors are impacting their choice. This would allow the government of Jordan other outside organizations to determine if there is a barrier to access or some other messaging that needs to be done in this governorate specifically.

Since cost can be a strong barrier to access contraception, it is not surprising to see that health insurance coverage does have an impact on contraceptive use. It also makes sense that age is an additional factor that is significant, since as women age, they may be less likely to want to have additional children, and more likely to use birth control. Contraceptive use can impact many different aspects of a woman's life, so it is important to also look at how

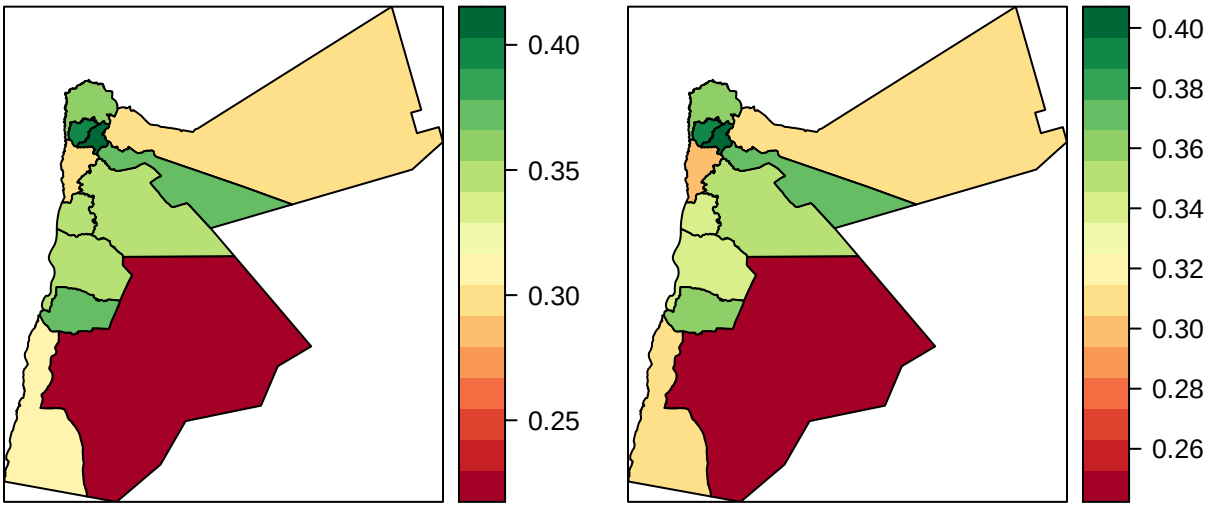

Figure 3: Examining the direct estimates with the smooth direct estimates with no covariates.

smoothSurvey BYM2 model	σ_b	σ_b LCI	σ_b UCI	ϕ	ϕ LCI	ϕ UCI
BYM2 Model No Covariates	0.0419	0.0158	0.1167	0.1713	0.0112	0.7626
BYM2 Model With Health Ins	0.0440	0.0160	0.1276	0.1767	0.0115	0.7728
BYM2 Model With Covariates	0.0162	0.0032	0.0747	0.1950	0.0107	0.8362

Table 3: Posterior median of total variance of random effects and proportion of total variance of spatial random effects from Smooth Direct Method

to increase and maintain contraceptive use.
A study of DHS data from 15 countries found that between 7 and 27% of women discontinued use in the first year.[15] There were many reasons given in the study, including side effects and health concerns, all of which can impact quality of life. The type of contraception that a women uses impacts her quality of life differently.[19] And, the quality of the medical care that a woman received with regards to her contraceptive method also can impact her continued use (with higher quality of care relating to higher probability of continued use).[15] In addition, there was a USAID program in Jordan which was shown to improve male involvement in contraception choice and use, and improved the accuracy of knowledge about contraception.[17] Quality of health care, and programs which help couples become more involved together in the choice of contraception, should both be investigated further to determine how best to impact adherence to contraceptive use.

While the cost of providing modern contraceptive methods for every women who wants to use it is large (estimated at 8.1 billion U.S. dollars each year), it is small compared to the costs of maternal and newborn care if the unmet modern contraceptive needs are unmet

Covariate	β_1	β_1 LCI	β_1 UCI
Health Ins	1.408	0.560	3.568

Table 4: Posterior median of β_1 value from Smooth Direct Method with Health Insurance

Covariate	β_i	β_i LCI	β_i UCI
Health Ins	1.590	0.761	3.458
Age	1.368	1.103	1.718
Education	0.755	0.097	5.572
Employed	0.026	0.001	0.452

Table 5: Posterior median of β_i values from Smooth Direct Method with Added Covariates

(estimated at 11.3 billion), not to mention cost of the health and well-being of the impacted women.[16]

A limitation in this study is that the answers were self-reported, which could increase the rate of incorrect responses due to forgetfulness or internal pressure to give what a respondent deems as a socially acceptable answer. It also only includes ever-married women, which misses any contraceptive needs/uses of single women. Although it is difficult to say whether the responses would be accurate or if there would be cultural/religious pressure against discussing contraceptive use outside of marriage.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-0.713	0.048	-14.882	< 0.001
Health Ins.	0.144	0.053	2.726	0.007

Table 6: Summary of svyglm output including only Health Insurance as a predictor.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-1.559	0.130	-11.997	0.000
Health Ins.	0.149	0.054	2.741	0.006
Age	0.021	0.003	6.849	< 0.001
Education	0.040	0.019	2.137	0.033
Employment	-0.330	0.088	-3.741	< 0.001

Table 7: Summary of svyglm output including other covariates Age, Education, and Employment.

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