BW project

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Abstract

This study explored whether "First Step" — a new provides free pre-natal care to low-income women — is helpful for increasing the birth weight of children. The information of 2500 newborns' mother was collected and analyzed. 403 of them once participated in "First Step" and the rest did not. The average birth weight of the program participant is 3358.506 grams, which is 66.181 grams less than which of the non-participants, shows poor effect of this program regardless of the confounders. After investigation,three risk factor that potentially affect the birth weight were identified: smoking, marriage and welfare. We make several recommendations to the board of Public Health King County about how did the program perform and how to improve the program's effect on increasing birth weight.

Introduction

Birth weight of newborns is one of the most important factors that influence neonatal mortality. Children with lower birth weight are more likely to have medical problems, such as asthma, rental failure, diabetes, in their later life. Multiple studies have identified that lower birth weight is associated with the combination of biological, behavioral, environmental and medical factors. To help increase the infant birth weight for those mothers with low income, Seattle and King County began a program called "First Step" to provides free medical attention and advice about lifestyle decision for them. The aim of this study is to investigate whether participants in this program increases birth weight.

Result

The descriptive statistics of each variables stratifying by the participation of "First Step" program are shown in Table 1. The means of the variables `birthweight`, `wpre`, `wgain`, `education` and `gestation` are all deviated from their medians, which indicates that there are outliers exist. While the mean and median of the variable `age` are basically the same, hence it has no outliers. To be noticed that `birthweight` shows some evidences of left skewness(Graph 1). This might caused by the non-randomized selection of participants in the program. Women at high risk for low birth weight babies were encouraged to participate, hence participants in this program are more likely to have babies with low birth weight.

The overall difference of birth weight between participants and non-participants are -66.181 grams with a 95% CI (-130.416, -1.946), means that the newborns of the participants in "First Step" program are averagely 66.181 grams lighter than those of the non-participants. Among the 403 participants, 49% were single, 5.2% were on welfare and 13% were smoker. AS for the factor of race, most of the participants are white(0.47). Asian(0,13), black(0.15), Hispanic(0.22) and others races(0.03) are much more less than white(Table 5). The participants are neither older(p=1.000) nor more educated(p=1.000) than the non-participants, and there is no significant difference between two groups' weight gain during pregnancy(p=0.308), indicates that they are not confounding variables associate with the birth weight. Therefore, we determined that `smoker`, `welfare`, `married` and `race`to be potential risk factors that are associated with `firstep`.

According to table 2, the birth weight between smoker and non-smoker, single and non-single, welfare and non-welfare mothers are significantly different, while the birth weight between drinker and non-drinker mothers shows no difference(p=0.33) (Table2, Table3), indicates that besides `firstep`, `smoker`, `married` and `welfare` are also risk factors that could potentially influence infant birth weight. The effects of these factors on `firstep` are shown specifically by using boxplot. The difference of birth weight between participants and non-participants is not as large as which between smoker/non-smoker, married/non-married, welfare/non-welfare, showing that the effect of the `firstep` on birth weight is not larger than the effect of other risk factors(Graph 2).

Among the three potential risk factors, we believe that the most amenable risk factor in this case is `smoker` since it is difficult to control the marriage status and welfare reception of an individual. However, the result from t-test showing that there is no significant difference in birth weight between participants and non-participants among mothers who were smokers(p=0.47). The same result exist in the non-smoker group as well(p=0.17)(Table 4).

The effect of the program did vary with race. There were some improvements shown in the birth weight of Asian and Hispanic participants, while there is no increases in birth weight of participant in white, black and other races(Graph 3). The percentage of "low birth" weight and "very low" birth weight in the participants are 6.2% and 1.5%, which are both higher than the non-participants group(4.9% and 0.5%)(Table 6)

Table 1: Descriptive Statistics Statified by firstep

	N	Msng	Mean	Std Dev	Min	25%	Mdn	75%	Max
sex: All	2500	0	0.5164000	0.4998309	0	0.0	1.0	1.0	1
sex: Str 0	2097	0	0.5145446	0.4999076	0	0.0	1.0	1.0	1
sex: Str 1	403	0	0.5260546	0.4999414	0	0.0	1.0	1.0	1
plural: All	2500	0	1.0000000	0.0000000	1	1.0	1.0	1.0	1
plural: Str 0	2097	0	1.0000000	0.0000000	1	1.0	1.0	1.0	1
plural: Str 1	403	0	1.0000000	0.0000000	1	1.0	1.0	1.0	1
age: All	2500	0	29.3040000	6.0016324	14	25.0	30.0	34.0	46
age: Str 0	2097	0	30.0562709	5.6976693	14	26.0	30.0	34.0	46
age: Str 1	403	0	25.3895782	6.0280927	15	20.5	24.0	30.0	43
race: All	2500	0	3.9708000	1.5670768	1	3.0	5.0	5.0	5
race: Str 0	2097	0	4.0491178	1.5656652	1	3.0	5.0	5.0	5
race: Str 1	403	0	3.5632754	1.5120877	1	2.0	4.0	5.0	5
parity: All	2500	0	0.8192000	1.0417992	0	0.0	1.0	1.0	12
parity: Str 0	2097	0	0.8006676	1.0129597	0	0.0	1.0	1.0	12
parity: Str 1	403	0	0.9156328	1.1772422	0	0.0	1.0	1.0	7
married: All	2500	0	0.7824000	0.4126965	0	1.0	1.0	1.0	1
married: Str 0	2097	0	0.8378636	0.3686638	0	1.0	1.0	1.0	1
married: Str 1	403	0	0.4937965	0.5005830	0	0.0	0.0	1.0	1
bwt: All	2500	0	3414.0188000	559.3543483	255	3095.5	3444.5	3765.5	5175
bwt: Str 0	2097	0	3424.6871722	548.4248049	255	3118.0	3459.0	3770.0	5175
bwt: Str 1	403	0	3358.5062035	610.8194006	788	2991.0	3402.0	3742.0	4933
smokeN: All	2500	0	0.5876000	2.6329260	0	0.0	0.0	0.0	25
smokeN: Str 0	2097	0	0.5021459	2.4465898	0	0.0	0.0	0.0	25
smokeN: Str 1	403	0	1.0322581	3.4129475	0	0.0	0.0	0.0	20
drinkN: All	2500	0	0.0328000	0.4756203	0	0.0	0.0	0.0	16
drinkN: Str 0	2097	0	0.0362423	0.5146914	0	0.0	0.0	0.0	16
drinkN: Str 1	403	0	0.0148883	0.1570140	0	0.0	0.0	0.0	2
firstep: All	2500	0	0.1612000	0.3677889	0	0.0	0.0	0.0	1
firstep: Str 0	2097	0	0.0000000	0.0000000	0	0.0	0.0	0.0	0
firstep: Str 1	403	0	1.0000000	0.0000000	1	1.0	1.0	1.0	1
welfare: All	2500	0	0.0168000	0.1285471	0	0.0	0.0	0.0	1

	N	Msng	Mean	Std Dev	Min	25%	Mdn	75%	Max
welfare: Str 0	2097	0	0.0100143	0.0995929	0	0.0	0.0	0.0	1
welfare: Str 1	403	0	0.0521092	0.2225234	0	0.0	0.0	0.0	1
smoker: All	2500	0	0.0700000	0.2551981	0	0.0	0.0	0.0	1
smoker: Str 0	2097	0	0.0591321	0.2359280	0	0.0	0.0	0.0	1
smoker: Str 1	403	0	0.1265509	0.3328824	0	0.0	0.0	0.0	1
drinker: All	2500	0	0.0116000	0.1070982	0	0.0	0.0	0.0	1
drinker: Str 0	2097	0	0.0119218	0.1085600	0	0.0	0.0	0.0	1
drinker: Str 1	403	0	0.0099256	0.0992547	0	0.0	0.0	0.0	1
wpre: All	2500	0	146.9440000	34.5852587	75	125.0	140.0	160.0	350
wpre: Str 0	2097	0	146.2083929	33.4117410	75	125.0	140.0	160.0	350
wpre: Str 1	403	0	150.7717122	39.9706670	80	125.0	140.0	169.0	300
wgain: All	2500	0	32.2792000	13.4094136	0	25.0	31.0	40.0	149
wgain: Str 0	2097	0	32.1430615	12.9411668	0	25.0	31.0	40.0	149
wgain: Str 1	403	0	32.9875931	15.6202555	0	24.0	32.0	40.0	138
education: All	2500	0	14.0724000	2.6257791	0	12.0	14.0	16.0	17
education: Str 0	2097	0	14.4549356	2.4418809	0	12.0	15.0	16.0	17
education: Str 1	403	0	12.0818859	2.6524642	3	11.0	12.0	14.0	17
gestation: All	2500	0	38.8756000	2.3770538	18	38.0	39.0	40.0	45
gestation: Str 0	2097	0	38.9070100	2.2884612	18	38.0	39.0	40.0	45
gestation: Str 1	403	0	38.7121588	2.7906250	19	38.0	39.0	40.0	45

Graph 1: Histogram of Birth Weight
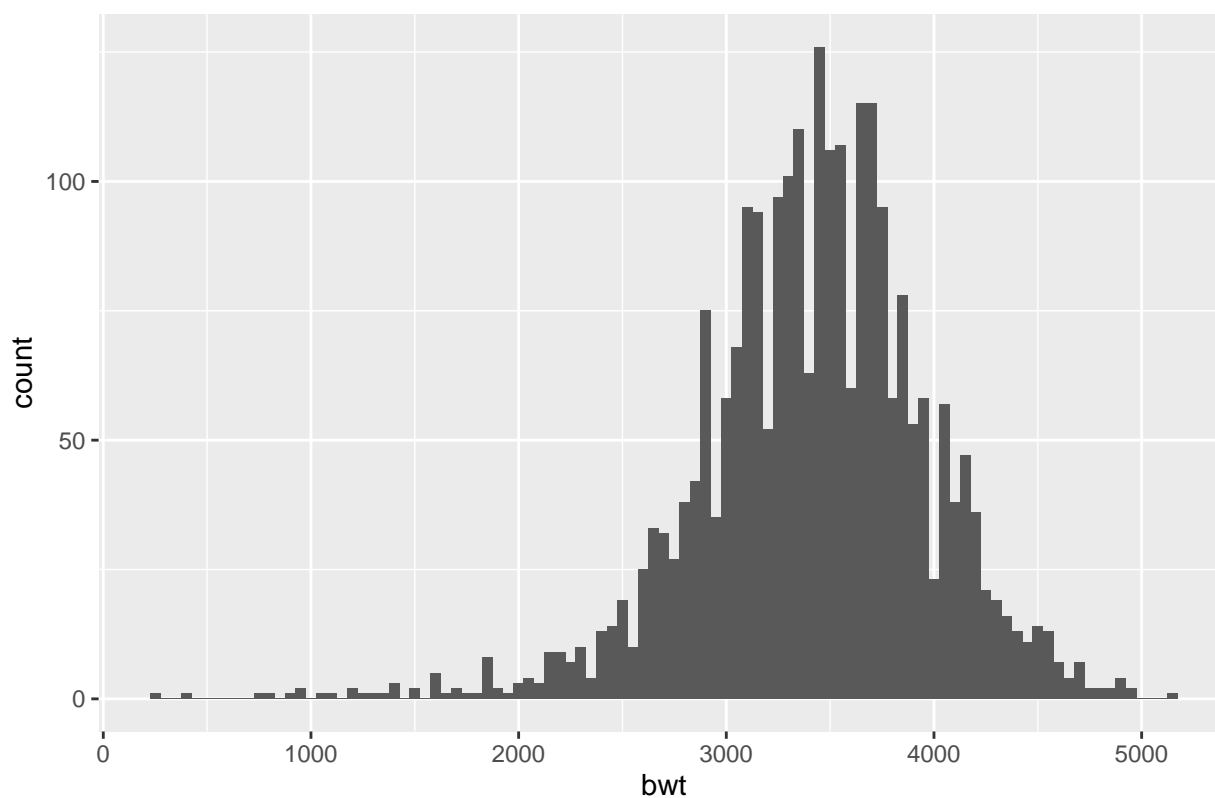
Table 2: Effect of Dichotomous Variables on Birth Weight

	N	Msng	Mean	Std Dev	Min	25%	Mdn	75%	Max
ALL	2500	0	3414.019	559.3543	255	3095.50	3444.5	3765.5	5175
non-drinker	2471	0	3415.091	559.9954	255	3099.50	3451.0	3770.0	5175
drinker	29	0	3322.655	501.9994	2410	2920.00	3317.0	3685.0	4564
ALL	2500	0	3414.019	559.3543	255	3095.50	3444.5	3765.5	5175
non-married	544	0	3298.035	641.3867	255	2971.25	3374.0	3709.5	4876
married	1956	0	3446.276	529.9951	414	3118.75	3459.0	3770.0	5175
ALL	2500	0	3414.019	559.3543	255	3095.50	3444.5	3765.5	5175
non-smoker	2325	0	3431.201	553.8304	255	3118.00	3459.0	3770.0	5175
smoker	175	0	3185.737	583.4798	414	2856.50	3275.0	3544.0	4508
ALL	2500	0	3414.019	559.3543	255	3095.50	3444.5	3765.5	5175
non-welfare	2458	0	3418.753	556.4204	255	3106.00	3453.5	3770.0	5175
welfare	42	0	3136.952	660.8383	1242	2700.25	3278.0	3564.5	4548

Table 3: T-test for Potential Modifiable Dichotomous Variables

	p-value	95% CI lower bound	95% CI upper bound
drinker	0.3330924	-99.65644	284.52821
married	0.0000010	-207.12763	-89.35466
smoker	0.0000002	155.58461	335.34368
welfare	0.0088211	74.77498	488.82637

Graph 2
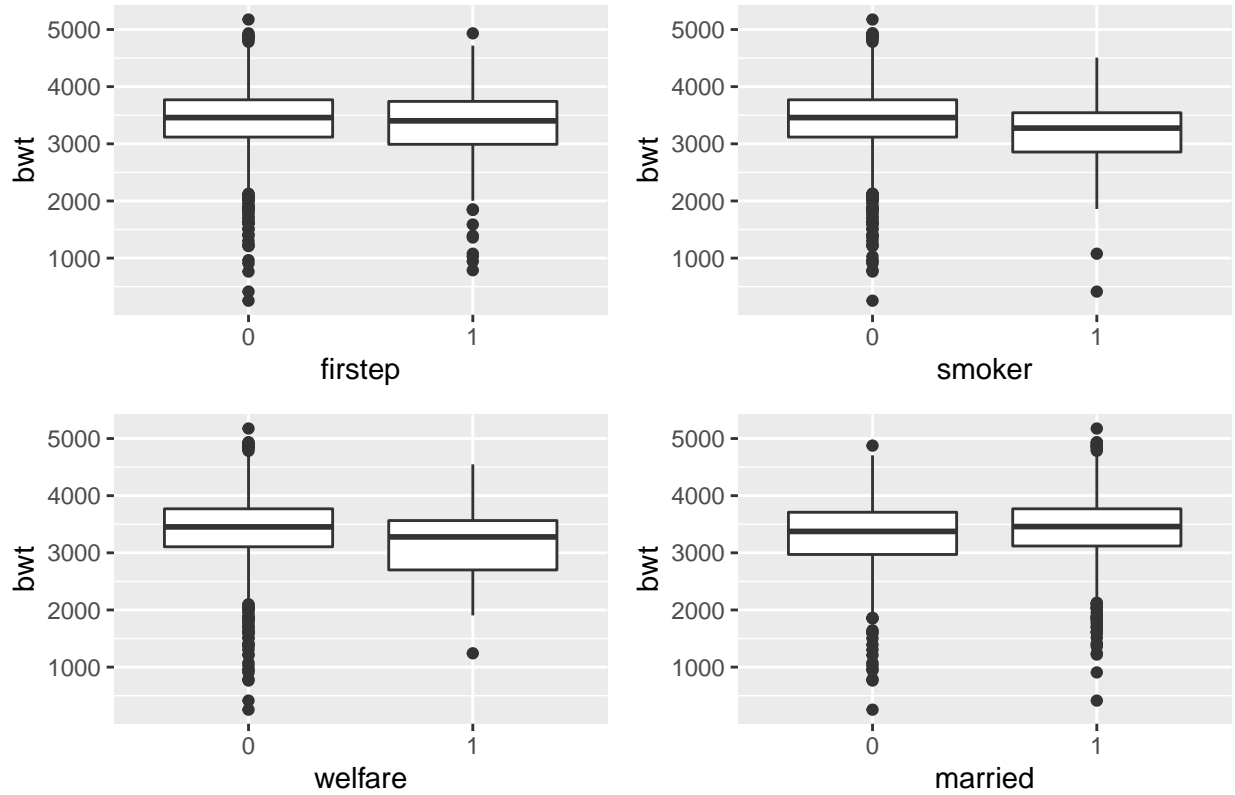
Table 4: Compare participants and non-participants(smoker)

	p-value	95% CI lower bound	95% CI upper bound
non_participants vs. participants(smoker)	0.4708857	-252.630	117.55599
non_participants vs. participants(non-smoker)	0.1701058	-116.642	20.64954

Table 5: Distribution of Different Races

	non-participants	participants
asian	0.1616595	0.1315136
black	0.0562709	0.1488834
hispanic	0.0629471	0.2183623
other	0.0095374	0.0272953
white	0.7095851	0.4739454

Graph 3: Effect of Firstep in Different Races
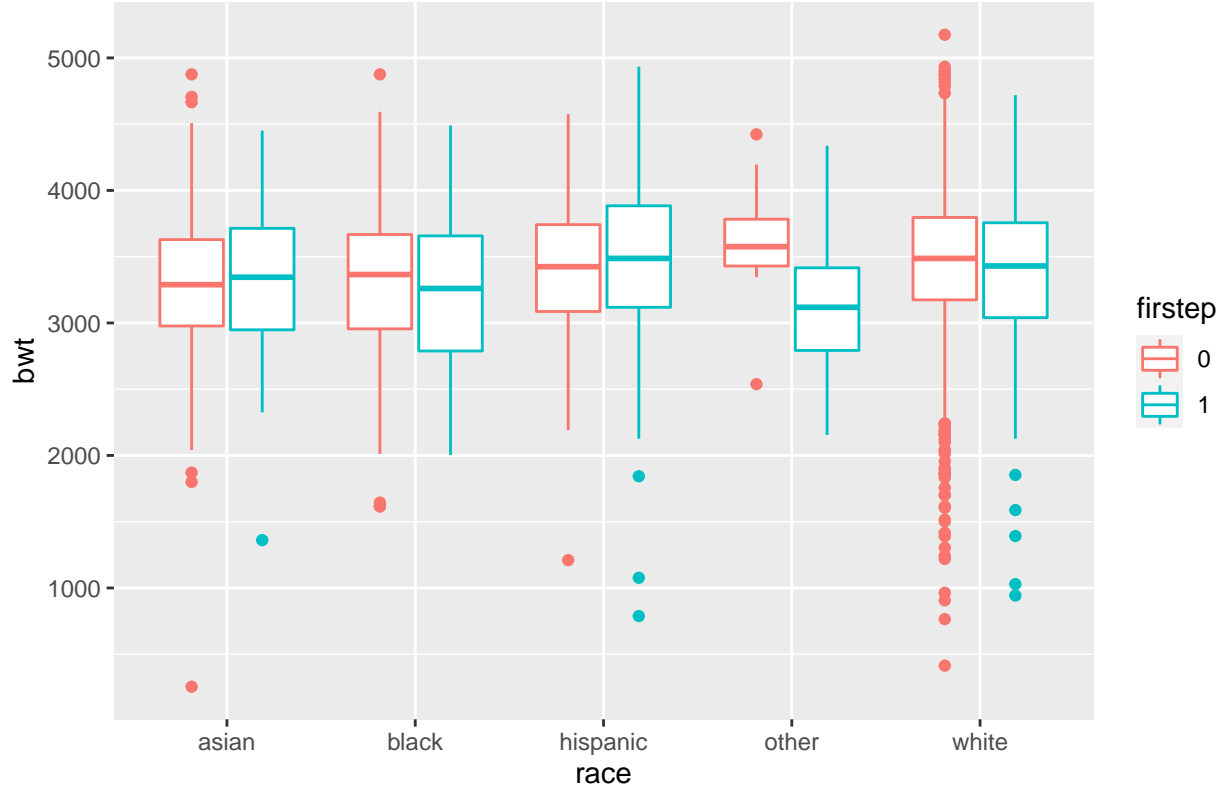
Table 6: Proportion of Low and Very Low Birth Weight

	participant	non-participants
low	0.0620347	0.0486409
very low	0.0148883	0.0052456

Discussion

The overall effect of "First Step" program is not as good as thought in this sample. The mean birth weight of participants(3358.506g) is 66.181g less than which of the non-participants(3424.687g). The proportion of the births with "low(<2500g)" and "very low(<1500g)" birth weight is also higher in the participants group. This might be caused by the bias of selection. Mothers at high risk for low birth weight babies were more likely to be recruited in the program, and they are also more possible to be exposed under the risk factors such as smoking, single and low-income(on welfare), which further decrease the birth weight of their children. Hence the data from participants are likely to be lower than which from the non-participants even thought they received the help from the program.

According to the investigation, smoking, status of welfare and marriage are also risk factors that can influence infant birth weight. Smoking causes such effects because the harmful chemical in tobacco could damage the health of fetus which leads to over low of birth weight. Mothers who are on welfare indicates that their low income level, which makes them not able to afford a good living condition for themselves during pregnancy, eventually leads to low birth weight to their babies. Having a partner can provides both financial support and emotional support for a mother during pregnancy, which explain why single mothers are more likely to have babies with lower birth weight. Race is also a factor requires consideration since most of the participants were white while Asian and Hispanic group obviously received more benefits from the program.

Since the program is focusing on providing medical attention and advice about lifestyle decisions, status of welfare and marriage are likely immutable. So we recommend: (1) Advice the participants not to smoke during pregnancy or, in some circumstances, prohibit them from smoking since the current program did not adjust this risk factor enough. (2) Recruit more Asian and Hispanic participants and further investigate why they are more affected by this program. ""First Step" could be more effective if it takes the risk factor "smoking" into account.

To be noticed that the imbalance between the sample size of participants(403) and non-participants(2097) could potentially cause extra bias to the result of the study. Future investigation about the effect of the program should base on a larger sample size hence the influence of "First Step" can be measured more accurately. Additionally, the program should also recruit mothers who are not at high risk of having low birth weight babies to eliminate the selection bias.