DOES FAMILY HELP COPING WITH WORK EXHAUSTION?

A study based on the experiment conducted by Nicholas A. Bloom, James Liang, John Roberts, Zhichun Jenny Ying on a Chinese company CTrip, and covered in their paper “Does Working from Home Work? Evidence from a Chinese Experiment”

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Introduction

The authors of the paper "Does Work From Home Work? Evidence from a Chinese Experiment" tried to analyse the effects of working from home by conducting a nine-month long Work From Home (abbreviated as WFH hereon) experiment for the call centre employees of airfare and hotel booking departments the at the Shanghai office of the Chinese travel agency, Ctrip. 503 employees volunteered for the experiment of which 249 employees were eligible. Of these 249 employees, control and treatment group were created by a public lottery based on the birthdays (employees with even birthdays to treatment group and with odd birthdays to control group). The results were: home working employees' performance improved by 13% (9% accounted for working more minutes per shift and 4% for more calls per minute), they were also more satisfied at work, their attrition rate halved, but promotion rate conditional on performance decreased (Bloom, Liang, Roberts, & Ying, 2015).

In this study, we are trying to analyse what effect having a family might have in the exhaustion levels of an employee using the same dataset used during the experiment. For the study, we do some data exploration from the given dataset used in the actual experiment and try to find some visual relationship between exhaustion and having a family, and how it changes for the people working from home (the treatment group in the actual experiment) and people working from office (the control group in the actual experiment). We then run the different hypothesis tests for the same to see if the effects we have seen visually are significant. We also see if the effects are different for the treatment and control group and whether the difference, if present, is significant enough. Finally, we provide a conclusion based on the analysis we did during this study.

Research Question: Does Family Help Coping With Work Exhaustion?

From the experiment conducted on the Ctrip employees, we found significant evidence that work from home helps with coping up with exhaustion. However, we also saw that 49% of the 994 employees did not volunteer for the experiment in spite of the considerable savings in both commute time and commute cost. Two potential reasons given for this in later interviews were, this being the major one, loneliness of WFH, and possible negative impact on promotion due to WFH. Moreover, we also see that post experiment, more than 50% of the volunteer group and 10% of the non-volunteer group switched preferences after the experiment, citing loneliness. Also more than half the employees eligible for WFH decided to return to office, suggesting social interactions at office were highly valued.

Studies have found that there is significant positive correlation between workplace loneliness and emotional exhaustion (Anand & Mishra, 2019). Studies also suggest that one of the main reasons for emotional exhaustion can be work related stress or exhaustion. Considering the above factors, it would be seem that family can help an employee to deal with loneliness and thus exhaustion. On the other hand, studies suggest work-family conflict (Karatepe, 2010) increase of exhaustion. Thus, ultimately the research question boils down to whether family has any effect on the exhaustion levels of employees. For this particular

study, an employee having a spouse (that is married), or having children, or both, is considered as having a family.

Hypotheses and Methods

In order to study the effect of family on exhaustion levels of employee, we are going to run 6 pairs of hypotheses. First pair of hypotheses would be check if having a family has any significant impact on exhaustion levels of the employees. Second pair of hypotheses would be to check if the effect of family on exhaustion is different for people working from home and that of people working from office. This is particularly required keeping in mind that a lot of companies are currently pursuing the management policy of WFH considering the ongoing COVID pandemic. Also, effects of loneliness and work-family conflict might create significant difference in the effect of family between the treatment and control group.

The next pairs of hypotheses would be check the individual effects of having a spouse or children on exhaustion. Third pair of hypotheses would be to check if having a spouse (being married) has any significant impact on exhaustion levels of employees. Fourth pair of hypotheses would be to check if the effect of marriage on exhaustion is different for people working from home and that of people working from office. Similar hypotheses are run to check the effect of having children as well. Third to sixth pair of hypotheses are required to understand if the individual effect of either marriage or children is significantly different from that of family. Figure 1 illustrates the hypotheses used.

1st pair:
H_o: There is no significant effect of family on exhaustion ($\beta = 0$)
H_a: There is significant effect of family on exhaustion ($\beta \neq 0$)

2nd pair:
H_o: There is no significant difference of effect of family on exhaustion between control and treatment group ($\beta = 0$)
H_a: There is significant difference of effect of family on exhaustion between control and treatment group ($\beta \neq 0$)

3rd pair:
H_o: There is no significant effect of marriage on exhaustion ($\beta = 0$)
H_a: There is significant effect of family on exhaustion ($\beta \neq 0$)

4th pair:
H_o: There is no significant difference of effect of marriage on exhaustion between control and treatment group ($\beta = 0$)
H_a: There is significant difference of effect of marriage on exhaustion between control and treatment group ($\beta \neq 0$)

5th pair:
H_o: There is no significant effect of children on exhaustion ($\beta = 0$)
H_a: There is significant effect of children on exhaustion ($\beta \neq 0$)

6th pair:
H_o: There is no significant difference of effect of children on exhaustion between control and treatment group ($\beta = 0$)
H_a: There is significant difference of effect of children on exhaustion between control and treatment group ($\beta \neq 0$)

Figure 1: Hypotheses used for the study

In order to test the hypotheses, we are considering data from only the treatment period. There are two reasons for that:

1. The treatment group already reported less exhaustion from work even before the experiment started. The difference was presumably due to control group's learning that they have lost the WFH lottery while the treatment group learned that they had won.
2. Only one record for each employee exists before the experiment started, which is the exhaustion score of employees for the week just before the experiment started. Considering there is already a bias as mentioned above, any analysis for this period is not going to give correct result.

We run three simple regression models to analyse the effect of having a family on exhaustion. First model is run to see the effect for control group, second for the treatment group and third model is run to check if the difference of effect for the groups, if any, is statistically significant or not. While running the regression models we eliminate the effect of fixed effects. There are two types of fixed effects, which are personal fixed effects of the employees, like age, gender and higher education, and the time period (year_week) of the experiment. We run similar analysis for being married and having children as well. Running regression models not only indicates the effect of family on regression and the difference of the effect between treatment and control groups, but also tells us how much the independent variables used in the model explains the effect on the dependant variable (exhaustion) through the R^2 value.

Data Description

We start with summarising the dataset used for the experiment.

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
exhaustion	5,109	8.320	7.974	0	0	12	36
expgroup	5,109	0.565	0.496	0	0	1	1
lnexhaustion	5,109	1.728	1.147	0.000	0.000	2.565	3.611
experiment_expgroup	5,109	0.550	0.498	0	0	1	1
announcement_expgroup	5,109	0.014	0.119	0	0	0	1
age	5,109	24.802	3.518	18	22	27	34
tenure	5,109	29.821	23.217	2	10	46	96
grosswage	5,109	3.115	0.841	1.388	2.523	3.665	6.221
children	5,109	0.168	0.374	0	0	0	1
bedroom	5,109	0.962	0.192	0	1	1	1
commute	5,109	110.286	62.212	2	60	180	300
men	5,109	0.481	0.500	0	0	1	1
married	5,109	0.267	0.443	0	0	1	1
volunteer	5,109	0.878	0.327	0	1	1	1
high_educ	5,109	0.351	0.477	0	0	1	1
T_pid	5,109	0.026	0.158	0	0	0	1

Table 1: Summary of the dataset being used for the study

We see that exhaustion score is highly skewed with scores of 0-12 accounting for 75% of the data, while the maximum goes till 36. Therefore, there is high probability that the higher scores are outliers. To remove the effects of outliers, we will be using the variable

"lnexhaustion", which is actually the natural log value of the exhaustion scores, for our analysis. Variables "age", "tenure", "grosswage", "commute" are quite evenly spread.

There are a few binary variables like "expgroup", "children", "married", "men", and others. The mean of each such variables indicates percentage of employees in the group denoted by 1. Therefore 56.5% of the employees are in the experiment group, 16.8% of the employees have children, 96.2% of the employees have a personal bedroom, 48.1% of the employees are men, 26.7% of the employees are married, 87.8% of the employees volunteered for work at home and 35.1% of the employees have higher education.

We introduce a few data transformations for our analysis. First, we introduce a variable "treatment" which is 1 during the treatment period and 0 during the week before the treatment started. Since, we are interested with data only during the treatment period, we create a subset from the original dataset when treatment = 1. We are going to use this subset for our further analysis. Second, we introduce the variable "family" which includes employees who are married, or have children, or both. "family_code" is 0 for employees with no family and 1 for employees with a family.

We need to understand if any of the explanatory variables are correlated with each other. For that we run a pair-wise correlation for the complete dataset. From the correlation plot we see that age and tenure (0.59), tenure and gross wage (0.55), and children and married (0.74) have strong correlation. We also see, that family_code (1 for family and 0 for no family) has perfect correlation with married. Thus for this dataset, we can conclude that result and analysis for "family" and "married" will be identical. Thus, we do not need to run separate analysis for "family" and "married".

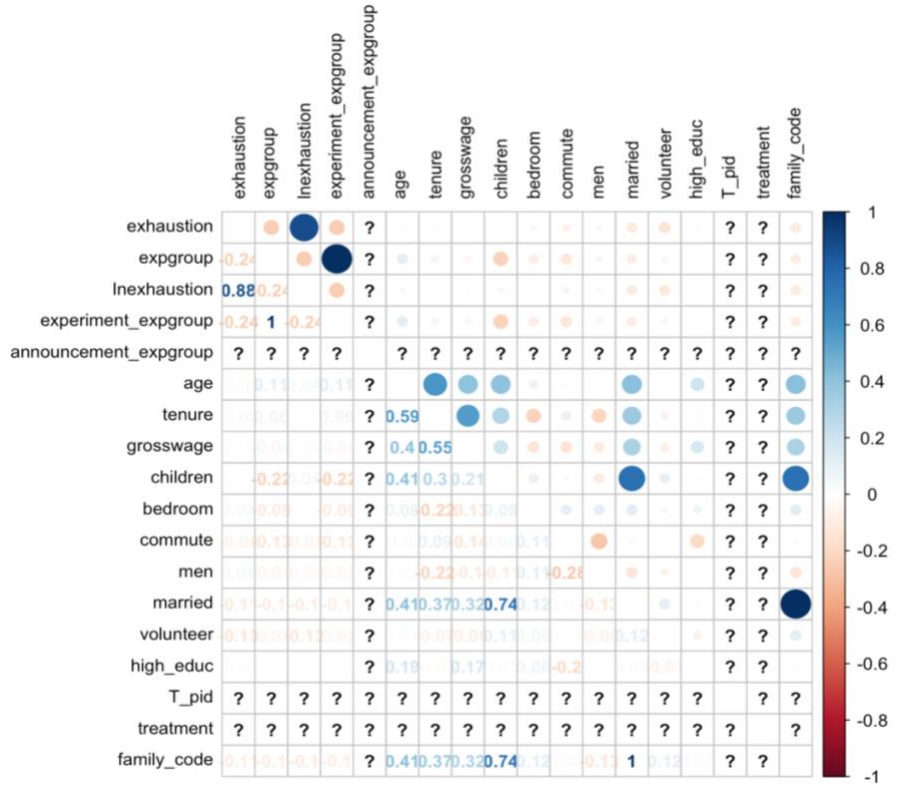

Figure 2: Pair-wise correlation plot

We now visually check which variables of the dataset apart from our variables of interest have an effect on exhaustion.

When we plot exhaustion vs age, we find no significant correlation as such, which is as per expectation from the above correlation plot. Therefore we try to identify the linear trend. The trend line suggests age has no effect on exhaustion as such. When we factor in higher education in the trend line we see that people with people with higher education have slight propensity to get exhausted with age.

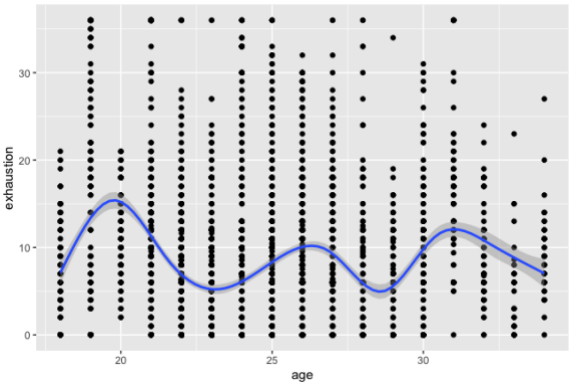

Figure 3: plot of exhaustion vs age

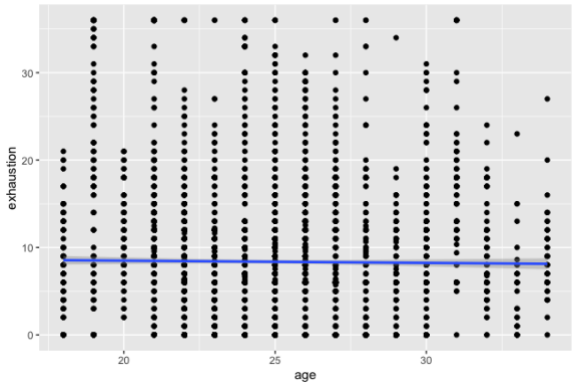

Figure 4: plot of exhaustion vs age with trend line

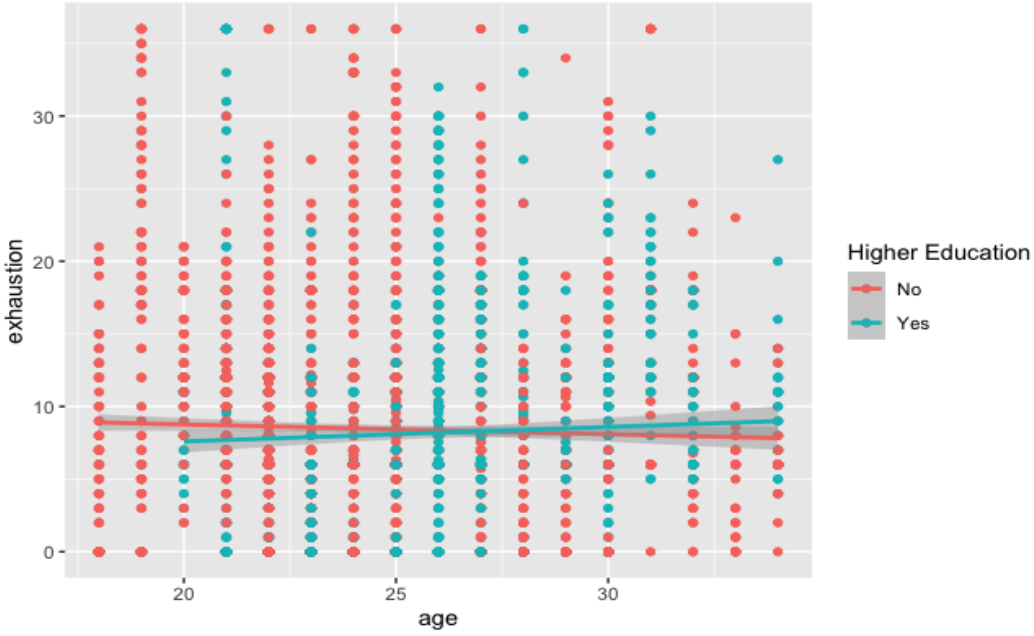

Figure 5: plot of exhaustion vs age with higher education as factor

Similarly, we find no tenure and gross wage has no effect on exhaustion. However, when factored with gender, we find that for men exhaustion has a decreasing trend with tenure, while for women it has an increasing trend. In case of gross wage, there is slight increasing trend in exhaustion for men.

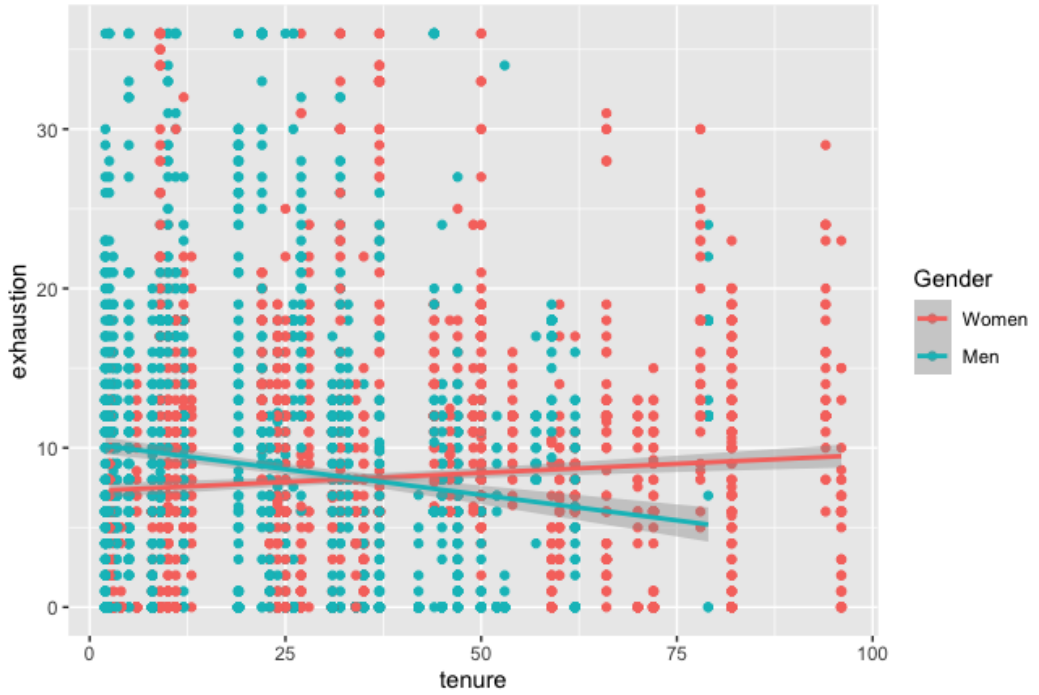

Figure 6: plot of exhaustion vs tenure with gender as factor

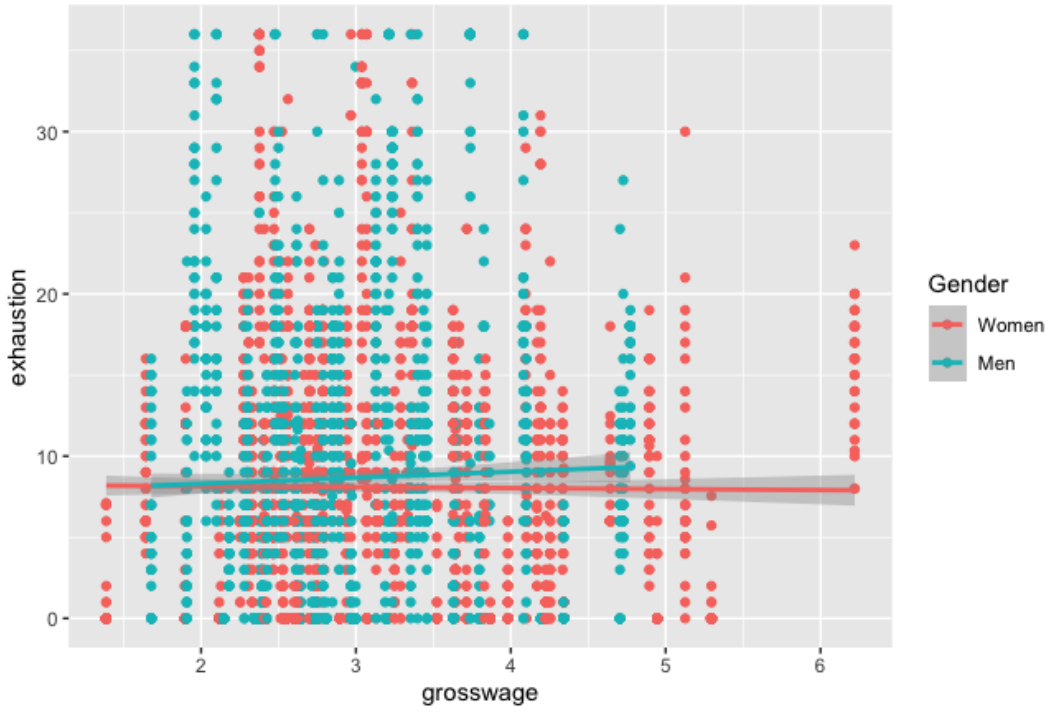

Figure 7: plot of exhaustion vs gross wage with gender as factor

When we plot exhaustion vs commute with volunteer as factor, we find that commute has no effect on exhaustion for employees who volunteered to work at home, which is as expected. However, for employees who did not volunteer to work at home, commute seems to have a negative effect. This clearly indicates that the volunteers did not mind commuting to office.

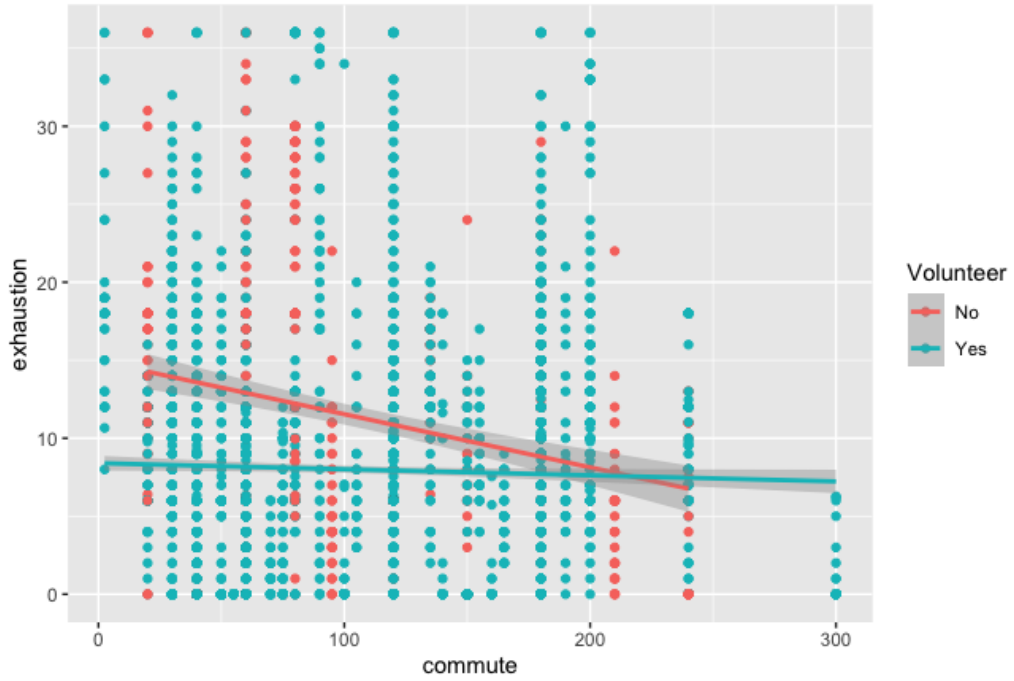

Figure 8: plot of exhaustion vs commute with volunteer as factor

Data Analysis

We now move to testing our hypotheses mentioned above.
We try to check our hypothesis with density plots first. A density plot is a smoothed version of histogram. It uses a kernel density estimate to show the probability density function of the variable, in our case log of exhaustion. Density plot using the complete dataset shows that the mean (green line) and median (red line) of log of exhaustion is less for employees with family compared to that of employees without family indicating that family has a positive impact on exhaustion.

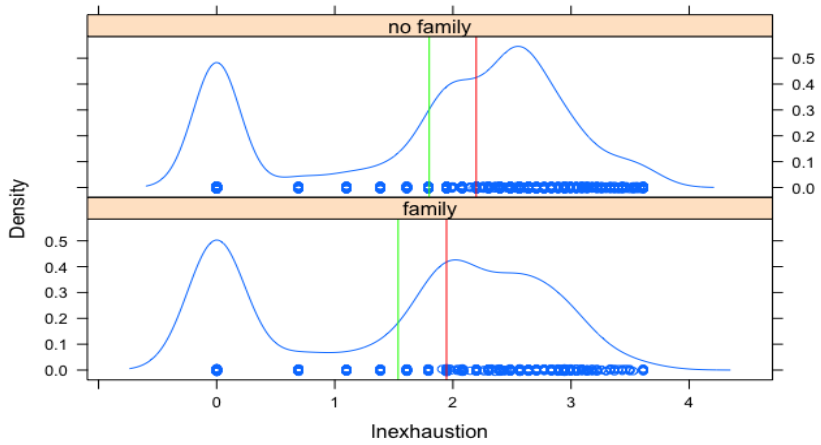

Figure 9: Density plot to show effect of family on exhaustion for the complete dataset

Similar plots are made for the treatment and control group respectively to visualize the effect of family on exhaustion for each group. It shows that family has a positive effect for both the control and treatment groups.

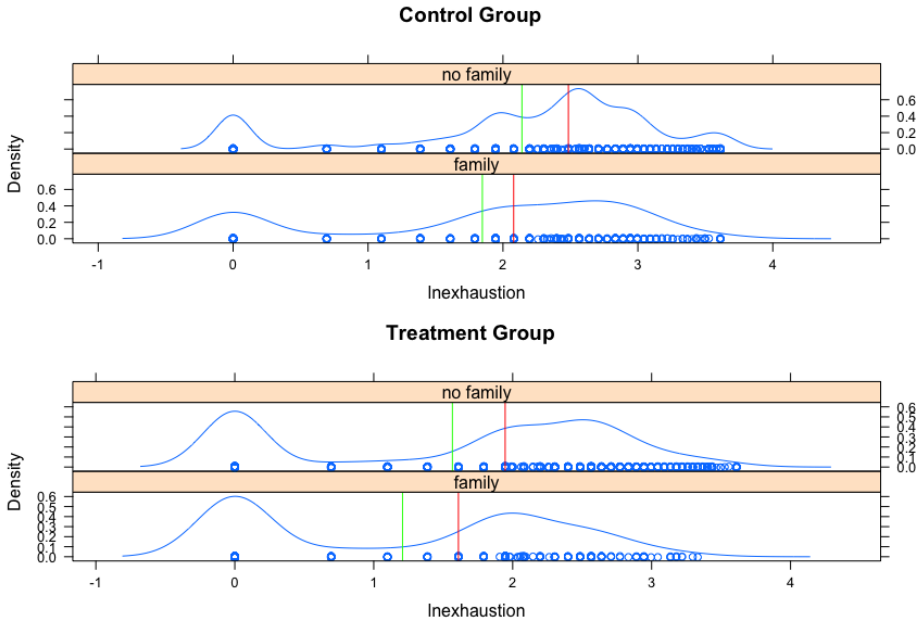

Figure 10: Density plots to show effect of family on exhaustion for treatment and control group

However, density plots do not give a clear picture of the extent the effect of family has on exhaustion. Neither do they provide any indication whether the difference of this effect is significant for the control and the treatment group. To understand this we need to run regressions models.

We start with a linear regression of exhaustion vs family. Since we want to see if the effect is different for control and treatment group we need to add an interaction term of experiment into the regression. The result is:

	Dependent variable:
	lnexhaustion
family_code	-0.293***
	(0.051)
expgroup	-0.575***
	(0.037)
family_code:expgroup	-0.065
	(0.071)
Constant	2.141***
	(0.029)
Observations	4,978
R2	0.075
Adjusted R2	0.074
Residual Std. Error	1.109 (df = 4974)
F Statistic	133.925*** (df = 3; 4974)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 2: effect of family on exhaustion with omitted variable bias

We see the family helps in reducing log of exhaustion score by 0.293 on an average and since the p-value of the coefficient is less the 0.01 the result is significant as well. However, the interaction term has a coefficient which is not significant, which suggests that there is no significant difference in the effect of family on exhaustion between treatment and control group. However, this regression might contain omitted variable bias as we have not included any other variables in the regression. When we include other variables in the dataset, including the interactions we found earlier in the graphs, the result is:

	Dependent variable:
	lnexhaustion
family_code	-0.397***
	(0.054)
expgroup	-0.634***
	(0.038)
grosswage	0.002
	(0.023)
tenure	0.004***
	(0.001)
commute	-0.002***
	(0.0003)
family_code:expgroup	0.006
	(0.072)
Constant	2.259***
	(0.080)
Observations	4,978
R2	0.085
Adjusted R2	0.084
Residual Std. Error	1.103 (df = 4971)
F Statistic	77.248*** (df = 6; 4971)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 3: effect of family on exhaustion without fixed effects

We see the effect of family on exhaustion increases when other variables are included. Family now helps reduce log of exhaustion by 0.397 on an average with a slight improvement R^2 has also improved significantly suggesting the variables explain exhaustion better. However, the difference of effect between treatment and control group is still not significant.

The previous models do not consider the fixed effects. The fixed effects in this experiment are the personal fixed effects of the employees like age, gender, education and independent bedroom, and the time period of the experiment captured from the variable “year_week”. Including the fixed effects to the model gives the following result:

	Dependent variable:		
	lnexhaustion		
	(1)	(2)	(3)
family_code	-0.518***	-0.674***	-0.792***
	(0.057)	(0.067)	(0.061)
expgroup	-0.625***		
	(0.039)		
grosswage	-0.032	0.285***	-0.299***
	(0.024)	(0.036)	(0.034)
tenure	-0.0002	-0.013***	0.004***
	(0.001)	(0.002)	(0.001)
commute	-0.002***	-0.003***	-0.002***
	(0.0003)	(0.0004)	(0.0004)
family_code:expgroup	-0.059		
	(0.079)		
Observations	4,978	2,166	2,812
R2	0.208	0.282	0.239
Adjusted R2	0.198	0.262	0.223
Residual Std. Error	1.032 (df = 4915)	0.908 (df = 2107)	1.025 (df = 2752)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 4: effect of family on exhaustion

We see significant improvement in the R^2 value by including the fixed effects. The effect of family on exhaustion also gets more pronounced for both treatment and control group but the interaction term still suggests that the difference between treatment and control group is still not significant. Thus we can conclude that having a family helps deal with exhaustion. But this result does not say the whether exhaustion is any different for people with children as we had seen through our literature review that while working from taking care of one's children can be difficult.

Since family and married had perfect correlation of 1, results of the regression analysis would be same for both. Hence we can say that being married helps with coping with exhaustion, but the difference of effect is not significant between control and treatment groups.

Running similar regression for employees with children, we get a negative coefficient for children for the whole dataset and the control group, and positive but not significant coefficient for treatment group and the difference of effect is positive and significant. This signifies on an average exhaustion is higher for employees with children while working from home compared to while working from office and the effect is not significantly different from zero for employees working from home which is opposite of employees working from office.

	Dependent variable:		
	lnexhaustion		
	(1)	(2)	(3)
children	-0.460***	-0.597***	-0.056
	(0.061)	(0.076)	(0.103)
expgroup	-0.695***		
	(0.038)		
grosswage	-0.041*	0.281***	-0.341***
	(0.024)	(0.036)	(0.036)
tenure	-0.002**	-0.015***	0.001
	(0.001)	(0.002)	(0.001)
commute	-0.002***	-0.002***	-0.003***
	(0.0003)	(0.0004)	(0.0004)
children:expgroup	0.709***		
	(0.114)		
Observations	4,978	2,166	2,812
R2	0.188	0.268	0.192
Adjusted R2	0.178	0.248	0.175
Residual Std. Error	1.045 (df = 4915)	0.916 (df = 2107)	1.057 (df = 2752)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 5: effect of children on exhaustion

Conclusion

The study shows that having a family has a positive effect on reducing exhaustion of an employee. It also shows that the effects are not significantly different for employees working from home and employees working from office. Similar effects are found for employees who are married. This can be because of two reasons.

1. Finding support: Studies have found that talking about the reasons for work related exhaustion can help with dealing with the exhaustion itself. Employees might find it easy to open up to a family member and thus family helps support and employee to deal with exhaustion (Smith, Segal, & Robinson, 2020).
2. Deal with loneliness: This is especially relevant for employees working from home. Employees with family are definitely going to feel much less lonely compared employees without a family.

Interestingly, we saw that having children has no significant effect on exhaustion. This might be because, even though children might help deal with loneliness, but the added responsibilities of raising a child takes a toll on an employee, increasing exhaustion and offsetting the positive impact on loneliness.

However, the result from the study cannot be conclusive enough due to two reasons:

1. Actual family can include parents and other members as well. Therefore, there can be significant upward shift in the mean exhaustion of employees with actual families

as high exhaustion employees which are grouped in “no family” will move to “family” group increasing the mean exhaustion.

2. As the R^2 of the models suggest, the variables used in the regression do not explain exhaustion sufficiently. There might other factors like personal traits of employees, or differences in lifestyle, or relationships with colleagues, which are not captured in the study, but which might be driving exhaustion.

Therefore, this study cannot be considered as a conclusive proof that family helps to deal with exhaustion.

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