Association between pregnancy planning and health behaviors: Results from the Behavioral Risk Factor Surveillance System (BRFSS) in seven states, 2013

Carol L. Stone,[1] using anonymous responses from randomly selected adult volunteers in Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, and Utah

Placed on web September, 2016

BACKGROUD: To have the best pregnancy outcomes, women should be as healthy and ready for pregnancy as possible. This requires reduced unhealthy behaviors and increased healthy behaviors among women before pregnancy. **STUDY QUESTION:** The purpose of this study was to evaluate if women planning pregnancy were more likely to engage in healthy behaviors than those who were not planning children. **METHODS:** Analysis was conducted from reproductive health questions offered in the Behavioral Risk Factor Surveillance System (BRFSS) during 2013, by seven states in the U.S. (Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, and Utah). Analysis was conducted by multivariate logistic regression, among women 18-44 years old who were not pregnant (N=11,889). Outcomes were leisure activity, fruit and vegetable consumption, seatbelt use, check-up in the past year, flu vaccination in the past year, as well as current cigarette smoking, heavy drinking, and binge drinking. The independent variable was pregnancy planning by either timing of plans (not planning (ref), planning within two years, and planning in two or more years) or by history of previous births (no children/not planning (ref), plans with no children, and plans with one or more children). Covariates were age (18-34 years, 35-44 years old), housing type (own, rent/ other), body mass index (not overweight/obese, overweight, obese), and race/ethnicity (non-Hispanic White, Minority race/ethnicity). **RESULTS:** Women planning pregnancy within two years were 2.1 times less likely to be heavy drinkers (OR=0.46; 95% CI: 0.25, 0.84). The two family planning variables did not contribute significantly to leisure activity, fruit and vegetable consumption, or check -up or flu vaccination in the past 12 months ($p > 0.10$). Among women without children, those planning pregnancy were 1.9 times more likely to be current cigarette smokers (95% CI: 1.4, 2.7), but 2.0 times more likely to always wear a seatbelt (95% CI: 1.4, 2.8). **CONCLUSIONS:** Generally, pregnancy planning was not a significant factor for healthy behaviors among women of childbearing age, and compared to women without plans for pregnancy, women planning pregnancy were no more likely to reduce unhealthy behaviors. Educational campaigns are needed to raise awareness about the importance of family planning and readiness for pregnancy.

Introduction

Preconception care for women involves the care received from a licensed health professional that is focused on maximizing health before pregnancy [1, 2]. Preconception care is also the care provided to all women of reproductive age who are either planning pregnancy or who may plan pregnancy during their reproductive life stage. This emphasis on health before pregnancy is linked to healthy and uncomplicated deliveries, and ultimately, healthy mothers and babies [3].

Care for women before pregnancy is especially important for those with plans for imminent pregnancy. For all women to be as healthy and ready for pregnancy as possible, risk behaviors, such as drinking and smoking, need to be reduced or eliminated well in advance of pregnancy [4]. Protective behaviors, such as receiving recommended vaccinations and eating nutritious meals, need to be increased.

[1] To whom Correspondence should be addressed: Carol Stone, PhD, MPH, MAS, MA, Health Statistics and Surveillance Section, Connecticut Department of Public Health, 410 Capitol Avenue, Hartford, Connecticut 06134, *Carol.Stone@ct.gov* (860-509-7147).

The Behavioral Risk Factor Surveillance System (BRFSS) is a phone survey that provides a wide range of state and national population-based estimates of health status, health risk and protective behaviors, as well as chronic conditions [5]. The public health survey is unique in its partnership with all states and U.S. territories, and Connecticut has been a partner and participating state since 1989 [6].

During the 2013 survey year, seven states offered a set of Reproductive Health questions to their female respondents up to 50 years of age. These states were Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, and Utah. The question set included the topics reproductive history, family planning, and infertility. Responses to these questions made possible the ability to explore the relationship between family planning and either risk or protective behaviors.

This study was conducted to explore in what ways, if any, women planning pregnancy in calendar year 2013 modified health enhancing and risk behaviors in preparation for pregnancy. The results show that, except for heavy drinking and seatbelt use, there was no significant link between pregnancy planning and modified risk or protective behaviors.

Methods

Data Selection and Variable Construction

Questions from the Reproductive Health module were offered in the CT BRFSS and six other states during the 2013 BRFSS survey year to women 18 through 50 years old. In Connecticut, the survey was offered from April 1, 2013 through December 31, 2013, and other states initiated the questions about the same time.

Questions in the reproductive health module covered topics of reproductive history, family planning, and infertility. For this study, a question about reproductive history was used to calculate the number of previous live births, “How many live births have you had?” A question about family planning was used to calculate if and within what time period a woman was planning to have future children, “Do you plan to have children…” within a year, within two years, within five years, or five or more years from now. Women who responded that they planned to have children in the future, regardless of timing of planned pregnancy, were considered to be planning pregnancy.

Plans for children in the future by timing were categorized as either planning within two years (imminent), or planning in two or more years (remote). Responses for plans by birth history were categorized as planning with no children, or planning with at least one child (mothers). Mothers who reported no plans for children were not included in the study and were coded as (n=3,016).

A total of 17,291 responses were compiled from the Reproductive Health module. Responses were distributed from among Connecticut (n=2,076), Kentucky (n=3,722), Massachusetts (n=2,968), Mississippi (n=2,078), Ohio (n=2,622), Texas (n=1,404), and Utah (n=2,421).

This study was limited to women who reported that they were not pregnant at the time of the survey (n=11,889), a question offered in the core of the survey to women less than 45 years of age. Therefore, the study could only be conducted of women between 18 and 44 years old.

Self-reported information collected from the BRFSS and used to create covariates included: _AGE80, which was grouped into

two categories (18-35 years old, and 36-44 years old); and _BMI5CAT, which was grouped into three categories (not overweight/obese for those with a BMI less than 25.0, overweight for those with a BMI 25.0 to less than 30.0, and obese for those with a BMI at least 30.0). In addition, the covariate _RACE_G1, which was grouped into two categories (non-Hispanic White, and Minority race/ethnicity), was used with the planning variable by birth history. The covariate HOME (housing arrangement), which was grouped into two categories (own, and rent/other), was used with the planning variable by timing. Use of these covariates in the regression model for either planning variables was determined by the SAS program SURVEYREG. Educational level (up to high school, and more than high school) did not contribute significantly to either planning variable, and was not used as a covariate (data not shown).

Health behaviors collected from the body of the BRFSS survey included: Leisure activity in the past 30 days (_TOTINDA); consumption of fruit (_FRTLT1) and vegetables (_VEGLT1) at least once daily; always using a seatbelt in the car (_RFSEAT3); check-up in the past 12 months (CHECKUP1); flu vaccination in the past 12 months (FLUSHOT6); smoking cigarettes every day or most days within the past 30 days (_RFSMOK3); heavy drinking within the past 30 days (_RFDRWM4), which was defined for women as having more than one drink daily; and binge drinking within the past 30 days (_RFBING5), which was defined for women as having at least four drinks on an occasion.

All responses to the questions of “Don’t Know/Not Sure” or “Refused” were coded as missing. The frequency of missing responses for most variables generally ranged from none for age, to a high of 262 for heavy drinking. There were 662 missing responses for BMI, however. Calculation of the BMI required a combination of both height and weight, and, in this dataset there were 206 missing responses for height and 597 missing responses for weight.

The prevalence values of all variables in the study produced coefficients of variation within 15%, except for family planning within two years among obese women. In this category, the coefficient of variation was 15.7%. Prevalence estimates were obtained in SAS from SURVEYFREQ, using weights provided by the BRFSS team at CDC specifically for this dataset [7], and using stratification variables _STSTR and _STATE.

Multivariate logistic regression was conducted with the SAS program SURVEYLOGISTIC for the eight health outcomes described above, using the covariates also described above. Individual contribution of each covariate and planning variable to the regression model was evaluated by Wald statistic. Odds ratios, with 95% confidence intervals, were obtained for each regression covariate. Regression was conducted on a total sample size of 10,491 for pregnancy planning by timing, and 5,186 for pregnancy planning by birth history. The latter sample size, as described earlier, was the result of excluding from analysis the category of women with children who were not planning children. All analyses were conducted with SAS (Cary, NC).

The BRFSS at the state level has been classified as exempt by the DPH Human

Table I
Prevalence of Pregnancy Planning, Women 18-44 years old
Behavioral Risk Factor Surveillance System (BRFSS), 2013
Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, Utah (N=11,889)

	Planning Children in Future			Not Planning Children in Future		
Variable	**Frequency**	**Prevalence (%)**	**95% CI**	**Frequency**	**Prevalence (%)**	**95% CI**
Overall	4,810	55.5	(53.1, 57.8)	5,681	44.5	(42.2,46.8)
Covariates						
Age						
18-34 years old	3,899	76.2	(73.5, 78.9)	1,499	23.8	(21.1, 26.5)
35-44 years old	911	18.3	(15.6, 20.9)	4,182	81.7	(79.1, 84.4)
Race/Ethnicity						
non-Hispanic White	3,323	51.8	(48.9, 54.8)	4,208	48.2	(45.2, 51.1)
Minority race/ethnicity	1,429	60.2	(56.4, 64.0)	1,435	39.8	(36.0, 43.6)
Home						
Own	2,196	44.3	(40.7, 47.9)	3,793	55.7	(52.1, 59.3)
Rent/Other	2,580	65.9	(63.0, 68.8)	1,866	34.1	(31.2, 37.0)
BMI						
not overweight/obese	2,380	60.2	(56.5, 63.9)	2,218	39.8	(36.1, 43.5)
overweight	1,145	55.3	(50.9, 59.7)	1,494	44.7	(40.3, 49.1)
obese	1,070	51.9	(47.6, 56.2)	1,614	48.1	(43.8, 52.4)
States						
Connecticut	616	52.7	(48.4, 57.0)	706	47.3	(43.0, 51.6)
Kentucky	922	52.8	(50.1, 55.5)	1,252	47.2	(44.5, 49.9)
Massachusetts	890	59.3	(55.8, 62.7)	916	40.7	(37.2, 44.2)
Mississippi	486	48.7	(45.1, 52.3)	620	51.3	(47.7, 54.9)
Ohio	644	51.9	(48.7, 55.2)	922	48.1	(44.8, 51.3)
Texas	396	56.9	(52.1, 61.6)	452	43.1	(38.4, 47.9)
Utah	856	60.2	(57.4, 62.9)	813	39.8	(37.1, 42.6)

The percent prevalence and 95% confidence interval were evaluted by demographic characteristic and state among women 18-44 years old who reported either planning a child in the future, regardless of timing, or women who reported not planning a child in the future.

Investigation Committee (protocol number 54E), as well as the CDC Human Research Protection Office (protocol number 2988.0).

Results

Prevalence of Family Planning

Prevalence estimates by age, race/ethnicity, housing arrangement, and BMI were obtained for women with future plans for children, regardless of how many prior births or when they planned to have children (**Table I**). The prevalence of plans

for children varied significantly with age. Whereas 76.2% (95% CI: 73.5%, 78.9%) of women between 18-34 years old reported planning children in the future, only 18.3% (95% CI: 15.6%, 20.9%) of women 35-44 years old had plans.

Similar significant differences were obtained by race/ethnicity, housing arrangement, and BMI (**Table I**). Whereas 51.8% (95% CI: 48.9%, 54.8%) of non-Hispanic White women reported plans for children in the future, 60.2% (95% CI: 56.4%, 64.0%) of women of minority race/ ethnicity reported having plans. Whereas 44.3% (95%CI: 40.7%, 47.9%) of women who owned their home reported planning children in the future, compared to 65.9% (95% CI: 63.0%, 68.8%) of women who rented their home. While 51.9% (95% CI: 47.6%, 56.2%) of obese women reported planning children in the future, 60.2% (95%CI: 56.5%, 63.9%) of women with a reported BMI less than 25.0 had plans.

The prevalence of future plans for children were obtained for each of the states that participated in the study (**Table I**). Mississippi had the lowest prevalence of women with future plans for children (prevalence = 48.7%, 95% CI: 45.1%, 52.3%). Compared to Mississippi, Massachusetts and Utah had significantly higher prevalence values of future plans for pregnancy. The prevalence of future plans for children was 59.3% (95% CI: 55.8%, 62.7%) in Massachusetts and 60.2% (95% CI: 57.4%, 62.9%) in Utah.

Prevalence of Family Planning, by Timing and Birth History

Among women planning pregnancy, prevalence estimates were obtained for those who reported either planning within two years or planning in two or more years (**Table II**). Among women planning a child in the future, 11.3% (95% CI: 9.8%, 12.9%) reported planning children within two years, while 44.1% (95% CI: 41.7%, 46.6%) reported planning children in two or more years. Among women 18 to 34 years old, 14.7% (95% CI: 12.4%, 16.9%) reported planning children within two years, and among women 35 to 44 years old, 5.4% (95% CI: 3.9%, 6.9%) reported planning children within two years.

A pattern of significantly greater prevalence for planning children in two or more years was similar across all demographics (**Table II**). For both women 18 to 34 years old, and women 35 to 44 years old, significantly more reported planning children in two or more years (61.5% among women 18-34 years old, and 12.9% among women 35-44 years old). Similarly, for all categories of race/ethnicity, BMI, and housing arrangement, significantly more women reported planning children in two or more years.

Among women who reported planning children in two or more years, significantly fewer were of older age, obesity, and living in owned homes. For instance, whereas the percent of obese women planning children in two or more years was 38.7% (95% CI: 34.3%, 43.1%), the percent of women with a BMI less than 25.0 was 48.4% (95% CI: 44.5%, 52.4%). Similarly, whereas the percent of women who owned their home and who reported planning children in at least two years was 34.8% (95% CI: 31.3%, 38.4%), the percent of women who rented their home was 52.2% (95% CI: 49.2%, 55.9%).

In addition to subcategories of pregnancy planning by timing, prevalence estimates for women planning children by birth history were calculated (**Table II**). Compared to women who were without children and not planning children, those planning children were less prevalent for every demographic category expect age. Among women 35 to 44 years old, only 23.8% (95% CI: 19.1%, 28.4%) were without children and not planning children, while 62.6% (95% CI: 59.6%,

Table II
Prevalence of Pregnancy Planning, By Timing and Birth History
(Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, Utah)
Behavior Risk Factor Surveillance System (BRFSS), 2013

		Percent Prevalence (95% confidence interval)									
			Age (years)		Race/Ethnicity		Body Mass Index			Home	
Pregnancy Planning	Sample Size	Overall	18-34	35-44	non-Hispanic White	Minority	Not obese/ overweight	Overweight	Obese	Own	Rent/ Other
Pregnancy Planning by Timing											
not planning	5,681	44.5 (42.2, 46.9)	23.8 (21.1, 26.5)	81.7 (79.1, 84.4)	48.2 (45.2, 51.1)	39.8 (36.0, 43.6)	39.8 (36.1, 43.5)	44.7 (40.3, 49.1)	48.1 (43.8, 52.4)	55.7 (52.1, 59.3)	34.1 (31.2, 37.0)
planning within two years (imminent)	1,145	11.3 (9.8, 12.9)	14.7 (12.4, 16.9)	5.4 (3.9, 6.9)	10.7 (9.3, 12.1)	12.1 (9.0, 15.2)	11.8 (9.4, 14.1)	10.0 (7.8, 12.2)	13.2[a] (9.1, 17,2)	9.4 (7.7, 11.2)	13.3 (10.7, 15.9)
planning in two or more years (remote)	3,665	44.1 (41.7, 46.6)	61.5 (58.4, 64.7)	12.9 (10.7, 15.1)	41.1 (38.0, 44.2)	48.1 (44.0, 52.2)	48.4 (44.5, 52.4)	45.3 (40.6, 50.0)	38.7 (34.3, 43.1)	34.8 (31.3, 38.4)	52.2 (49.2, 55.9)
Pregnancy Planning by Birth History[b]											
not planning with no children	2,665	57.2 (54.5, 59.9)	62.6 (59.6, 65.6)	23.8 (19.1, 28.4)	58.5 (55.5, 61.5)	55.4 (50.3, 60.5)	64.3 (60.6, 67.9)	54.2 (48.1, 60.2)	47.6 (41.2, 54.0)	54.8 (51.0, 58.6)	58.2 (54.2, 62.0)
planning with no children	801	10.0 (8.8, 11.2)	5.7 (4.7, 6.7)	36.6 (31.7, 41.4)	12.4 (10.7, 14.2)	6.7 (5.3, 8.1)	8.8 (7.2, 10.3)	9.3 (7.2, 11.4)	11.0 (8.6, 13.4)	12.2 (10.3, 14.2)	8.5 (7.0, 10.0)
planning with one or more children (mother)	1,720	32.8 (30.2, 35.4)	31.7 (28.8, 34.6)	39.7 (34.2, 45.1)	29.1 (26.2, 32.0)	37.9 (32.9, 42.9)	27.0 (23.4, 30.5)	36.6 (30.7, 42.4)	41.4 (35.3, 47.4)	33.0 (29.3, 36.6)	33.3 (29.6, 37.1)

[a] Coefficient of variation = 15.7%. All other coefficients of variation were less than 15%.
[b] The category of women with one or more children who were not planning children was not included in the study (n=3,016).

65.6%) of women 18-34 years old were without children and not planning children.

Among women who were without children and not planning children, a significantly higher percent were young and either overweight or obese (**Table II**). Among women without children who were planning children, a significantly great percent were older, non-Hispanic White, and home owners. Among women with children who were planning children, a significantly greater percent were older, of minority race/ethnicity, either overweight or obese, or home renters. These data suggest that family planning by birth history is dependent on demographics.

Selection of Covariates for Analysis

To determine what covariates to include in the logistic regression analysis of pregnancy planning by timing and birth history, multivariate regression was conducted to determine what covariates contribute significantly to pregnancy planning (**Table III**). Age was strongly significant ($p < 0.0001$) as a covariate for pregnancy planning by both timing and birth history. Body mass index was mildly significant for pregnancy planning by timing ($p = 0.0816$) and strongly

Table III
Significance of Model Effects for Pregnancy Planning, 2013
Behavioral Risk Factor Surveillance System (BRFSS), Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, Utah

Covariate	Timing		Birth History	
	F-Value	Prob	F-Value	Prob
Age	496.61	<0.0001	53.36	<0.0001
Race/Ethnicity	2.33	0.1267	3.88	0.0490
Housing Arrangement	10.11	0.0015	0.05	0.8223
Body Mass Index	2.51	0.0816	9.03	0.0001

Model effects were evaluated for pregnancy planning by timing and pregnancy planning by birth history. Tested covariates were age, race/ethnicity, body mass index, and housing arrangement, as described in **Methods** Section.

significant for pregnancy planning by birth history (p = 0.0001). Race/ethnicity was significant for only pregnancy planning by birth history (p = 0.0490), while housing arrangement was significant for only pregnancy planning by timing (p = 0.0015). Multivariate logistic regression with pregnancy planning by timing as a covariate, therefore, was evaluated with age, housing arrangement and body mass index as covariates. Regression with pregnancy planning by birth history was evaluated with age, race/ethnicity, and body mass index as covariates.

Multivariate Logistic Regression of Selected Health Indicators and Pregnancy Planning by Timing

The contribution of pregnancy planning by timing was evaluated for eight selected health behaviors, using multivariate logistic regression with the covariates age, housing arrangement and body mass index (**Table IV**). Pregnancy planning by timing contributed poorly to two health behaviors: leisure activity in the past 30 days (p = 0.9959) and binge drinking in the past 30 days (p = 0.2545. Pregnancy planning by timing also did not contribute significantly to receiving a checkup in the past year (p = 0.1205), receiving a flu vaccine in the past year (p = 0.2754), and consuming fruits and vegetables daily (p = 0.977). These results suggest that pregnancy planning did not factor into these behaviors.

Pregnancy planning by timing contributed significantly to the logistic regression model for three health behaviors (**Table IV**). Always using a seatbelt in the car (p < 0.0001), heavy drinking in the past month (p = 0.0037), and smoking cigarettes every or most days (p = 0.0006) contributed strongly to the regression model.

The three health behaviors for which pregnancy planning by timing contributed significantly to the logistic regression model were further evaluated for adjusted odds ratios (**Figure 1**). Compared to women not planning pregnancy, women planning pregnancy in at least two years were significantly less likely to always use a seatbelt in the car (OR = 0.55; 95% CI: 0.39, 0.79), and to smoke cigarettes every day or most days (OR = 0.64; 95% CI: 0.50, 0.82).

Compared to women who were not planning

Table IV
Significance of Pregnancy Planning and Selected Health Indicators
Behavioral Risk Factor Surveillance System, 2013
Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, Utah

	By Timing		By Birth History	
Health Indicator	**Wald Statistic**	**Significance**	**Wald Statistic**	**Significance**
Leisure activity in past 30 days	0.03	0.9859	2.05	0.3578
Consume fruit and vegetable at least once daily	3.24	0.1977	2.62	0.2696
Always use seatbelt in a car	19.66	<0.0001	18.15	0.0001
Checkup in past 12 months	4.23	0.1205	3.51	0.1732
Flu vaccination in past 12 months	2.58	0.2754	4.10	0.1285
Smoke cigarettes every day or most days	14.67	0.0006	16.37	0.0003
Heavy drinking in past 30 days	11.21	0.0037	2.43	0.2972
Binge drinking in past 30 days	2.74	0.2545	7.95	0.0187

Multivariage logistic regression was conducted for family planning by timing (not planning, planning within two years, planning in more than two years) and family planning by birth history (no plans with no children, planning with no children, planning with one or more child). Regression with pregnancy planning by timing was controlled for age, housing arrangement and body mass index. Regression with pregnancy planning by birth history was controlled for age, race/ethnicity, and body mass index. Analysis was conducted as described in **Methods** section.

pregnancy, women planning pregnancy within the next two years were no more likely to always use a seatbelt in the car, and smoke cigarettes every or most days (**Figure 1**). Only for heavy drinking was there a significant likelihood of improved behavior among women planning pregnancy within the next two years (OR = 0.46; 95% CI: 0.25, 0.84).

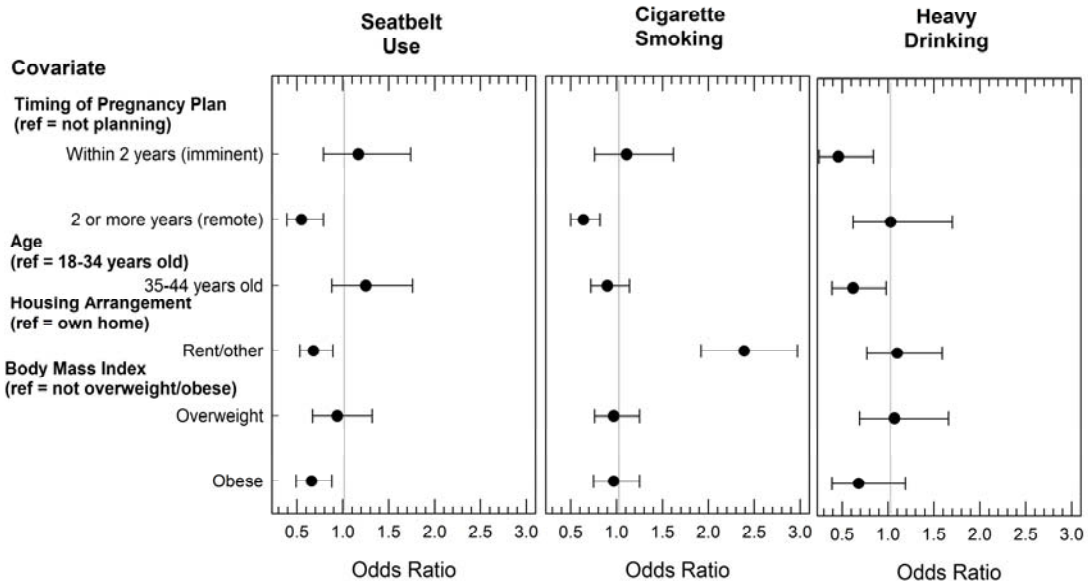
Multivariate Logistic Regression of Selected Health Indicators and Pregnancy Planning by Birth History

Multivariate logistic regression of selected health behaviors for pregnancy planning by birth history was evaluated with the covariates age, race ethnicity, and body mass index (**Table IV**). Pregnancy planning by birth history contributed poorly to three health-related behaviors: Leisure activity in the past 30 days (p = 0.3578), consumption of fruits and vegetables daily (p = 0.2696), and heavy drinking in the past 30 days (p = 0.2972). Pregnancy planning by birth history also did not contribute significantly to having either a checkup (p = 0.1732) or a flu vaccine (p = 0.1285) in the past year.

Pregnancy planning by birth history contributed significantly to three health-related behaviors (**Table IV**): Always using a seatbelt in the car (p = 0.0001), smoking cigarettes every or most days in the past 30 days (p = 0.0003), and binge drinking in the past 30 days (p = 0.0187).

Adjusted odds ratios are shown in **Figure 2** of the three health behaviors for which pregnancy planning by birth history contributed significantly to the regression model. Compared to women without children who were not planning pregnancy, women without children who were planning children were significantly more likely to always use seatbelts in the car (OR = 1.97; 95% CI: 1.40, 2.77), but were more likely to smoke cigarettes every or most days (OR = 1.91; 95% CI: 1.36, 2.69).

Figure 1
Adjusted Odds Ratios of Selected Health Behaviors *versus* Timing of Pregnancy Planning, 2013
Behavioral Risk Factor Surveillance System (BRFSS), Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, Utah



Multivariate logistic regression analysis was conducted on fruit and vegetable consumption at least once daily, always using a seatbelt in the car, cigarette smoking every or most days, and heavy drinking in the past month. Regression was conducted with the covariates age, housing arrangement and body mass index. Adjusted odds ratios are shown for each level of the covariates, with 95% confidence intervals.

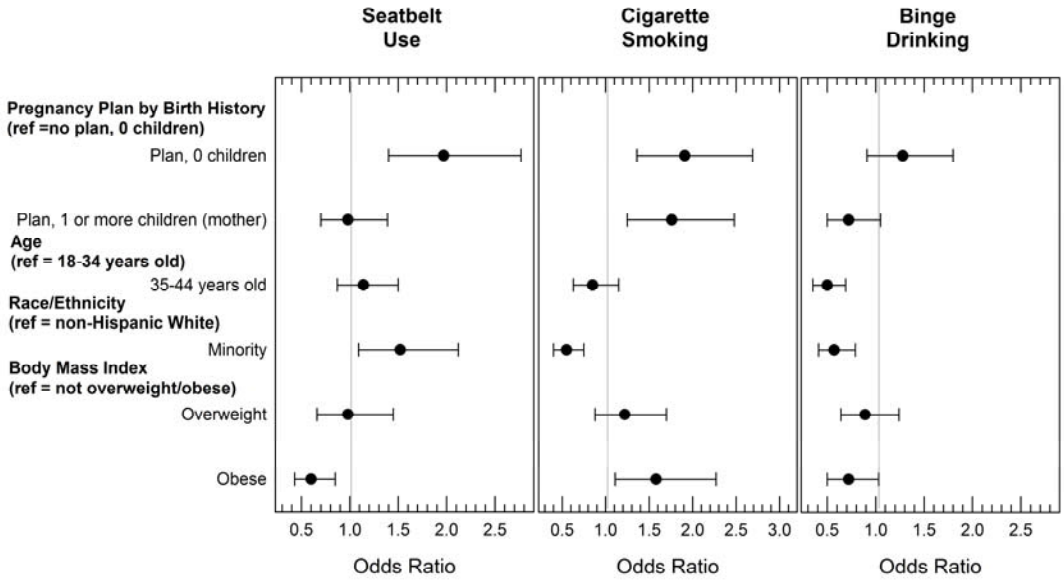
Compared to women without children who were not planning children, those with at least one child who were planning pregnancy were significantly more likely to smoke cigarettes every or most days (OR = 1.76; 95% CI: 1.25, 2.48) (**Figure 2**). For binge drinking behavior within the past 30 days, women planning children, either with or without children, were no less likely to engage in the behavior than women without children who were not planning children.

Discussion

The results of multiple logistic regression for selected health behaviors *versus* pregnancy planning among women show significantly improved behaviors for only heavy drinking among women with imminent plans for pregnancy, smoking cigarettes among women with remote plans for pregnancy, and always using a seatbelt in the car among women without children. The health-related behaviors of binge drinking in the past 30 days was not significantly improved among women planning pregnancy. Further, women planning pregnancy, regardless of number of the prior births, were significantly more likely to smoke cigarettes daily or most days than women without children who were not planning pregnancy. These results suggest that pregnancy planning was not connected to changes in most health-related behaviors.

The association of family planning with behavioral changes was examined in two ways. First, family planning was considered according to timing of planned pregnancy, looking at plans that were either imminent or remote. The limited sample size required aggregated categories that were difficult to assess. For instance, imminent plans for pregnancy included women who were planning children within one or two years. This

Figure 2
Adjusted Odds Ratios of Selected Health Behaviors *versus* Pregnancy Plan by Birth History, 2013
Behavioral Risk Factor Surveillance System (BRFSS), Connecticut, Kentucky, Massachusetts, Mississippi, Ohio, Texas, Utah



Multivariate logistic regression analysis was conducted on always using a seatbelt in the car, always using a seatbelt in the car, cigarette smoking every or most days, and binge drinking in the past month. Regression was conducted with the covariates age, race/ethnicity and body mass index. Adjusted odds ratios are shown for each level of the covariates, with 95% confidence intervals.

was necessary because the coefficient of variation for women planning children within one year was greater than 15%. The behaviors of a woman planning pregnancy within one year, however, may be very different from those of a woman planning pregnancy within two years. The need to combine these two categories may have obscured possible results.

In addition to analysis by timing of planned pregnancy, pregnancy planning was considered by history of prior births to discern the possible difference between women without children who either were planning or were not planning children, and mothers who were planning additional children. For this analysis, the fourth category of mothers with no future plans for children was excluded because it was a very heterogeneous group. A larger sample size might have allowed a more thorough analysis with all four possibilities.

This study examined the association between pregnancy planning and selected health behaviors for which the planning variables contributed significantly ($p < 0.10$) to the regression model. Other health behaviors, such as leisure activity in the past 30 days, daily fruit and vegetable consumption, a medical checkup in the past 12 months, and flu vaccination in the past 12 months, did not contribute significantly to the regression model for either pregnancy planning by timing or pregnancy planning by birth history. Full regression analysis on these health behaviors confirmed that pregnancy planning was not a significant factor in these health behaviors (data not shown).

The disconnect between the health behaviors described in this report and pregnancy planning

suggests that many health behaviors are not part of a woman's thoughts in pregnancy planning. The lack of association between these health indicators and pregnancy planning need to be further studied. In addition, other health behaviors collected in the BRFSS and not reported in this study need to be explored.

Results in the study were conducted by combining responses from all states that offered the reproductive health module in their 2013 BRFSS survey. When prevalence estimates for family planning were examined by state (**Table I**), only a few states varied significantly. Despite this limited degree of variation, it is possible that cultural or geographic/regional variation exists in the association between family planning and behavioral changes. This possible variation needs to be explored.

Analysis of the reproductive health module in the BRFSS was recently conducted to assess contraceptive use among women at-risk for infection by the Zika virus [8]. The results described in this report compare well to the publication, further suggesting that there is a need to encourage preconception care and family planning among women of reproductive age. The report also highlights the capability of the BRFSS survey to assess and monitor behaviors, attitudes, and health conditions of women of reproductive age.

This study identified several demographic characteristics that were more prevalent among women planning pregnancy. As discussed below, body mass index, age, race/ethnicity, and housing arrangement as a proxy for income varied among women planning pregnancy, compared to women who were not planning pregnancy.

Body mass index was a covariate in this study. Prevalence of overweight and obesity were significantly different between women planning or not planning children in the future (**Table I**). Also, body mass index contributed significantly to the regression model for both pregnancy planning by timing and pregnancy planning by birth history (**Table III**). The prevalence of obese women planning children was significantly less than women at a normal weight, however many obese women were planning pregnancy within two years (**Table II**).

As expected, the prevalence of family planning varied significantly with age. Pregnancy planning was more prevalent among women 18-34 years old (**Tables I** and **II**), yet over 18% of women 35-44 years old reported planning children in the future, and 12.9% older women reported planning children in two or more years.

The results of this study show significant differences between housing arrangement and race/ethnicity in family planning. The prevalence of planning children among women of minority race/ethnicity was significantly greater than that of non-Hispanic White women, as well as among women who live in rental units (**Table I**). Further, both race/ethnicity and housing arrangement varied with plans for children by timing and birth history.

Limitations

Surveys such as the CT BRFSS are subject to sources of bias that include nonresponse bias, recall bias, and selection bias. This survey depends on anonymous responses from citizen volunteers, and all questions within the survey are voluntary and, therefore, subject to nonresponse bias. The survey is offered within a 20-25 minute time period, with some questions asking respondents to remember events years before the interview. Also, although the survey sampling methodology selects respondents at random, participation in the survey is voluntary.

This survey was conducted among adults in seven states who lived during the year 2013 in residential units, and did not include long-term group quarters, such as convalescent homes,

though women living in school dormitories were included in the survey. Further, the survey was conducted by phone, excluding responses from those who were hearing-impaired, or those suffering from moderate to severe cognitive impairment. These exclusions likely introduced selection bias into the estimates.

For the analysis described in this report, the data were controlled for only those covariates that contributed significantly ($p < 0.10$) to the regression model and only when the coefficient of variation for the covariate was less than 15%. Despite this choice of analysis, many variables had to be collapsed due to a limited sample size. For instance, non-Hispanic White was compared with all minority races and ethnicities combined. Together with the limitations of the pregnancy variable, it is possible that health behavioral changes were masked. A larger sample size is needed to confirm these results.

In the 2017 BRFSS survey, as many as 20 states are expected to once again offer the family planning module, and this time for a full year (*C. Stone, personal communication*). The data generated from this upcoming opportunity may make possible a more comprehensive assessment of behavioral changes among women planning pregnancy, and may allow an assessment that accounts for geographic and cultural variation in reproductive health planning.

Public Health Implications

For all women, preconception care commonly involves preparing a plan for pregnancy, obtaining medical well-visits to control existing medical conditions that can affect a pregnancy outcome, taking folic acid supplements, reducing risk behaviors such as alcohol, street drugs, and tobacco products, avoiding exposure to toxic substances, maintaining or working toward a healthy weight, getting help for violence, learning about family health history, and getting mentally healthy [9].

Preconception care is now encouraged at the federal level, and publications by at least six federal agencies have been produced to support the practice [10]. Preconception health is also a priority in states [11], as well as within Connecticut [12]. Preconception care is encouraged for all women of reproductive age [13], even if they are not planning pregnancy, due to a high prevalence of unplanned pregnancies [14].

A multi-generational approach to preconception care for both women and men has been identified as a growing need [15]. Further, it has been suggested that preconception care be broadened and defined as preconception health *and* care, and that it include topics such as intimate partner violence and psychosocial issues [16].

Recent research in the laboratory suggests that preconception maternal use of alcohol may be directly linked to adverse birth outcomes [17]. This finding with potential implications for humans emphasizes the need to address known risk behaviors well in advance of conception. Reduction of known risk factors prior to pregnancy has been shown to reduce the risk of adverse birth outcomes [18].

Despite this growing priority on preconception care within multiple sectors and at all levels of public health agencies, the results of this study suggest that women planning pregnancy are not preparing in several important ways. They appear to be making health-enhancing changes in heavy drinking and seatbelt use, but are not otherwise preparing for pregnancy by making health-conscious changes.

The results described in this report show that body mass index is a contributing factor in pregnancy planning (**Table III**). Women who are obese are at increased need for preconception health, and

reproductive planning needs to include weight maintenance and reduction programs [19, 20].

Age is a factor in planning for children (**Table III**). Preconception care is also needed for women of all ages. Particularly for women of older age, preconception care should include co-morbid conditions that occur with age, as well as reproductive issues such as infertility and assisted reproductive technologies [21].

Preconception health among women of minority race/ethnicity must also be a priority, as well as among women living in rental units. Recent evidence suggests that, despite no significant difference in family planning goals, women of low income were significantly more likely to drink and smoke [22].

The strong link between preconception health, reproductive planning, and improved pregnancy and birth outcomes provides public health agencies with the evidence needed to make preconception health a priority. Strategies need to be focused at the individual and institutional levels as described below.

To meet the goal of having all women healthy and ready for pregnancy, women need to prepare for pregnancy well in advance of conception and need to place an emphasis on their own health needs. Public health agencies can help to raise awareness of this need by encouraging all women to obtain regular well-visits and to make reproductive health plans that fit with their plans for future children [9].

Educational programs are also needed to encourage family physicians treating women of reproductive age to include preconception care in adult well-visits [23]. Many topics can be included in preconception care, including screening for risk of alcohol use during pregnancy [24], advising ways to avoid environmental toxins known to affect fetal development [25], and a variety of other topics for both women and their partners [26, 27].

Institutional barriers exist to incorporating preconception care into primary care [28], and several recent efforts have aimed to bring the very broad concept of preconception care to a more manageable level for primary care providers. A recently developed tool may be useful in identifying non-pregnant women at greater risk for adverse birth outcomes and in greater need of preconception health intervention [29]. Also, Nobles-Botkin and coworkers have published a set of resources for clinical providers [30]. A guide has also been produced for health care providers which outlines, at a minimum, the most important factors to address in a well-visit that includes preconception care [31].

Of all women planning children in the future, nearly one in three (32.8% ,95% CI: 30.2%, 35.4%; **Table II**) mothers were planning children in the future. This makes possible the use of well-child visits for preconception/interconception care. A recent study reported that women were very responsive to preconception care during these visits for their children [32]. Further, the American Academy of Family Physicians recently published a position paper on preconception care that outlines components of preconception care for mothers during well-child visits [33].

Preconception care is important for men as well as women [34, 35, 36]. This study was conducted only among women of reproductive age, but public health interventions need to also encourage regular well-visits and family planning among men. Recent studies have shown a link between preconception health behaviors among men and adverse birth outcomes [37], highlighting the need for preconception care among men.

Making preconception health a priority at the individual, institutional, and population levels will improve reproductive health for both men and women, with promise for improving the health and wellbeing of women, children, and families.

Acknowledgements

The author acknowledges the contribution of members of the CDC Reproductive Health Workgroup, as well as state BRFSS coordinators in the states of Kentucky Massachusetts, Mississippi, Ohio, Texas, and Utah. Work by C. Stone on this project was funded by the Connecticut State Title V Maternal and Child Health Block Grant (grant number B04MC25330), the Connecticut Behavioral Risk Factor Surveillance System (grant number 5U58SO000003), and the Connecticut Preventive Health and Health Services Block Grant (grant number B01-DP009008).

References

1. Centers for Disease Control and Prevention: Preconception Care, Overview, *https://cdc.gov/preconception/overview.html*, accessed on August 24, 2016.

2. Connecticut Department of Public Health: What to Know Before You Consider a Pregnancy, *http://www.ct.gov/dph/cwp/view.asp?a=3138&q=562060*, accessed on August 24, 2016.

3. Hussein, N, Kai, J, Qureshi, N (2016) The effects of preconception interventions on improving reproductive health and pregnancy outcomes in primary care: A systematic review. *Eur J Gen Pract 22(1):42-52*.

4. Johnson, K, Posner, S.F., Biermann, J., Cordero, J.F., Atrash, H.K., Parker, C.S., Boulet, S., Curtis, M.G. (2006) Recommendations to improve preconception health and health care—United States. *MMWR 55(RR-06):1-23*.

5. Centers for Disease Control and Prevention: Behavioral Risk Factor Surveillance System (BRFSS), *http://www.cdc.gov/brfss/* accessed on August 26, 2016.

6. Connecticut Department of Public Health: Behavioral Risk Factor Surveillance System, *http://www.ct.gov/dph/BRFSS*, accessed on August 26, 2016.

7. Centers for Disease Control and Prevention: Behavioral Risk Factor Surveillance system: Weighting the Data, *http://www.cdc.gov/brfss/annual_data/2012/pdf/Weighting%20the%20Data_webpage%20content%2020130709.pdf*, accessed on August 26, 2016.

8. Boulet, SL, D'Angelo, DV, Morrow, B, Zapata, L, Berry-Bibee, E, Rivera, M, Ellington, S, Romero, L, Lathrop, E, Frey, M, Williams, T, Goldberg, H, Warner, L, Harrison, L, Cox, S, Pazol, K, Barfield, W, Jamieson, DJ, Honein, MA, Kroelinger, CD (2016) Contraceptive use among nonpregnant and postpartum women at risk for unintended pregnancy, and female high school students, in the context of Zika preparedness — United States, 2011–2013 and 2015, *MMWR 65(30);780–787* (*http://www.cdc.gov/mmwr/volumes/65/wr/pdfs/mm6530e2.pdf*, accessed on September 3, 2016).

9. Centers for Disease Control and Prevention: Preconception Care, Women, *http://www.cdc.gov/preconception/women.html*, accessed on August 24, 2016.

10. Centers for Disease Control and Prevention: Preconception Care, Free Materials, Policy Strategies and Resources, *https://www.cdc.gov/preconception/freematerials-policies.html*, accessed on August 24, 2016.

11. Centers for Disease Control and Prevention: Preconception Care, Free Materials, State and Local Strategies and Programs, *https://www.cdc.gov/preconception/freematerials-state-local.html*, accessed on August 24, 2016.

12. Connecticut Department of Public Health (2014) Healthy Connecticut 2020. 2: State Health Improvement Plan, Hartford, CT, *http://www.ct.gov/dph/lib/dph/state_health_planning/sha-ship/hct2020/hct2020_state_hlth_impv_032514.pdf*, accessed on August 26, 2016.

13. Shapiro-Mendoza, CK, Barfield, WD, Henderson, Z, James, A, Howse, JL, Iskander, J, Thorpe, PG (2016) CDC Grand Rounds: Public health strategies to prevent preterm birth. *MMWR Morb Mortal Wkly Rep 65(32):826-830*.

14. Godiwala, P, Appelhans, BM, Moore Simas, TA, Xiao, RS, Liziewski, KE, Pagoto, SL, Waring, ME (2016) Pregnancy intentionality in relation to non-planning impulsivity. *J. Psychosom Obstet Gynaecol 20:1-7*.

15. St. Fleur, M, Damus, K, Jack, B (2016) The future of preconception care in the United States: multigenerational impact on reproductive outcomes. *Ups J Med Sci Jul 19:1-5*.

16. Berglund, A, Lindmark, G (2016) Preconception health and care (PHC) - A strategy for improved maternal and child health. *Ups J. Med Sci Jun 20:1-6*.

17. Jabbar, S, Chastain, LG, Gangisetty, O, Cabrera, MA, Sochacki, K, Sarkar, DK (2016) Preconception alcohol increases offspring vulnerability to stress. *Neuropsychopharmacology Jul 6, pending publication*.

18. Barua, S, Junaid, MA (2015) Lifestyle, pregnancy and epigenetic effects. *Epigenomics 7(1):85-102*.

19. Masho, SW, Bassyouni, A, Cha, S (2016) Pre-pregnancy obesity and non-adherence to multivitamin use: Findings from the National Pregnancy Risk Assessment Monitoring System (2009-2011). *BMC Pregnancy Childbirth 16(1):210*.

20. Delcore, L, Lacoursiere, DY (2016) Preconception care of the obese woman. *Clin Obstet Gynecol 59(1):129-139*.

21. D'Alton, ME, Walsh, JM (2016) Pregnancies in older women—it's time to adopt an 'every women, every time' approach to preconception care. *BJOG Jul 13: 1*.

22. Ayoola, AB, Sneller, K, Ebeye, TD, Dykstra, MJ, Ellens, VL, Lee, HG, Zandee, GL (2016) Preconception health behaviors of low-income women. *MCN Am J Matern Child Nurs 41(5):293-298*.

23. Ciftci, B, Uzel, N, Ozel, MO, Zergerogly, S, Deger, C, Turasan, SS, Karakoc, AG, Ozbalci, S (2016) "Maternal Health and Family Planning Distance Education" experience among physicians: A three-phase study to determine the educational needs, develop education program, and evaluate efficacy of the education administered. *Ad Med Educ Pract 7:347-355*.

24. Montag, AC (2016) Fetal alcohol-spectrum disorders: Identifying at-risk mothers. *Int J Women's Health 8:311-323*.

25. Genuis, SJ, Genuis, RA (2016) Preconception care: A new standard of care within maternal health services. *Biomed Res Int 2016:6150976*.

26. Nypaver, C, Arbour, M, Niederegger, E (2016) Preconception care: Improving the health of women and families. *J. Midwifery Womens Health 61(3):356-364*.

27. Landeen, LB, Bogue, R, Schuneman, M (2015) Preconception and prenatal care—useful tools for providers of women's health. *S D Med Spec No: 36-43*.

28. M'hamdi, HI, van Voorst, SF, Pinxten, W, Hilhorst, MT, Steegers, EA (2016) Barriers in the uptake and delivery of preconception care: Exploring the views of care providers. *Matern Child Health J Jul 16, pending publication*.

29. Mehta-Lee, SS, Palma, A, Bernstein, PS, Lounsbury, D, Schlecht NF (2016) A preconception nomogram to predict preterm delivery. *Matern Child Health J Jul 26, pending publication*.

30. Nobles-Botkin, J, Lincoln, A, Cline, J (2016) Preconception care resources: Where to start. *J. Midwifery Womens Health 61(3):365-369*.

31. Frayne, DJ, Verbiest, S, Chelmow, D, Clarke, H, Dunlop, A, Hosmer, J, Menard, MK, Moos, MK, Ramos, D, Stuebe, A, Zephyrin, L (2016) Health care system measures to advance preconception wellness: Consensus recommendations of the Clinical Workgroup of the National Preconception Health and Health Care Initiative. *Obstet Gynecol 127(5):863-72*.

32. Rosener, SE, Barr, WB, Frayne, DJ, Barash, JH, Gross, ME, Bennett, IM (2016) Interconception care for mothers during well-child visits with family physicians: An IMPLICIT Network Study. *Ann Fam Med 14(4):350-355*.

33. Academy of Family Physicians: Preconception Care (Position Paper), 2015, *http://www.aafp.org/about/policies/all/preconception-care.html*, accessed on September 5, 2016.

34. Besera, G, Moskosky, S, Pazol, K, Fowler, C, Warner, L, Johnson, DM, Barfield, WD (2016) Male attendance at Title X family planning clinics—United States, 2003-2014. *MMWR Morb Mortal Wkly Rep 65(23):602-605*.

35. Day, J, Savani, S, Krempley, BD, Nguyen, M, Kitlinska, JB (2016) Influence of paternal preconception exposures on their offspring: through epigenetics to phenotype. *Am J Stem Cells 5(1):11-18*.

36. Agricola, E, Gesualdo, F, Carloni, E, D'Ambrosio, A, Russo, L, Campagna, I, Pandolfi, E, Tozzi, AE (2016) Investigating paternal preconception risk factors for adverse pregnancy outcomes in a population of internet users. *Reprod Health 13:37*.

37. McBride, N, Johnson, S (2016) Fathers' role in alcohol-exposed pregnancies: Systematic review of human studies. *Am J. Prev Med 51(2):240-248*.

Suggested Citation:
Stone, C (2016) Association between pregnancy planning and health behaviors: Results from the Behavioral Risk Factor Surveillance System (BRFSS) in seven states, 2013, Connecticut Department of Public Health, Hartford, Connecticut.

This document can be viewed at *http://www.ct.gov/dph/BRFSS*