Examine the Intervention Program for First Steps to Reduce the Risk of Low Birth Weight

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Abstract

The goal of this study is to examine the intervention program for first steps to reduce the risk of low birth weight. The data was extracted from birth records in King County in 2001 and includes sociodemographic and other covariates that are associated with the risk of low birthweight. We conducted descriptive statistics and chi-square and independent t-test analyses to examine the First Steps Program's association with birth weights for confounding factors. The study included 2,500 participants, 403 (16.1%) of whom were enrolled in the First Steps program. The covariates race, age, marital status, welfare, smoking status, and education level are associated with participation in the First Steps intervention program (all P-values < 0.05) and associated with the risk of low birth weight. Particularly, race, age, smoking status, marital status, education level and welfare are potential cofounders. After cofounders were adjusted, the effects of the First Steps intervention program on birth weight changed. We found low birth weight in participants who enrolled in the First Steps program. Based on this result, I will recommend that it would be better to improve the First Steps intervention at the board of public health in King County and further studies to see the effects of first program intervention on birth weight.

Introduction

Low birth weight (LBW) continues to remain a major public health problem worldwide. World Health Organization defines low birth weight (LBW) as the birth weight less than 2500 grams irrespective of gestational age [1]. Low birth weight (LBW) is a significant contributor to perinatal mortality as well as short- and long-term infant and childhood morbidity in both developed and developing countries. It also contributes risk of later adult chronic medical conditions, such as diabetes, hypertension, and heart disease [2-3]. According to WHO, about 25 million LBW babies are born each year, nearly 95% of them in developing countries [4]. In 2020, 1 in 12 babies (8.2% of live births) was low birthweight in the United States [5].

There are several studies have been conducted on risk factors for low birthweight in different populations. Many studies identify sociodemographic factors associated with the risk of low birthweight [6]. Most likely, a combination of biological, behavioural, environmental, and

medical factors contribute to a baby's birthweight. However, studies on risk factors for low birthweight in the USA are still limited. Also, no studies have assessed the effect of participation in the First Steps Program on low birth weights. The new program, called 'First Steps,' provides free pre-natal care to low-income women. As a result, we investigated the effects of participation in the First program on birth weights and the risk factors for low birth weight.

Methods

The data for the present study were extracted from Washington State birth records to conduct a study of singleton, live births in King County in 2001. We identified 2,500 live births for the current analyses. The study covariates included child's sex, age, the multiplicity of birth, mother's age at birth, prior number of children in family, status of marriage, years of mother's education, birth weight, gestational age at birth (in week), participation in first steps, and race. Race/ethnicity was categorized as Asian, Black, White, Hispanic, and others. Maternal smoking and alcohol use during pregnancy, number of cigarettes per day during pregnancy, number of drinks per day during pregnancy, mother's pre-pregnancy weights in points, and amount of maternal weight-gain during pregnancy.

In the descriptive analysis, continuous variables are shown as means (standard deviation [SDs]), while categorical variables are presented as the number and percentage of subjects. We also used Box-plot and histogram to show the distribution the variables. We independent t test to observed difference in birthweights between babies whose mothers participated in First Steps and babies, whose mothers did not participate in First Steps. In addition, to estimate a 95% CI for mean of birthweights in each group. All analyses were performed by R program (Version: 4.0.5; R Foundation for Statistical Computing, Vienna, Austria).

Results

A total of 2,500 participants were included in the final analyses. Baseline characteristics stratified by participation in the First Steps Program are reported in Table 1. Among those participants, 403 (16.1%) subjects were enrolled in the First Steps program, and 2,097 (83.9%) subjects were not enrolled in the First Steps program. Of the participants in the First Steps program, 50.62% were single. This figure was higher than that of non-first program participants who were single (16.21%). Approximately 5.12% and 1.0% of participants were on welfare among the participants and non-participants in the first program, respectively. Among participants, 12.7% and 5.9% of participants reported being smokers during pregnancy among participants and non-participants in the first steps program, respectively. The mother's average age at birth was 30.05 years (SD = 5.70 years) and 25.39 years (SD = 6.03 years) for the participants and non-participants of the first program, respectively. The non-participants were relatively older than the participants of the First Steps Program. The average years of mother's education was 14.45 years (SD = 2.44 years) and 12.08 years (SD = 2.65 years) for the participants and non-participants of the first program, respectively. The non-participants in the First Steps program were more educated than the participants.

The mean amount of maternal weight-gain during pregnancy for the participants and the non-participant of the First Steps Program were 32.14±12.94 and 32.99 ± 15.62 years, respectively. There was not a difference in mean weight gain between them (P-value = 0.38). The majority of the respondents had no prior number of children in family. Beside, majority of mothers' had no smoke cigarettes and drinks alcohols per day during pregnancy. Further information about skewness and outlier for of child's birth weights was a negative skewed and had outliers shown in Figure 1 using histogram and boxplot, respectively. The histogram in figure 1 indicates a negative skewness, meaning that the distribution is left skewed and the mean of the child's birth weight is less than the median value. The cause of skewness I think mothers who are at risk encouraged to participate in the intervention and probabilities taper off more slowly for lower values. The child's birth weight data set had an outliers using Box plot, and the coefficient of skewness (-0.687) is indicated negatively skewed.

The child's average birth weight was 3358.51 grams and 3424.68 grams for the participants and non-participants of the first program, respectively. A 95% confidence interval (CI) for

the child's mean birth weight difference between the participants and non-participants in the First Steps program was (95 % CI: 6.57–125.79). This 95% CI does not include the hypothesised mean difference value of zero, and it indicated that there was a difference in the mean child's birth weight between them (P-value = 0.029)

Table 1 Baseline characteristics of participants stratified by participation in the First Steps Program (N=2,500)

Variables	Participants in First Step Program		
	Yes	**No**	**Total**
	403 (16.1%)	**2097 (83.9%)**	
Female (n, %)	191 (47.4%)	1,018 (48.5%)	1,209 (48.4%)
Age (years)	25. 39 (6.03)	30.06 (5.70)	29.3 (6.0)
Plural (n, %)	403 (100%)	2,097 (100%)	2500 (100%)
Race (n, %)			
Asian	53 (13.2%)	339 (16.2%)	392 (15.7%)
Black	60 (14.9%)	118 (5.6%)	178 (7.1%)
Hispanic	88 (21.8%)	132 (6.3%)	220 (8.8%)
White	191 (47.4%)	1488 (71.0%)	1679 (67.2%)
Other	11 (2.7%)	20 (1.0%)	31 (1.2%)
Married (n, %)	199 (49.4%)	1757 (83.8%)	1956 (78.2%)
Mother's education (years)	12.1 (2.65)	14.5 (2.44)	14.1 (2.63)
Welfare (n, %)	21 (5.2%)	21 (1.0%)	42 (1.7%)
Smoker	51 (12.7%)	124 (5.9%)	175 (7.0%)
Alcohol user (n, %)	4 (1.0%)	25 (1.2%)	29 (1.2%)
Birth weight (gm)	157 (6)	170 (6)	0.000
Gestational age at birth (weeks)	38.7 (2.79)	38.9 (2.29)	38.9 (2.38)
Mother's pre-pregnancy weights	151 (40.0)	146 (33.4)	147 (34.6)
Maternal weight-gain	33.0 (15.6)	32.1 (12.9)	32.3 (13.4)

Values are means (SD), unless otherwise specified

Table 2 shows the association between responses to the First Steps program and dichotomous variables. The First Steps Program has a statistically significant relationship with the mother's marriage, welfare, and smoking status (all P-values 0.001) and there are also a potential cofounder. The overall proportion of the participants in the First Steps program is different for each status of mother in those variables. Particularly, race, age, smoking status, marital status, education level and welfare are potential cofounders. In Figure 2, it shows the effects of birthweight on the mother's welfare, and smoking status that are different in proportion between participants and non-participants in the First Steps Program. Particularly, we can see the slope change between smoking and welfare status in Figure 2. Low birthweight was associated with mothers' welfare status and smoking status during pregnancy. Participants in the First Steps program who smoked cigarettes during pregnancy and were on welfare had a higher risk of having a low birth weight than the non-participants.

Using the t-independent test, there is no difference in birth weight between participants and non-participants among mothers who were exposed to the risk factors (all P-value >0.05). Similarly, the same is true for mothers who were not exposed to the risk factors (all P-value >0.05). However, there is a difference in birth weight between participants and non-participants among mothers in the overall subjects (all P-values 0.05).

Table 2 Association between dummy variables with participation of the First Steps Program

Variables	Participants in First Steps Program			
	Yes 403 (16.1%)	**No 2097(83.9%)**	**Total**	**P-value***
Female (n, %)	191 (47.4%)	1,018 (48.5%)	1,209 (48.4%)	0.67
Plural (n, %)	403 (100%)	2,097 (100%)	2500 (100%)	>0.99
Married (n, %)	199 (49.4%)	1757 (83.8%)	1956 (78.2%)	<0.001
Welfare (n, %)	21 (5.2%)	21 (1.0%)	42 (1.7%)	<0.001
Smoker	51 (12.7%)	124 (5.9%)	175 (7.0%)	<0.001
Alcohol user (n, %)	4 (1.0%)	25 (1.2%)	29 (1.2%)	>0.99

P significant at ≤ 0.05
*Pearson's Chi-squared test

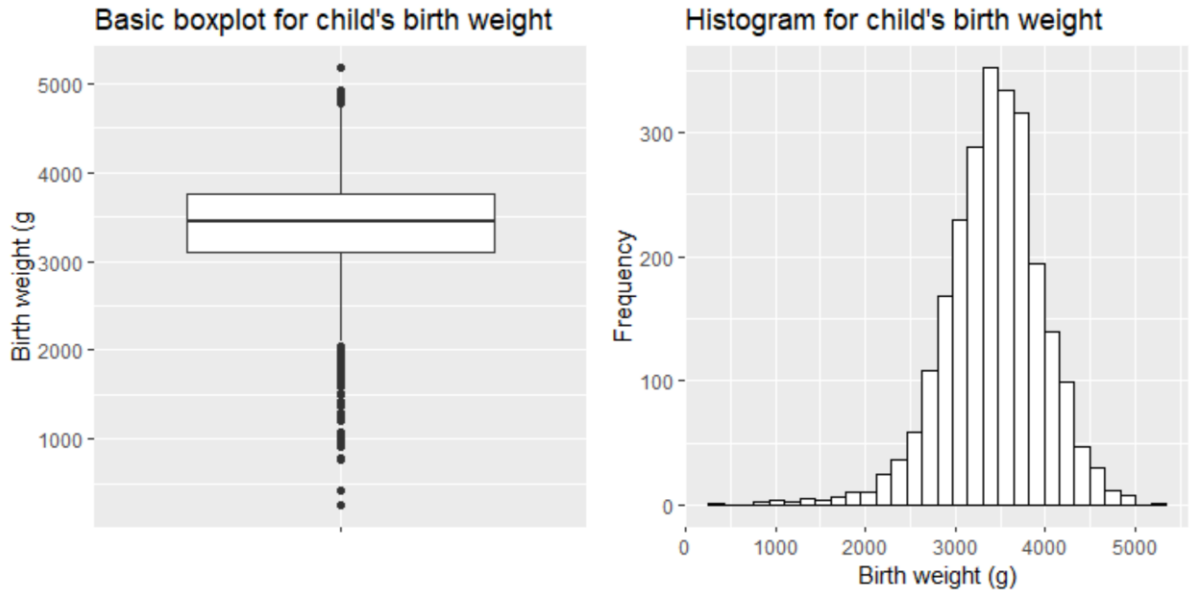

Figure 1: Boxplot and histogram plot for child's birth weight

Of the participants in the First Steps program, 4.7% had low birth weight (LBW). This figure was higher than that of non-First program participants who had LBW (4.3%). Approximately 1.5% and 0.5% of participants had very low birth weight among the participants and non-participants in the first program, respectively. There is not statistical association between participating in the First Steps Program and define of birth weight category (P-value = 0.10).

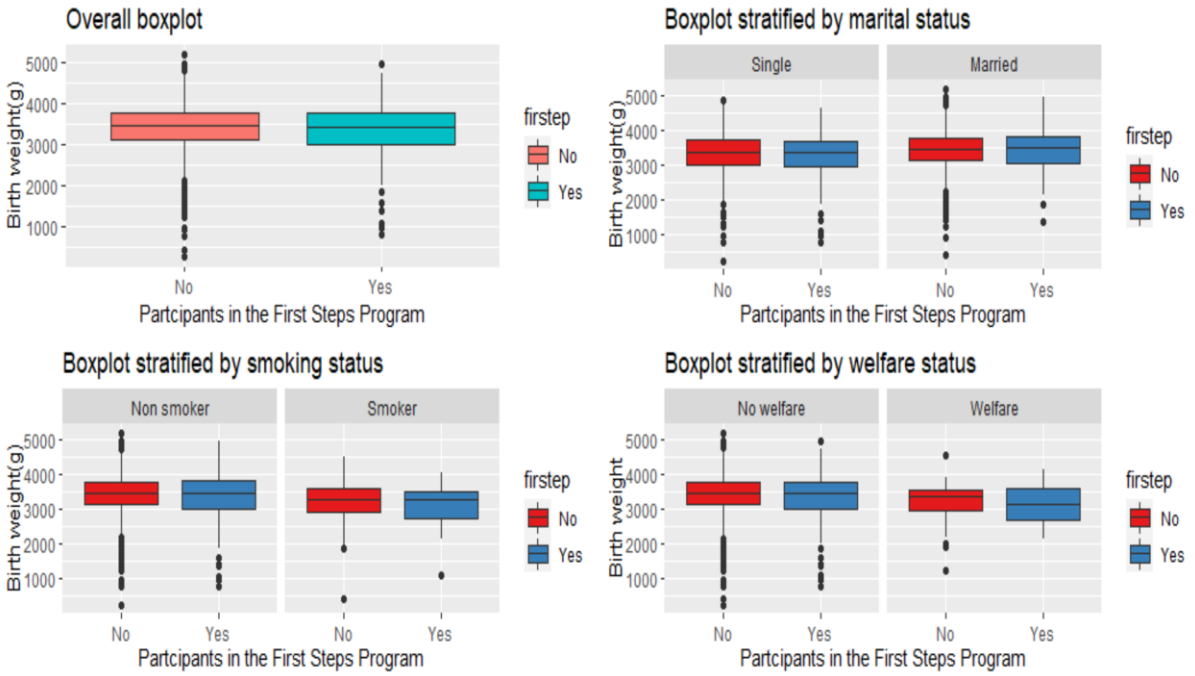

Figure 2: Boxplot for child's birth weight and participants in the First Steps Program stratified by marital, welfare and smoking status

Table 3: Child's birth weight category stratified by participation in First Steps Program

Variables	**Participants in the First Steps Program**			
	Yes	**No**	**Total**	**P-value**
	403 (16.1%)	2097 (83.9%)		
Child's birth weight (n, %)				0.10
Very low birth weight	6 (1.5%)	11 (0.5%)	17 (0.7%)	
Low birth weight	19 (4.7%)	91 (4.3%)	110	
Normal	378 (93.8%)	1,995 (95.1%)	2,373 (94.9%)	

P significant at ≤ 0.05

The box plot shows the values of a child's birth weight with respect to participation in the First Steps program stratified by race (Figure 3). It shows that there is a different amount of a child's birth weight between participants and non-participants in the First Steps program in each race. In other race categories, participants in the First Steps program have a lower birth weight. Using analysis of variance (ANOVA), we can determine whether the mean birth weight statistically different or not among the race categories of the respondents. The result shows that the average birth weight are statistically significant in the race category (P-value <

0.05).

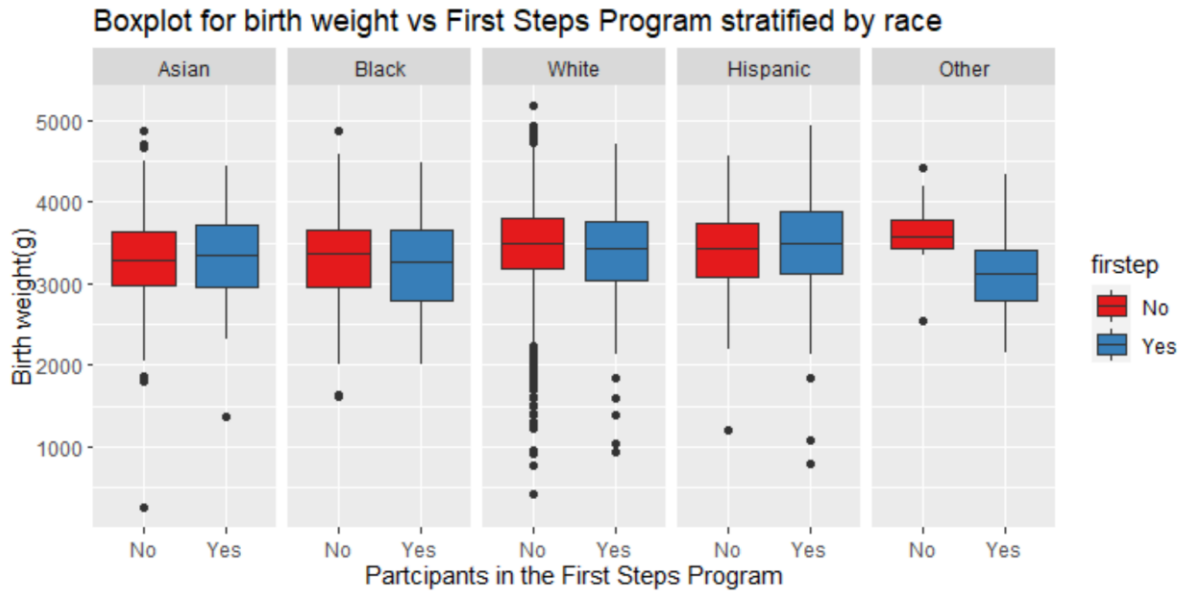

Figure 3: Stratified by race using a box plot for child's birth weight and participate in First Steps program

Discussion

I investigated whether or not participation in the First Steps program increases birthweight and compared socio-demographic and other factors to low birth weight in this study. I found that there is not strong evidence to indicate that the First Steps program intervention will increase birth weight. This could be due to a variety of factors, including the fact that the majority of First Steps participants are white, their mothers are younger, they are single mothers, they smoke more, they are less educated, and there are extreme outliers in the dataset. In this study, mothers were more likely to be recruited from younger age groups, single mothers, slightly less educated, and on welfare in the intervention group.

Many other strategies have been used in an attempt to reduce low birth weights (LBW) [6-7]. In this study, I found that the covariates race, age, marital status, welfare, smoking status, and education level were associated with participation in the First Steps intervention program and with the risk of low birth weight. Particularly, race, age smoking status, marital status, education level and welfare are potential cofounders. A successful intervention would address smoking status, education level, and the welfare of mothers. After cofounders were adjusted, the effects of the First Steps intervention program on birth weight changed. I would like to see more scientific research on the first steps of the program's intervention to reduce low birth weight.