



Hormonal Contraception, depression, and Academic Performance among females attending college in the United States

Sean T. Gregory^{a,d,*}, Kristin Hall^b, Troy Quast^b, Amy Gatto^b, Jennifer Bleck^c, Eric A. Storch^d, Rita DeBate^b

^a Department of Politics & International Affairs, Northern Arizona University, Flagstaff, AZ, USA

^b Department of Health Policy & Management, University of South Florida, Tampa, FL, USA

^c Department of Child and Family Studies, University of South Florida, Tampa, FL, USA

^d Menninger Department of Psychiatry & Behavioral Sciences, Baylor College of Medicine, Houston, TX, USA



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ABSTRACT

Associations between Hormonal Contraception (HC) and Depression have been previously reported, and indicate increased risk to younger women. These relationships need to be explored and expanded to include measures of impact on Academic Performance (AP). Data was acquired from the National College Health Assessment (NCHA), administered from Fall 2008 to Spring 2015 across 370 schools nationwide. The most popular HC method was oral, followed by an IUD, and vaginal ring. HC use increased across all ages groups 18–29, and then decreased in the 30–34 age group. HC use significantly increased the odds of ever being diagnosed with depression in all age groups. HC use was found to have significantly increased odds of reporting AP issues in the 18–19 age group and to have significantly decreased odds of reporting AP issues in the 25–29 age group. Adding depression as a moderator, HC use continued to significantly increase the odds of AP issues. Women and their providers should balance the risks and benefits of initiating HC. Specifically, younger women, and be advised of the risks that HC presents in terms of a potential association with depression. Efforts to develop standardized protocols for discussing the risk-benefits for HC therapy should be pursued.

Hormonal Contraception (HC) is used by women internationally (Frye, 2006; Sitruk-Ware et al., 2013; Spencer et al., 2009). The primary reason women discontinue HC use are mood disorders commonly reported as onset and/or exacerbation of depressive symptoms (Sitruk-Ware et al., 2013; Skovlund et al., 2016). Overall, 30% of reproductive-age women report some type of psychiatric disorder or symptoms, and those who report frequent symptoms tend to be younger, and are more likely to be Hispanic and African-American (Farr et al., 2011). The association between HC and depression has been recently reported (Skovlund et al., 2016), finding an overall Relative Risk (RR) of 1.2 (95% CI 1.22–1.25) for oral contraceptives, increasing to 2.7 (95% CI, 2.45–2.87) for implantable forms of HC. There was a stronger relationship among younger versus older women. This is especially concerning, given the historically high proportion of women enrolling in college, completing undergraduate studies, and matriculating into graduate school and advanced post-baccalaureate training (Eisenberg et al., 2009; Foundation, 2016; Moore et al., 2017). Our primary interest is the age relationship, specifically the strong association between HC and depression among younger age (15–19 & 20–24), as a key

public health and well-being issue for young women. Recent reports of the state of behavioral health among college populations, and the need for improved access to behavioral health services, (Foundation, 2016; Health, 2017) motivated this exploration.

1. Introduction

Skovlund and colleagues (Skovlund et al., 2016) examined a large administrative database of health care encounters in Denmark and measured the association between HC and depression by sequencing the initiation of HC pharmacotherapy and either an ICD-10 coded diagnosis of a depressive disorder and/or the initiation of an antidepressant medication (ADM). Both methods yielded similar results; HC was associated with both initiation of ADM pharmacotherapy for depression, and a first diagnosis of depression from a health care encounter. Key findings include an age effect, namely the younger the age of HC initiation, the higher the associated risk of diagnosis and/or treatment for depression, with decreasing odds of depression as age increases. The association varied by route of administration for HC, wherein the risk

* Corresponding author at: PO Box 15036, Flagstaff, AZ 86011, USA.

E-mail address: sean.gregory@nau.edu (S.T. Gregory).

was 1.8 times higher rate for oral HC and 3 times for implantable HC (Skovlund et al., 2016). Initiation of HC among teens (15–19) increased odds of depression, as it did for women in their early 20's (20–24) before subsiding in late 20's and 30's. This association persisted for all women, but declined with age. The age association between HC and depression is concerning, especially due to the contemporaneous enrollment in college for women at highest risk, 15–19 and 20–24 (Skovlund et al., 2016). Strengths of the Skovlund et al. (2016) study include the large sample (> 1,000,000 individuals >13 years) and the ability to temporally order initiation of HC therapy and diagnosis or treatment for depression.

Conflicting evidence exists regarding the HC and depression relationship (Schaffir et al., 2016). There is substantial support for the family planning benefits of HC use despite the risks of depression (Carroll, 2017). Early college years are associated with behavioral health issues stemming from homesickness and adaptation to new environments, access to illicit substances, and pressures for Academic Performance and from interpersonal relationships. The relationship between depression and other behavioral health diagnoses and both academic and job performance has been well established (Eagan et al., 2017; Eisenberg et al., 2009; Hysenbegasi et al., 2005; Owens et al., 2012).

The purpose of this study is twofold: (1) to examine the HC and depression relationship among women attending college/university in the United States, (2) to examine if the association between depression and Academic Performance (AP) was moderated by HC use, and (3) further examine the relationship between age and depression, and incorporate both with and understanding of their relationship with AP.

2. Methods

2.1. Data

Data were acquired from the American College Health Association (ACHA) National college Health Assessment (NCHA) Surveys, administered from Fall 2008 to Spring 2015 across 370 schools nationwide. Females 34 years old and younger that completed the survey were eligible for inclusion. Hormonal birth control use was reported, including specificity regarding the modality, the use of birth control pills, shots, implants, patch, a vaginal ring or intrauterine device (IUD) as the method of birth control reported during last vaginal intercourse.

Hormonal birth control was indicated by a 'yes' response to one and only one of these methods, and 'no' otherwise. Participants that indicated the use of more than one method of hormonal birth control at the last time of vaginal intercourse were excluded from the analysis. Women who indicated the use of more than one method of birth control were included (e.g. HC and condoms during last intercourse). Student status was categorized as undergraduate (1st–5th or more year) or graduate/professional. Non-degree seeking students and those who responded 'other' to year in school were excluded.

Additional inclusion criteria required that respondents answered at least one of the survey questions related to depression: 1) Ever been diagnosed with depression? and 2) Within the last 12 months, was your AP affected by depression? The first question was in yes/no format. The second question was dichotomized to a yes/no format as a 'no' by a 'This did not happen to me/ not applicable' or 'I have experienced this issue but my academics have not been affected' response, and a 'yes' by either a, 'Received a lower grade on an exam or important project', 'Received a lower grade in the course', 'Received an incomplete or dropped the course', or a 'Significant disruption in thesis, dissertation research, or practicum work' response. Among the 389,307 females eligible for inclusion, 349,697 (89.83%) met all inclusion criteria.

2.2. Statistical analyses

Differences in demographic variables between HC use groups were

tested with chi-square tests. Two generalized linear models (GLM) were fit for depression diagnosis (HC and depression) and depression affecting AP (HC and AP), with regression on covariates for HC use, age group, race, student status and a HC use with age group interaction. A binary distribution, logit link function, and covariance structure adjusting for potential within school and study period correlations were specified using the generalized estimating equations (GEE) method to estimate the covariance structure. An additional model was run for the depression affecting AP (HC and AP, moderated by depression), in which covariates for depression diagnosis, an interaction between HC and depression diagnosis, and three-way interactions between HC, depression diagnosis and age group were added to the regression equation. Adjusted risk differences and odds ratios between various contrast groups were calculated from these models. All analysis was conducted using SAS (version 9.4).

3. Results

The analytical sample consisted of $n = 146,938$ (42%) reporting HC use, and $n = 202,759$ (58%) reporting no HC use. The mean age was 21.26 years (SD = 3.24), among which over half were 20–24 (52%) years old, about a third were 18–19 (34%), a tenth were 25–29 (10%) with the remaining 4% ranging from 30–34 years old. Students were mostly undergraduates (86%) and the majority were White (70%) followed by other (16%), Hispanic (8%) and Black (6%) race categories. Differences between age, student status and race by HC groups are shown in Table 1.

The most popular HC method was birth control pills (82%) followed by an IUD (7%), vaginal Ring (5%), birth control shots (3%), birth control implants (2%) and a birth control patch (1%). (Table 1) HC use increased from the 18–19 age group (34%) to the 20–24 age group (46%) to the 25–29 age group (50%) and then decreased in the 30–34 age group (40%). Almost half (48%) of the White ethnicity group reported using HC, while it was lower in the Hispanic (31%), Black (30%) and Other (24%) race groups. HC use was higher for graduate students (50%) than undergraduate students (41%). Overall, about 23% of the HC group and 17% of the no HC group were diagnosed with depression, and about 28% of the HC group and 26% of the no HC group felt AP was affected by depression (Table 1).

3.1. Model 1: HC and depression

HC use was higher among those ever diagnosed vs never diagnosed with depression across all age groups, with 44% vs 32% observed in the 18–19 age group, 53% vs 44% in the 20–24 age group, 55% vs 49% in the 25–29 age group and lastly 44% vs 39% in the 30–34 age group. After adjusting for race and student status (Model 1), HC use increased the odds of ever being diagnosed with depression by 1.558 in the 18–19 age group, 1.283 in the 20–24 age group, 1.158 in the 25–29 age group and 1.194 in the 30–34 age group ($all p < 0.001$). Compared to White: Black (OR = 0.487), Hispanic (OR = 0.604,) and Other (OR = 0.549) ethnicity groups observed lower odds of ever being diagnosed with depression ($all p < 0.001$). Graduate student status decreased the odds of a depression diagnosis by 0.719 ($p < 0.001$). (Table 2) Table 2 summarizes the model results, coefficients and ORs, for models 1 and 2.

To aid in the interpretation of increased odds, we used the model to estimate the probability of depression associated with HC use for each age group over a balanced population (i.e., weighting each ethnicity and student status group equally), and summarized the Risk Difference (RD) between HC use groups ($p < 0.001$) in Table 3. These RDs were calculated by subtracting the estimated probability of depression for women in each age and HC use category. For example, the model estimates the probability of depression among 18–19 women using HC is 13.20%, ($p < 0.001$) and the probability among 18–19 women not using HC is 8.89% ($p < 0.001$). The corresponding RD, given below in Table 3 is 4.31% ($p < 0.001$), indicating the increase in the probability

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