Is it truth or a misconception that smoking will reduce weight in newborns? Consumers deserve to know if a product is safe or hazardous beyond public opinion. The facts are in the data, are cigarettes safe for mothers or not?

By: Erik Thompson

The United States records high infant mortality when compared to other high-income countries. At 32.9 maternal deaths per 100,000 live births in 2021, according to ncbi.nlm.nih.gov, the US mortality rate is more than 10 times higher than Australia, Israel, Japan, and other developed nations. One of the behaviors that is under investigation is the effect of mothers' smoking habits during pregnancy. For decades, it was considered by many that smoking was cool, but in the 1980s, things changed according to an article on academic.oup.com.

Like many new behaviors, safety and risks are not understood until large piles of data are accumulated and analyzed. Studies like the article at ncbi.nlm.nih.gov associate a 28% increase in perinatal mortality and a 170-g reduction in birth weight. To confirm the argument that smoking is hazardous and adversely affects newborn birth weights, a sample of 42 mothers, 20 non-smoking, and 22 smoking, will be used to flush out the truth, are cigarettes safe for mothers or not? It is expected that there will be a correlation between the number of cigarettes smoked and the decrease in birth weight of a newborn. There could be other factors to flush out.

Below in **Fig 1.1**, the **sample of 42** mothers shows a mean birth weight of 3.31kg with a median of 3.30 kilograms, suggesting a symmetric distribution. Considering that there are 20 non-smoking mothers in the sample, it is essential to examine the entire sample to establish a baseline. The minimum birth weight of 1.92kg is expected to show up in smoking mothers' sample, and the 4.57kg maximum birth weight recorded will most likely be in the non-smoking mothers' sample. Just how strong will the correlation between smoking and birth weight be?

Fig 1.1 – Full Sample of Mothers (Smoking AND Non-Smoking)

Smoking AND Non-Smoking	N	N*	Mean	SE Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
Newborn Birth Weight (KG)	42	0	**3.31**	0.09	0.60	1.92	2.92	**3.30**	3.68	4.57
Gestation (Weeks)	42	0	39.19	0.41	2.64	33.00	38.00	39.50	41.00	45.00
Cigarettes per Day - Mother	42	0	9.43	1.93	12.51	0.00	0.00	4.50	17.00	50.00

Years of Education - Father	42	0	13.67	0.33	2.16	10.00	12.00	14.00	16.00	16.00
Cigarettes per Day -Father	42	0	17.19	2.67	17.31	0.00	0.00	18.50	25.00	50.00

Mothers who are smokers have infants with lower birthweight than mothers who are not smokers and they have shorter gestation times. According to **Figure 1.2 & 1.3**, the average birth weight for a smoking mother is **10.8% lower** than non-smoking mothers. The lowest birth weight recorded, 1.92kg, is also in the subsample of smoking mothers. Interestingly, the highest birth weight recorded is also in the same subsample of smoking mothers. The gestation period appears to be about the same for both groups, an average of 39.45 for non-smoking mothers, and 38.96 (slightly lower) for smoking mothers.

Figure 1.2 – Subsample of (20) Mothers (Non-Smoking)

Non-Smoking Mother	N	N*	Mean	SE Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
Newborn Birth Weight (KG)	20	0	3.51↑	0.12	0.52	2.65	3.12	3.39	3.94	4.55
Gestation (Weeks)	20	0	39.45	0.63	2.80	33.00	38.00	40.00	41.00	44.00
Cigarettes per Day - Mother	20	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Years of Education - Father	20	0	13.70	0.49	2.18	10.00	12.00	14.00	16.00	16.00
Cigarettes per Day -Father	20	0	9.70	2.88	12.87	0.00	0.00	0.00	25.00	35.00

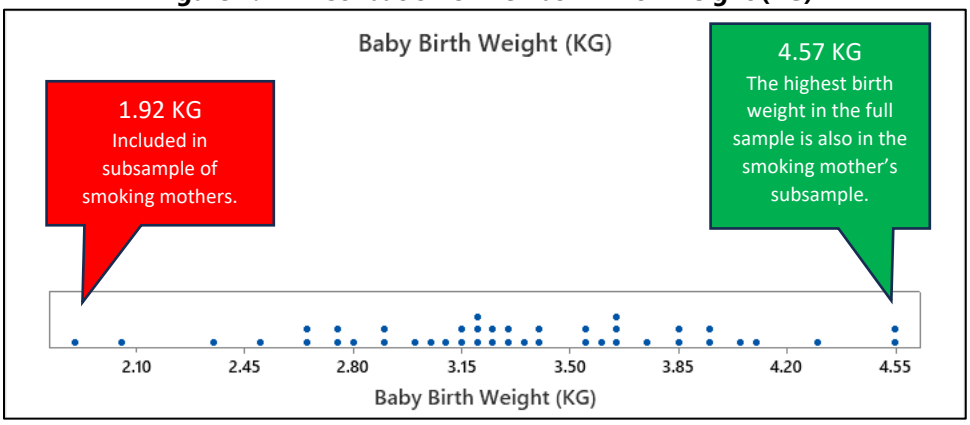
Another interesting detail is that the median birth weight for non-smoking mothers is lower than the mean, suggesting the data is skewed right. For smoking mothers, the median is higher than the mean, suggesting the data is skewed left.

Figure 1.3 – Subsample of (22) Mothers (Smoking)

Smoking Mother	N	N*	Mean	SE Mean	Std Dev	Minimum	Q1	Median	Q3	Maximum
Newborn Birth Weight (KG)	22	0	3.13↓	0.14	0.63	1.92	2.72	3.19	3.56	4.57
Gestation (Weeks)	22	0	38.96	0.54	2.54	33.00	37.75	39.00	40.25	45.00
Cigarettes per Day - Mother	22	0	18.00	2.56	12.00	2.00	7.00	14.50	25.00	50.00
Years of Education - Father	22	0	13.63	0.47	2.19	10.00	12.00	14.00	16.00	16.00
Cigarettes per Day -Father	22	0	24.00	3.89	18.25	0.00	5.75	25.00	38.75	50.00

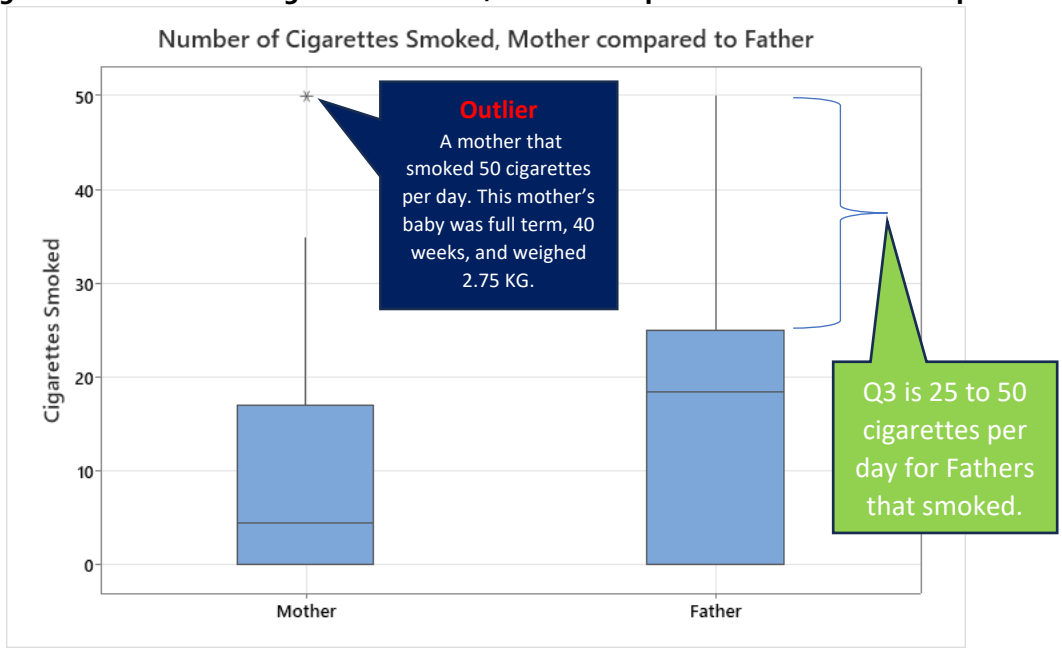
According to **Figure 1.4**, the Baby birth weights are bi-modal, skewed left, with outlier weights at 1.92kg and 2.05kg. The weights are concentrated from 3kg to 4kg. The average gestation period for the sample is 39.39 weeks, just short of full term (40 weeks). Babies must be carried for the entire term to avoid potential health risks. The baby's brain is the last organ to develop according to health.ny.gov. Smoking is only one of several avoidable risks that also include diabetes, alcohol consumption, being overweight, and stress.

Figure 1.4 – Distribution of Newborn Birth Weight (KG)



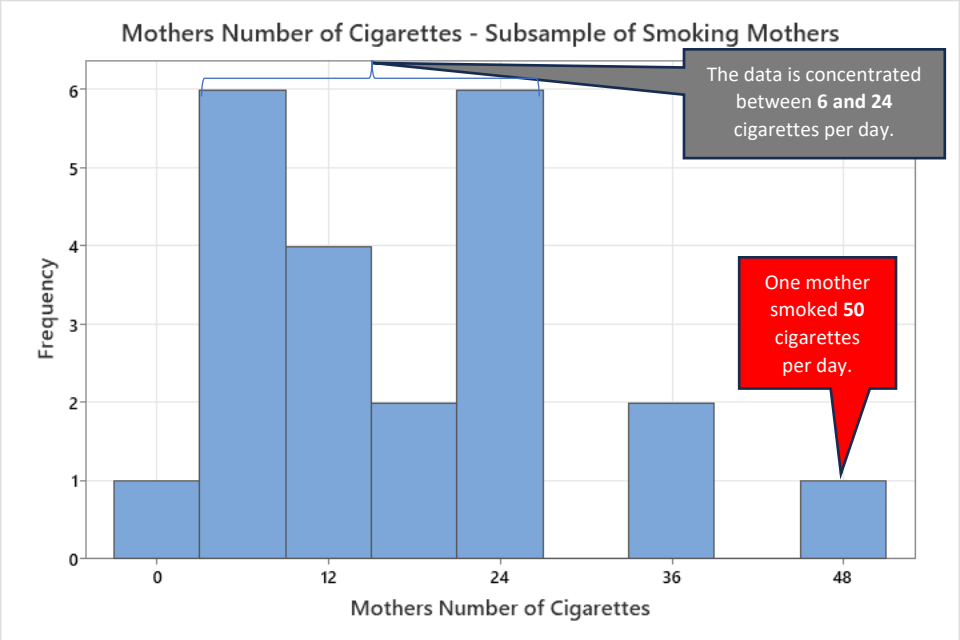
One of the mothers smoked 50 cigarettes per day, **Figure 1.5**, an outlier that shows up in the entire sample, but not in the subsample. Second-hand smoke from the father's may be a factor to consider. Fathers smoked more cigarettes per day than the mothers, and both were skewed left.

Figure 1.5 – Number of Cigarettes Smoked; Mother compared to Father – Full Sample



The frequency distribution in **Figure 1.6** shows a bimodal feature at 6 and 24 cigarettes per day, but the actual values are 7 and 25. According to Figure 1.3, the distribution is skewed right, averaging 18 cigarettes per day. Only one mother smoked 50 cigarettes.

Figure 1.6 – Distribution of the Number of Cigarettes Smoked by Mother

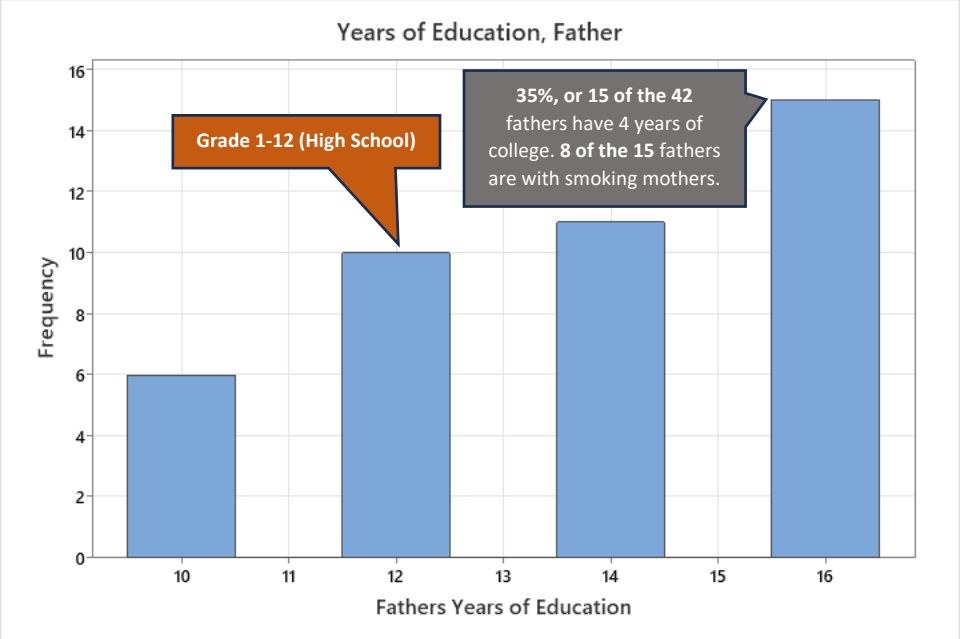


The frequencies in **Figure 1.8** show the mode at 24, above the mean of 17.19 cigarettes per day from **Figure 1.1, which** shows the average number of cigarettes the father smokes from the entire sample. Four non-smoking fathers and one father who smoked only 2 per day were present.

Figure 1.8 – Distribution of the Number of Cigarettes Smoked by Father – Subsample

There is no relationship between the father's education (years) and the baby's birth weights (KG). According to **Figure 1.1,** the average is 13.67 years of education, indicating a college education. The disbursement is skewed left with an even distribution.

Figure 1.7 – Distribution of the Years of Education for Father – Full Sample



Smoking mothers will correlate with lower birth weights than non-smoking mothers and should be inverse. According to **Figure 1.9**, the correlation between the number of cigarettes a mother smokes and the associated birth weight is 0.148 and is not an inverse value. Because the value is positive, it suggests that the baby's birth weight is increasing with the number of cigarettes the mother smokes, a finding in opposition to what was expected.

Figure 1.9 – Correlation of Baby Birth Weight (KG) to Mother's Number of Cigarettes Smoked

Baby Birth Weight to Mother's Number of Cigarettes	Correlation Value
	0.148

There will be no relationship between a father's education and the birth weight of his newborn, which is lower than average. Considering there is no physiological connection between these values, a connection would be a surprise. According to **Figure 2.0**, the correlation value between father's education and birth weight is 0.071, which supports the assertion that there is little to no correlation. A larger sample will be needed to verify the strength of these findings.

Figure 2.0 – Correlation of Baby Birth Weight (KG) to Father's Years of Education

Baby Birth Weight (KG) to Father's Years of Education	Correlation Value
	0.071

Figure 2.1 shows that there is an inverse correlation between the number of cigarettes a father smokes and the baby's birth weight. A correlation that suggests the more cigarettes a father

smokes, the lower the birth weight. Secondhand smoke decreases the baby's birth weight. The inverse correlation noted here would indicate that the chemistry in secondhand smoke is more hazardous than the chemicals absorbed by the mother when smoking.

Figure 2.1 – Correlation of Baby Birth Weight (KG) to Father's Number of Cigarettes

Baby Birth Weight (KG) to Father's Number of Cigarettes	Correlation Value
	-0.085

Mothers who smoked during pregnancy had an average baby birth weight of **10.8%**, or **380 g** less than non-smoking mothers in the same sample of 42 mothers evaluated. A finding that is more than double the ncbi.nlm.nih.gov findings. A relationship exists between how many cigarettes a mother smokes, but it is not an inverse correlation as was expected. The secondhand smoke from the father ultimately yielded a weak inverse correlation. Finding the lowest birth weight in the smoking side of the data was expected, but finding the highest birth weight in the same data was unexpected. There is a large concentration of mothers and fathers smoking over a pack a day, but more fathers smoking two packs or more per day. The average gestation period drops by about 4 days on the smoking side of the data, but this is not a significant enough difference to account for the 380-g drop in average birth weight. The study shows a drop in birth weight that cannot be fully explained by the number of cigarettes a mother or father smokes, or the father's education level. Additional studies should focus on the physiological effects of smoking and interactions with a mother's blood chemistry.