SEKOLAH KAJIAN STRATEJIK DAN GLOBAL

UNIVERSITAS INDONESIA
SEKOLAH KAJIAN STRATEJIK DAN GLOBAL
PUSAT KAJIAN JAMINAN SOSIAL

FINAL REPORT
PARENTAL SMOKING BEHAVIOR AND IT'S IMPACT ON CHILDREN DEVELOPMENT

STUDY ON TOBACCO CONSUMPTION EFFECTS TO POVERTY AND SOCIAL WELFARE IN INDONESIA

Parental Smoking Behavior and its Impact on Stunting, Cognitive, and Poverty:

Empirical Evidence from the IFLS Panel Data

Final Report

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Center for Social Security Studies Universitas Indonesia (CSSS-UI)

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Parental Smoking Behavior and its Impact on Stunting, Cognitive, and Poverty:

Empirical Evidence from the IFLS Panel Data

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Acknowledgement

The research team would like to thank Campaign for Tobacco Free Kids (CTFK) for funding this project. The views expressed in this report are not necessarily those of CTFK. The data published in this report cannot be considered as either endorsed by, or the expression of the interest of CTFK, Universitas Indonesia, or other institutions involved in this study. We acknowledge all respondents and contributors for their cooperation and participation in the study.

Acknowledgement

Social protection plays a key role in achieving sustainable development, promoting social justice and realizing the human right to social security for all. Today, virtually all countries had social protection systems in place, and efforts to extend social protection coverage and benefits are continuing.

The report on "Parental Smoking Behavior and its Impact on Stunting, Cognitive, and Poverty" is part of the contribution of the Pusat Kajian Jaminan Sosial Universitas Indonesia (*Center for Social Security Studies Universitas Indonesia*) towards the improvement of social protection system in Indonesia through its research activity on health protection system.

This report provides an approach that highlights how the quality of the Indonesian future generation, both their physics and cognitive quality, is affected by the behavior of parental smoking, which in turn, the problems will burden the health protection system.

Aryana Satrya, PhD

Head of PKJS-UI

Acknowledgement

Indonesia is the last resort for the tobacco industries. It has the highest prevalence of daily smokers in the world and its richest people are coming from cigarette industries. Ironically, the largest "donors" to the richest men are coming from low income people. The low income people in Indonesia are trapped into the circle of poverty. The have low education and low intake of protein in their consumption. Protein is the main source of brain development and growth of human babies and children. Low protein intake associates with low intellectual capacity and physical strength. The low income Indonesia spent higher proportion of their income for cigarettes compare for protein and education. Consequently, they children could not finish high education and remain potentially poor. They are highly likely to stay in chronic poverty.

This research send serious messages to the Government, Congress members, and all policy makers that Indonesian economy and competitiveness will continue low, unless cigarette consumptions are reduced. Cigarettes contribute significantly to stunting and low intellectual ability of the low Income. Without aggressive campaign and tobacco control, the Government's high spending on education will be in fruitless.

Prof. Hasbullah Thabrany

Principal Investigator

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Abstract

Smoking prevalence has continually increased in Indonesia and is one of the highest in Asia. Smoking itself has been proven to deteriorate health of both active and passive smokers. However, there are also intergenerational effects of smoking, caused by the crowding-out of other expenditures and the smoke itself, that will threaten the quality of the Indonesian future generation. Using the Indonesia Family Life Survey (IFLS) data, we find that (1) children with parents that smoke (chronic smokers) have averagely a lower weight growth 1.5 kilograms and height growth 0.34 centimeters compared to children with parents that are non-smokers, (2) children with smoker parents have a probability to experience stunting 5.5 percent (percentage point from average) higher compared to children with parents that are non-smokers, (3) one percent increase of tobacco expenditure will increase the probability of household being poor by 6 percent (percentage point from average), (4) parental smoking causes their children to experience stunting and stunting on children is an important factor that determines children cognitive (logic and math), thus is indirect. Therefore, policies should direct their attention to control tobacco as this will save the future generation of Indonesia and help Indonesia escape the middle-income trap.

Keywords: *Stunting, Child Cognitive, Indonesia, Parental Smoking, Poverty, Intergeneration.*

1. Introduction

Smoking has been an issue in Indonesia for a long time. Based on World Bank (2000), Indonesia has one of the highest prevalence of smoking in Asia. Based on the Indonesian Socio-Economic Survey (Susenas) in 2017, the number of active smokers in Indonesia has reached 21.38 percent of the Indonesian population, while the prevalence in 2016 was around 21 percent. This may stem from the affordability of cigarettes in Indonesia (Qian, Li, & Zheng, 2015). In terms of age cohort, Indonesian Family Life Survey (IFLS) shows that over two decades, most smoking prevalence occurred in the 21 to 40 age cohort which is the productive age peak. Interestingly in 1993, the number of smokers from age 11 to 20 was at a very low point (1.77%). However, over the last two decades, the number of smokers from age 11 to 20 have significantly increased to 7.7%.

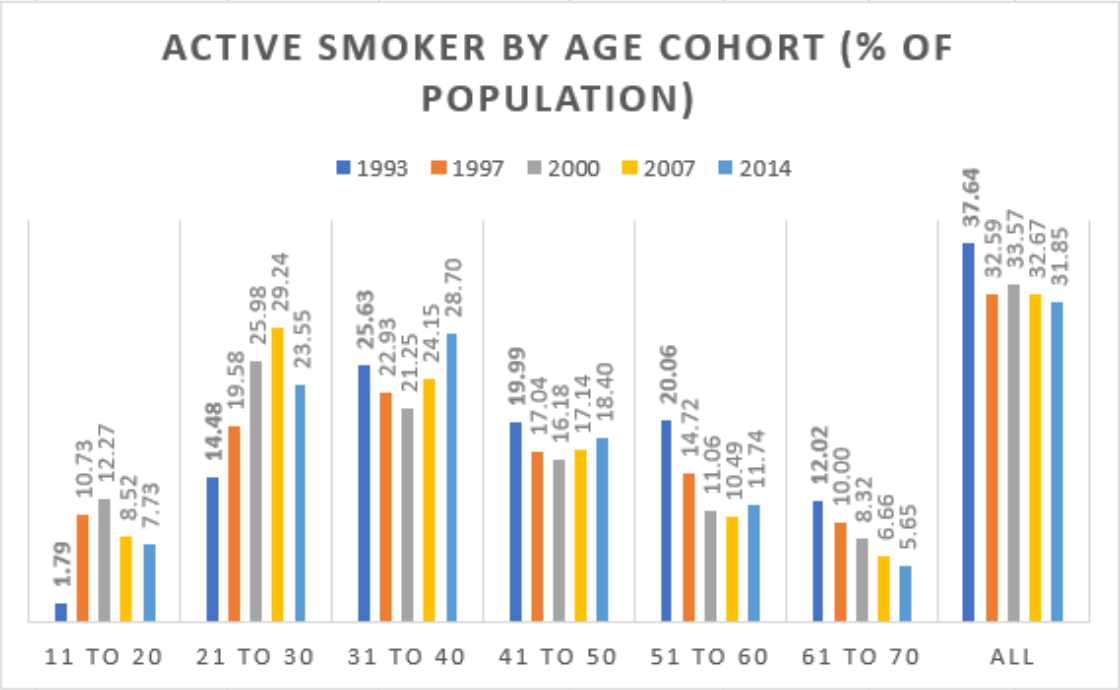


Figure 1 – Active Smoker by Age Cohort (% of Population)
Source: Author's Calculation

With the increase of active smokers, especially in the young generation, policies to control smoking (e.g. duty, written and picture warnings, and anti-smoking zones) have been considered not able to effectively lower the number of smokers in Indonesia (Adioetomo, Djutaharta, & Hendratno, 2005). This situation is worrying as smoking not only causes short-term problems through the health of active and passive smokers but also causes negative intergenerational problems such as stunting and child cognitive.

Stunting itself has become a national issue by the Ministry of Health. In the 2013 Riskesdas, 37.2 percent of the child population in Indonesia experienced stunting which was an increase from 35.6 percent in 2010 (*Badan Penelitian dan Pengembangan Kesehatan*/Health Research and Development Agency, 2013). WHO (World Health Organization, 2018) has also calculated an updated number of stunting children in 2017 which has reached 7.8 million children which

covers 36.5 percent of the number of children in Indonesia. This number is also the fourth highest in the world. This high number of stunting cases indicates that many children are receiving low nutrition. This causes a negative impact on the growth of children's physic (height) and cognitive (intelligence). The stunted growth of these children may threaten Indonesia's future and may hamper the attainment of Sustainable Development Goals (SDGs).

Indonesia has targeted to decrease this number to 28 percent by 2019 (Ministry of National Development Planning/Bappenas, 2018). However, this target may be unrealistic if there is only minimal effort to understand the causes of stunting itself. A comprehensive policy is needed to significantly reduce stunting. A high prevalence of smoking may contribute to an increase in stunting prevalence. This is because parental smoking as smoking may cause the crowding-out of food consumption (such as protein) which is important in the early stages of children to grow (John, 2008). The smoke of cigarettes contains chemical that will react with chemicals in the children's body (if inhaled) that will hamper growth of the child.

"The issue of stunting is very interesting. The fact from World Bank shows that stunting creates a 2-3% GDP loss. Thus, is vital to know how much does parent's smoking behavior contribute to children stunting."

Entos Zainal, SP, MPHM
(Ministry of National Development Planning/ BAPPENAS)

This study aims at exploring empirical evidence on the intergenerational effects of smoking as there have been limited studies on the topic. We would like to see if parental smoking causes children to experience stunting, increases poverty incidence of the household, and affects children's cognitive. We believe with this study will create awareness for policy makers of these issues which may have not been considered in the policy making process concerning tobacco control.

The report proceeds as follows: section 1 explains the background of the study; section 2 provides a framework of intergeneration transmission of parental smoking behavior on child development including stunting, poverty and cognitive ability; section 3 presents the methodological framework, data and econometric estimation procedure; section 4 analyzes the findings of relationship between parental smoking behavior and its implication on stunting, cognitive and poverty; lastly, the concluding section of the paper summarizes the key findings and discusses policy implications.

2. A Framework of Parental Smoking Behavior, Stunting, Poverty and Cognitive Ability

The direct effect of tobacco consumption has been recorded multiple times to affect the health of its active users. Smokers become more vulnerable to diseases such as lung cancer, impotence, stroke, and stomach problems. The exposure to the smoke of cigarettes not only affect active user, passive users are also affected with the same diseases with a higher risk (Cao, Yang, Gan, & Lu, 2015). The exposure to cigarette smoke will affect the growth of babies in mother's womb that may cause stunting (Rona, Chinn, & Florey, 1985, Muraro et al., 2014, and Xie et al., 2016). From a medical perspective, the physiological mechanism of stunting is due to the embryotoxic effects of nicotine or other toxic pollutants found in cigarette smoke. These chemicals act directly on growth plate chondrocytes to decrease matrix synthesis which suppresses hypertrophic differentiation via alpha7 nAChR leading to delayed skeletal growth (Kawakita et al., 2008). There is also strong association between maternal smoking with stunting. Smoking creates vasoconstriction on blood vessels which gives lower O_2 to the mother and the nutrition supply for the umbilical cord. This creates lower O_2 supply and nutrition for the placenta and increases the baby's defect. This will increase the risk of premature delivery, low birth weight, and lung problems for the baby. Also when the mother breastfeeds, the toxic substances from tobacco can inhibit growth by changing the supply and bioavailability of essential nutrients, such as zinc (Berlanga, Salazar, Garcia, & Hernandez, 2002).

"The essence of stunting is growth failure, impaired cognitive, and metabolic disorder. Other than fetal nutrition, environmental risks like tobacco is also a risk factor for stunting among children."

Ir. Doddy Izwardi, MM.
(Director of Nutrition, Directorate General of Nutrition and Maternal and Child Health, Ministry of Health)

Meanwhile, the indirect effects of tobacco consumption are the crowding out of other goods and services consumed by the household. This is also fuelled by the fact that tobacco is an addictive good which means that tobacco must be consumed routinely by consumers. Studies in countries like India, Bangladesh, and Taiwan have shown that consumption of tobacco does cause the crowing-out of other goods and services, especially in food (milk, fruits, vegetables, and grain) and education (John, 2008 and MacLennan, Ahmed, & Khan, 2015). Fuel, entertainment, and transportation are also crowded out by tobacco consumption sometimes. Semba et al. (2011) found in Indonesia that paternal smoking does cause food insecurity and if the household is also poor the risk is even greater.

For Adults, the effect of the crowding out will cause lower human capital investment (in health/nutrition and education) which causes lower productivity and end up into poverty. However, there are also repercussions on the child of the household, as the child is also exposed to the lower nutritional intake and investment in education. Nutritional intake may affect the

growth of children and cause stunting while low investment in education will cause low education attainment. In the end, these children will have low human capital, lower productivity, and stuck in the chain of poverty. In a macro perspective, low human capital will create a weak young generation that will eventually lead this country. Based on the literature review, stunting has been resulted from three important factors: nutritional intake, genetic and environmental. Smoking will have a double impact on stunting through nutritional intake and creating bad environment for child development.

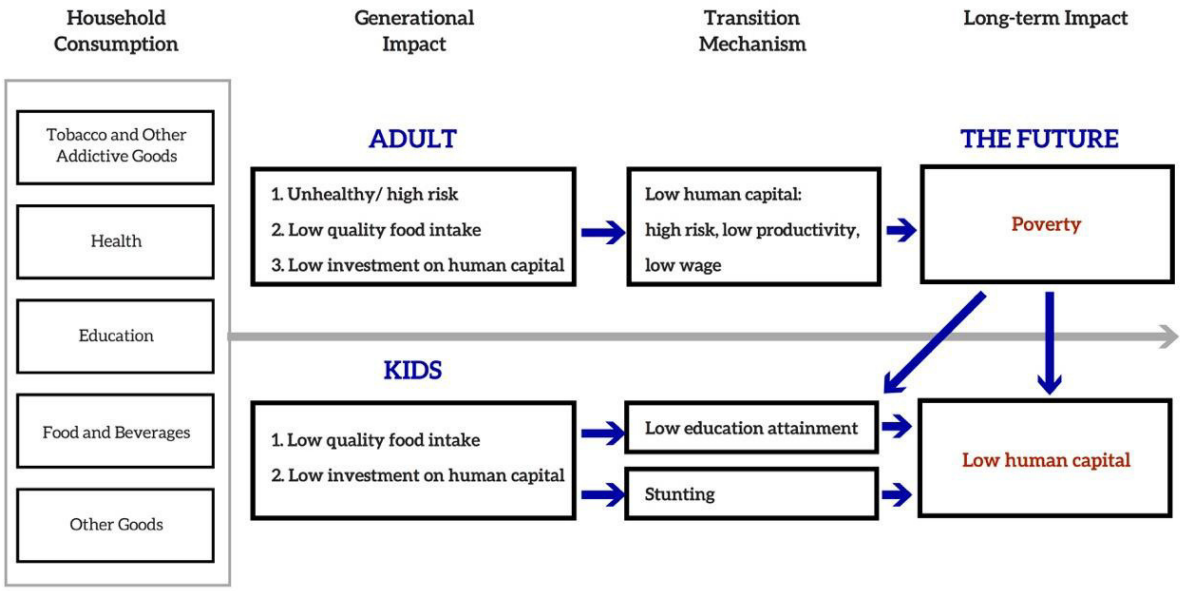


Figure 2 – Framework of Tobacco Consumption Impact
Source: Author's Illustration

Using the IFLS data, it shows in the last two decades, the percentage of alcohol and tobacco expenditure from the total expenditure has increased from 3.6 percent in 1993 to 5.6 percent in 2014. This increase in alcohol and tobacco expenditure percentage is accompanied with a decrease in rice (from 8.6 percent in 1993 to 7.5 percent in 2014), protein (from 10.3 percent in 1993 to 7.8 percent in 2014), education (from 11.4 percent in 1993 to 7.5 percent in 2014), and medical expenditure (from 2.4 percent in 1993 to 2.3 percent in 2014). This shows that the alcohol and tobacco expenditure has crowded-out other expenditures. This situation is worrying as the crowded-out expenditures are important for development of human capital (education, health, and nutrition). This will hamper the productivity and quality of labor in Indonesia.

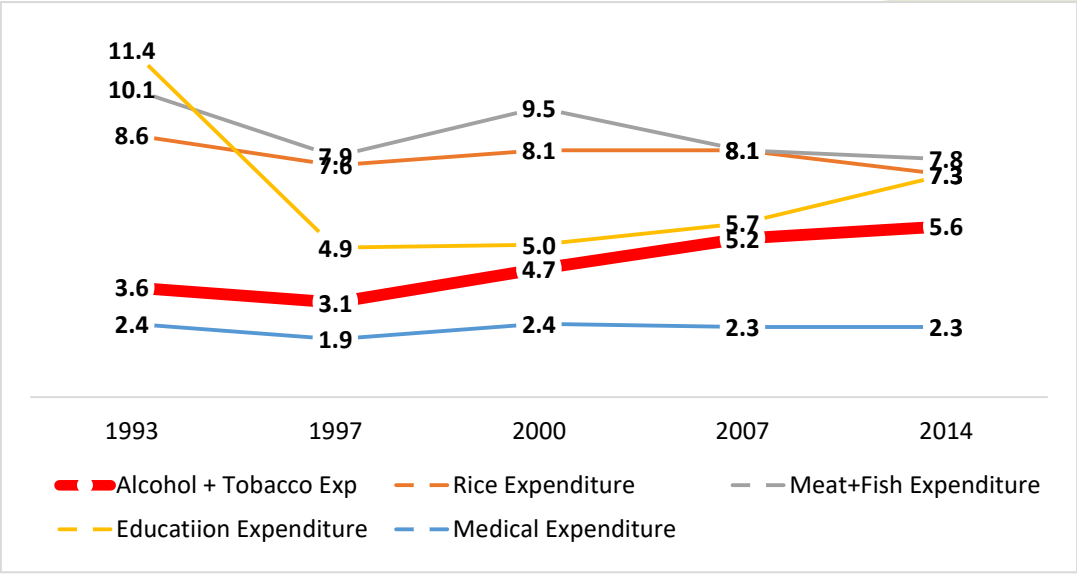
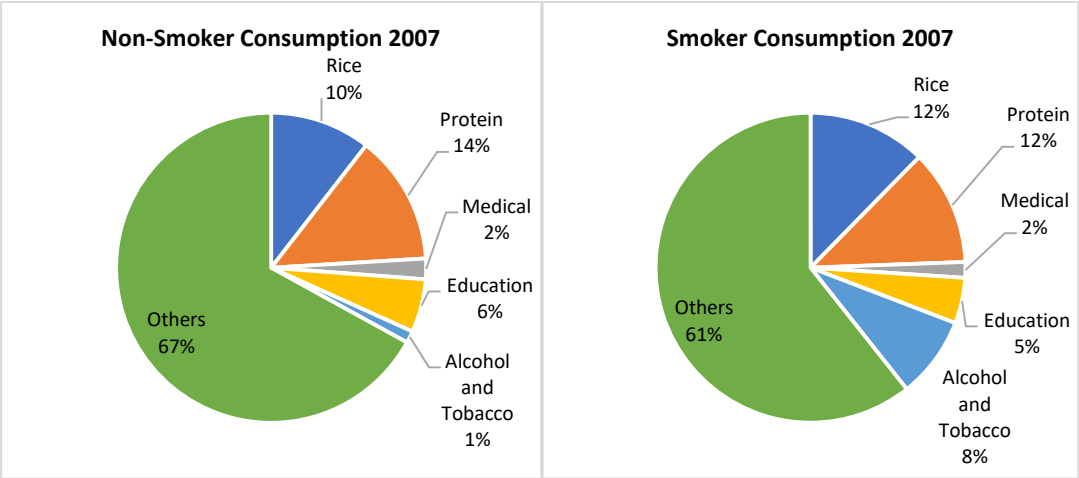


Figure 3 – Ratio Household Expenditure to Total Household Expenditure (%)
Source: Author's Calculation

Using only the 4th and 5th wave of the IFLS data, comparing between smokers and non-smokers, the percentage of alcohol and tobacco expenditure is higher in smokers in both 2007 and 2014 (e.g. 1 percent versus 8 percent in 2007). There may also be alcohol and tobacco expenditure on non-smokers if other members of the household have this expenditure (expenditure is in the household level while smoking incidence is at the individual level). This is accompanied by lower expenditure in protein and education expenditure by smokers (compared to non-smokers) in both 2007 and 2014. While medical expenditure is only lower by smokers (compared to non-smokers) in 2014 (in 2007 the percentage was equal). This is worrying as these expenditures are considered important to develop the quality of human capital of the family. However, interestingly, rice expenditure is higher in smokers compared to non-smokers.



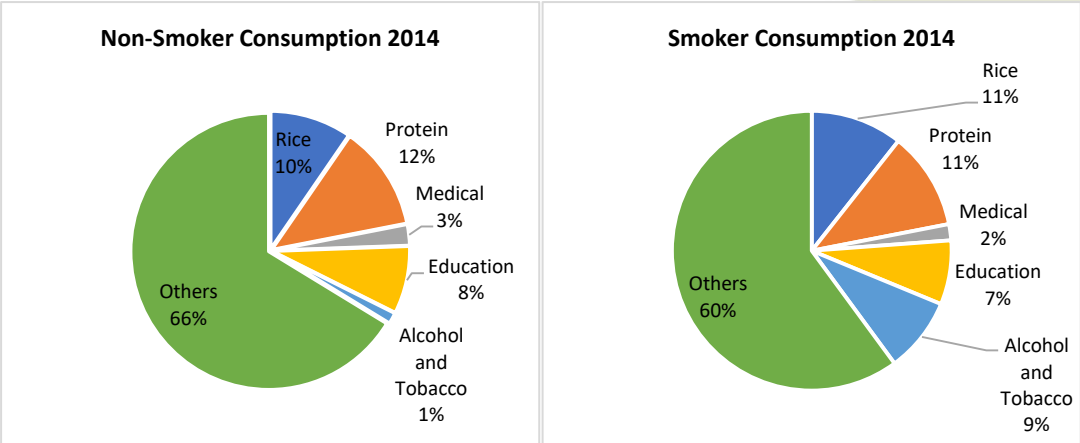


Figure 4 – Smoker and Non-Smoker Consumption Proportions 2007-2014
Source: Author's Calculation

While there are differences in the value of expenditures between smokers and non-smokers, we must use a statistical approach to see if this difference is significant statistically. Using the Difference-in-difference approach (results in Appendix 1 to 4), we found that smokers have significantly lower medical, education, and protein per capita expenditure compared to non-smokers (this approach controls the growth of expenditure between years). While rice per capita expenditure is not significant between smokers and non-smokers. This approach strengthens the claims that there is crowding-out of other expenditures by smokers.

3. Data and Methodology

The data used in this research is the Indonesia Family Life Survey (IFLS). The IFLS is a socio-economy survey that had been collected in 5 waves (1993, 1997, 2000, 2007, and 2014) by RAND Corporation. The respondents from the 1993 survey are re-surveyed in the other surveys with low levels of attrition, therefore the data can be used for panel (cohort) analysis. This survey is representative of 83 percent of the population in Indonesia which is conducted in 13 provinces. The initial sample size in 1993 is 7,224 households and eventually 14,773 in 2014 (due to split-off households).

For each research question, we use different waves of the IFLS. For the stunting and cognitive analysis, we use the 4th and 5th of the IFLS where we sample children that were below 5 years old in the 4th wave (2007) of IFLS. While, analysis of household poverty uses all 5 waves of the IFLS data. All balanced households are used in the analysis. The analysis itself will use the combination of descriptive and inferential statistics.

For the analysis of stunting, we use the stunting definition of WHO where a child is considered to experience stunting if his/her height is lower than two standard deviations of the WHO population reference median height (which differs between age in months and sex). The regression method is the ordered logit regression. The dependent variable is the number of times of the child experiences stunting between 2007 to 2014. A positive coefficient would implicate the variable will cause an increase of probability of stunting. However, due to the

coefficients of the regression not being able to be interpreted directly, we add the marginal effect of variables in the results. The model is as follows:

$$StuntDyn_i = \alpha_1 TransSmoke_i^0 + \alpha_2 ChronSmoke_i^0 + \sum_{j=1}^{J} \alpha_j Demographic_{ji}^0 + \sum_{k=1}^{K} \alpha_k Environment_{ki}^0 + \sum_{l=1}^{L} \alpha_l\, Nutrition_{li}^0 + \sum_{m=1}^{M} \alpha_m\, Genetic_{mi}^0 + \epsilon_i$$

For the analysis of poverty, we also use the ordered logit regression. The dependent variable is the number of times a household is poor between 1993 to 2014. A positive coefficient would implicate the variable will cause an increase of probability of being poor. However, due to the coefficients of in the regression not being able to be interpreted directly, we add the marginal effect of variables in the results. The model is as follows:

$$PovDyn_i = \beta_1 TobaccoExp_i + \sum_{j=1}^{J} \beta_j Demographic_{ji}^0 + \sum_{k=1}^{K} \beta_k Socioeconomic_{ki}^0 + \sum_{l=1}^{L} \alpha_l\, Change_{li} + e_i$$

Lastly, for the analysis of the cognitive, we use ordinary least square (OLS) and instrumental variable (IV) regression. An OLS regression will implicate that there is a direct relationship between parental smoking behavior and child cognitive. Whereas, an IV regression will implicate there is an indirect relationship between parental smoking behavior and child cognitive. The IV regression will show that parental smoking behavior will affect the probability of the child to experience stunting (which closely follows the model of stunting dynamics), thereby affecting the child cognitive. The child cognitive is measured in logic and mathematics subjects where we use the raw score of the test. The model is as follows:

$$LogicCognitive_i = \delta_1 PredictedStunt_i + \sum_{j=1}^{J} \delta_j Demographic_{ji}^0 + \sum_{k=1}^{K} \delta_k Environment_{ki}^0 + \sum_{l=1}^{L} \delta_l\, Nutrition_{li}^0 + \sum_{m=1}^{M} \delta_m\, Genetic_{mi}^0 + u_i$$

$$MathCognitive_i = \gamma_1 PredictedStunt_i + \sum_{j=1}^{J} \gamma_j Demographic_{ji}^0 + \sum_{k=1}^{K} \gamma_k Environment_{ki}^0 + \sum_{l=1}^{L} \gamma_l\, Nutrition_{li}^0 + \sum_{m=1}^{M} \gamma_m\, Genetic_{mi}^0 + \varepsilon_i$$

4. Results and Discussions

First, we use descriptive statistics to see the patterns of children's height and weight growth with parental smoking behavior in IFLS wave 4 and 5. For the dynamics of parental smoking, we divide parental smoking behavior into three categories, never smoke, transient smoker, and chronic smoker. Never smoke, as the name implies, means that the parents both were not active smokers in both the 4th and 5th wave of IFLS. Transient smoker means that the parents were active smokers in either the 4th or 5th wave of IFLS but not in both. The parents may have been active smokers in the 4th wave and stopped in the 5th wave or only began smoking in the 5th wave. While, chronic smoker means that the parents were active smokers in both the 4th and 5th wave of IFLS.

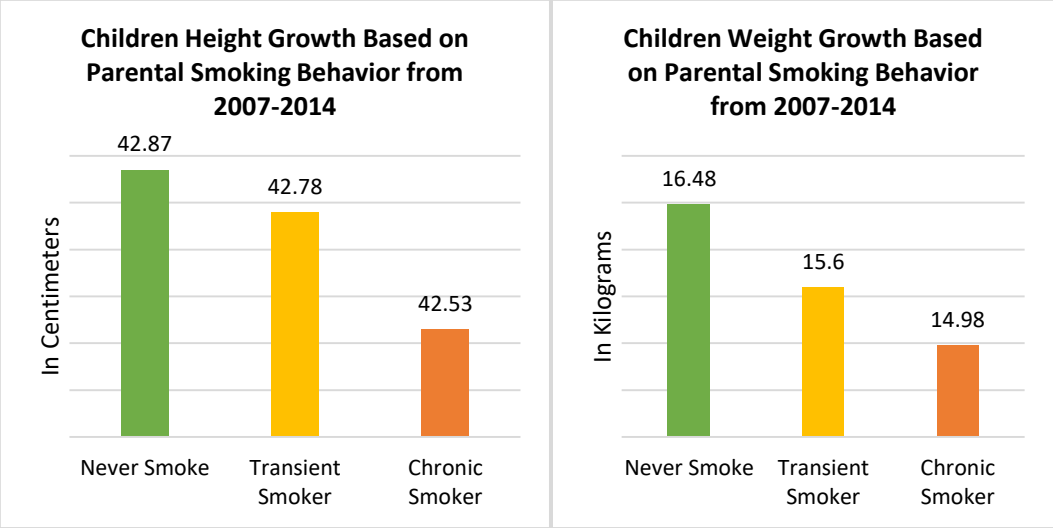


Figure 5 – Children Height and Weight Growth Based on Parental Smoking Behavior
Source: Author's Calculation

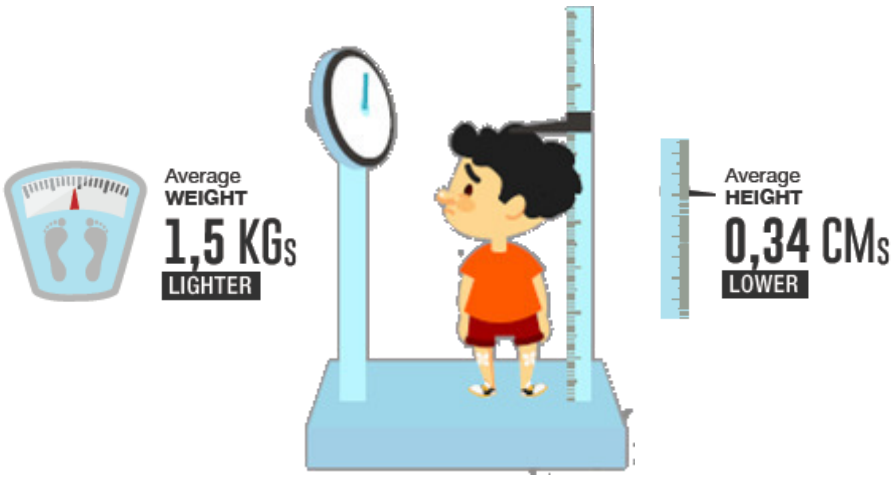


Figure 5 shows that the height growth of children is the highest when the parents never smoke and the lowest when the parents are chronic smokers (transient smokers' children are in between). Children with parents that never smoke, on average, grow 0.34 centimeters higher than children with parents that are chronic smokers. Children who have parents that are smokers (either transient or chronic) tend to have lower growth in height compared to children with parents that don't smoke.

This pattern can also be seen when comparing the growth of children's weight. The weight growth of children is the highest when the parents never smoke and the lowest when the parents are chronic smokers (transient smokers' children are in between). Children with parent that never smoke, on average, weigh 1.5 kilograms heavier than children with parents that are chronic smokers. Children who have parents that are smokers (either transient or chronic) tend to have lower growth in weight compared to children with parents that don't smoke.

While height and weight growth of children is lower by children that have parents that are smokers, does this translate into stunting children? Figure 6 shows that children that never experience stunting is the lowest when the parents are chronic smoker while transient and chronic stunting children are the highest when the parents are chronic smokers. Using the Chi-Square Goodness-of-fit test, we find that there is significant evidence (at the 5 percent significance level) that stunting incidence and parental smoking behavior are dependent. This relationship is also found when the sample is separated between males and females. This indicates that there is a tendency of parents that always smoke have children that experience stunting.

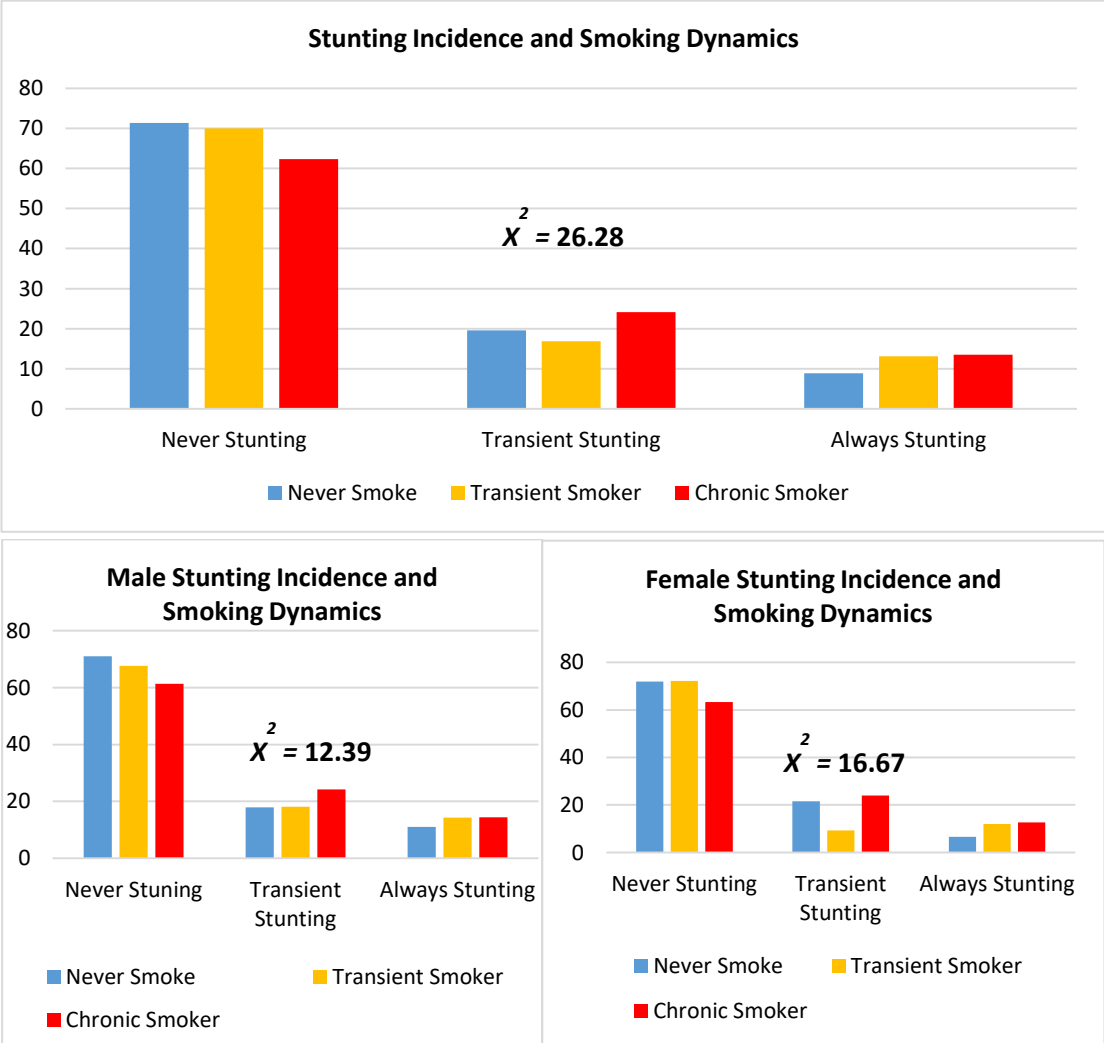


Figure 6 – Stunting Incidence and Parent Smoking Dynamics Aggregate and by Sex
Source: Author's Calculation and Estimation

Child cognitive that is measured by logic and math tests also show a certain pattern concerning parental smoking behavior. The cognitive score (in both logic and math) in the 7 to 14 years old age cohort (the youth) show that, on average, is the highest when the parents never smoke and the lowest when the parents are chronic smokers (transient smokers are in between). This shows that for the youth cohort, the cognitive score tends to be lower if parents are smokers compared to non-smokers. This is worrying considering the youth are the future generation.

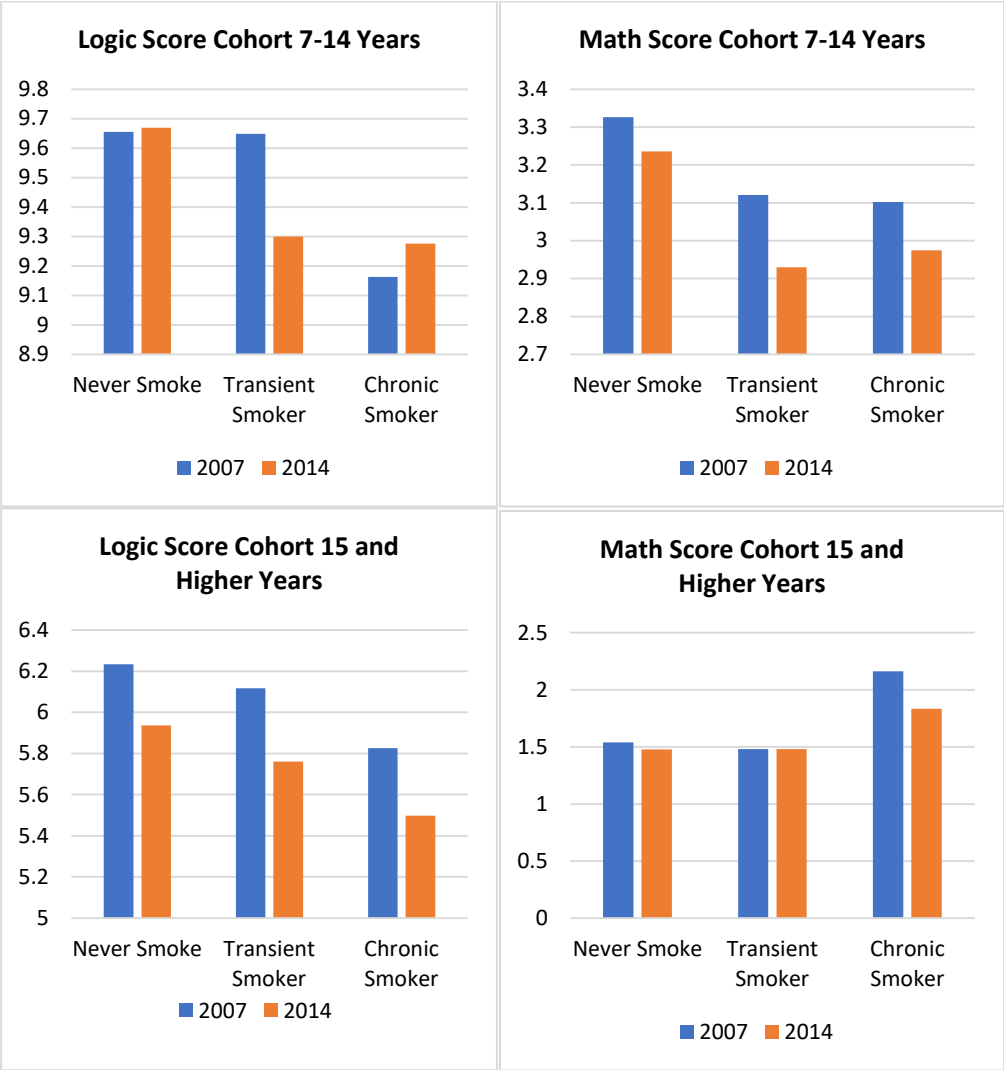


Figure 7 – Cognitive Score of Logic and Math based on Parental Smoking Behavior between Different Age Cohorts

Source: Author's Calculation

For the 15 and higher years age cohort, the logic cognitive follows the pattern of the youth cohort where the cognitive score is the highest when the parents are non-smoker and the lowest when the parents are chronic smokers. However, the math cognitive does not follow this pattern. The highest math cognitive, on average, is the highest when parents are chronic smokers and followed by parents that never smoke. While there is one deviation from the pattern, in general, cognitive is higher on average when parents are non-smokers compared to smokers.

Another interesting statistic is the comparison of cognitive scores between stunting children and non-stunting children. Stunting has been indicated to not only hinder the height of children but also hinders the growth of child cognitive. Comparing the logic and math cognitive scores shows that stunting children have lower math and logic cognitive scores. We also use a two-population difference t-statistics test to prove that there is a statistical difference between the cognitive score of stunting children and non-stunting children. The test results show that there is a significant difference (at a 5 percent significance level) in cognitive scores (logic and math) between stunting children and non-stunting children.

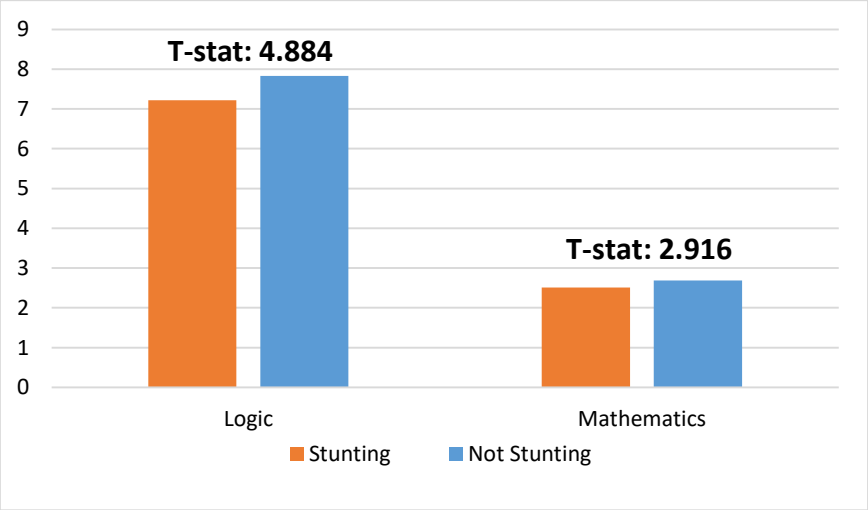


Figure 8 – Cognitive Score of Logic and Math based on Child Stunting Status
Source: Author's Calculation and Estimation

The descriptive statistics test has indicated that there may have a relationship between smoking behavior and children stunting and cognitive. However, we must prove this relationship by using a regression analysis that allow us to control with other variables. The first model to analyze is the stunting dynamics model. Table 1 shows that there is a positive significant correlation between chronic smokers and stunting dynamics before and after controlling demographic, environment, nutrition, genetic variables. This means that if the parent is a chronic smoker, the child has a higher probability of stunting continuously compared to parents that never smoke. Using the marginal effect approach (see Appendix 5), a child with chronic smoker parents have a 5.5 percent (percentage point from average) higher chance to experience stunting compared to children with parents that are non-smokers (this effect has been controlled with other factors stated above). This shows that parental smoking behavior/exposure does increase the chance of the child to experience stunting (Rona, Chinn, & Florey, 1985 and Muraro et al., 2014). While if the parent is a transient smoker, there is no significant effect on stunting incidence compared to parents that never smoke.

Table 1 - Results of Ordered Logit of Stunting Dynamics (2007 & 2014)

No	Explanatory Variables	Stunting Dynamics	Stunting Dynamics
		Coefficient	Coefficient
1	Parents Transient Smoker (1 = Transient Smoker; 0 = Others)	0.133	0.167
		(0.91)	(1.00)
2	Parents Chronic Smoker (1 = Chronic Smoker; 0 = Others)	0.382***	0.253**
		(3.86)	(2.34)
3	Poverty Status in 2007 (1 = Poor; 0 = Non-Poor)	0.709***	0.462***
		(8.57)	(4.62)
4	Years of Schooling of HH Head in 2007 (in Years)		-0.026***
			(-2.24)
5	Age of HH Head in 2007 (in Years)		0.0002
			(0.04)
6	Electricity Access in 2007 (1=having electricity; 0=other)		-0.032
			(-0.16)
7	Distance to Water Supply in 2007 (Log)		0.095***
			(3.90)
8	Child Weight in 2007 (in kg)		-0.067***
			(-2.56)
9	Mother Breastfeeds in 2007 (1 = Breastfeeds; 0 = No)		-0.302**
			(-2.46)
10	Average Protein Expenditure during 2007 and 2014 (in Million Rupiah)		-0.289*
			(-1.83)
11	Height of Mother in 2007 (in cm)		-0.019***
			(-2.64)
12	Height of Father in 2007 (in cm)		-0.013***
			(-3.96)
13	Mother takes anaemia pills in 2007 (1 = Takes Pills; 0 = No)		-0.205
			(-0.61)
	cut1	1.118***	-5.178***
		(12.41)	(-4.07)
	cut2	2.454***	-3.810***
		(24.41)	(-3.01)
	N	2767	2366
	Pseudo R-Square	0.019	0.046
	Chi-Square	95.47	149.64

Note: t statistics in parentheses * p<0.10 **p<0.05 *** p<0.01

Source: Author's Estimation

Control variables have also been added to the model to control their effects on stunting incidence. Demographic variable such as the household being poor increases the probability of a child to experience stunting continuously. While education of the household head will decrease the probability of a child to experience stunting continuously as it increases. Lastly, age of household does not affect the probability of a child to experience stunting continuously. Environment variables such as electricity and distance to water source are also added. A child that has electricity access in their household will have a lower probability to experience

stunting continuously. Whereas, the distance of water source has a positive effect on the probability of a child to experience stunting continuously. This shows that children with more/closer access to utilities will tend to not experience stunting.

Breastfeeding as one of the nutritional factors has a negative effect to the probability of a child to experience stunting continuously compared to children that were not breastfed. A higher average of protein consumption will decrease the probability of a child to experience stunting continuously. While taking anemia pills does not affect the probability of a child to experience stunting continuously. This shows that nutritional factors also hold an important role in affecting stunting. Breastfeeding and protein contain macro and micro nutrients that are important for the child's growth. Lastly, genetics factor is also important. Results show that if the higher the parents of the child (both father or mother), the child will tend to not experience stunting. Genetically the child's height is influenced by his/her parents height thus taller parents will have taller children.

In case of the poverty incidence, Table 2 shows that an increase of average household share of alcohol and tobacco expenditure before 2014 will increase the probability of a household being continuously poor (its statistically significant). Using the marginal approach (see Appendix 6), an increase of 1 percent increase in alcohol and tobacco expenditure will increase the probability of the household being poor by 6 percent (percentage point from average), this has been controlled with demographic, socioeconomic, and change variables. Households that have higher expenditure will tend to crowd-out other consumptions such as nutrition, health, and education which are important for the development of human capital (Block & Webb, 2009 and Pu, Lan, Chou, & Lan, 2008). Thus, these households will tend to have lower human capital and lower productivity and be unable to move out of poverty, increasing their poverty incidence in the long-run.

Lastly, Table 3 shows the IV regression of child cognitive (logic and math). Initially, we used an OLS regression (see Appendix 7) which results show that there is no significant direct effect of parental smoking behavior to child math and logic cognitive after controlling effects of other variables (initially, without the control variables parental, smoking behavior affected child cognitive). Therefore, we also use an IV regression. The IV regression uses stunting as the instrument variable which is significantly influenced by parental smoking behavior (see Appendix 8 for instrument regression results). Children that have parents that are active smokers tend to experience stunting compared to children with parents that are not active smokers.

The stunting variable predicted from the instrument regression is regressed with the child logic and math cognitive. This variable has a significant negative effect on the child's logic and math cognitive which means that stunting children will have lower cognitive (logic and math) compared to non-stunting children. Therefore, unlike the other results, parental smoking behavior does not directly affect the cognitive of the child. However, parental smoking behavior does increase the probability of the child to experience stunting where then stunting children will tend to have a lower cognitive compared to non-stunting children.

Table 2 - Results of Ordered Logit of Poverty Dynamics
(1993, 1997, 2000, 2007 and 2014, 0=never poor, 1, 2, 3, 4, 5=chronic poor)

No	Explanatory Variables	Poverty Dynamics	Poverty Dynamics
		Coefficient	Coefficient
1	Average HH's Share of Alcohol and Tobacco Exp. during 1993, 1997, 2000 & 2007 (in %)	1.058***	0.402**
		(6.82)	(2.41)
2	Average HH's Share of Medical Exp. during 1993, 1997, 2000 & 2007 (in %)	-1.376***	-1.095***
		(-4.50)	(-3.49)
3	Number of Household Member in 1993		0.184***
			(9.41)
4	Marital Status in 1993 (1= Marriage; 0=other)		-0.380**
			(-1.97)
5	Sex of HH Head in 1993 (1= Male; 0=other)		0.585***
			(2.99)
6	Years of Schooling of HH in 1993		-0.156***
			(-15.47)
7	Change in Years of Schooling during 1993-2007 (1=increase; 0=other)		-0.388***
			(-5.02)
8	Location in 1993 (1=urban; 0=other)		-0.451***
			(-5.29)
9	Change in Location during 1993-2007 (1=rural to urban; 0=other)		-0.070
			(-0.52)
10	Distance to Water Supply in 1993 (Log)		0.091***
			(4.65)
11	Change in Distance to Water Supply during 1993-2007 (1=increase distance; 0=other)		0.215**
			(2.26)
12	Electricity Access in 1993 (1=having electricity; 0=other)		-1.348***
			(-7.03)
13	Change in Electricity Access from 1993-2007 (1=no access to have access to electricity; 0=other)		-0.573***
			(-3.03)
	cut1	-1.016***	-2.224***
		(-16.40)	(-9.04)
	cut2	-0.043	-1.002***
		(-0.73)	(-4.11)
	cut3	0.724***	-0.056
		(12.08)	(-0.23)
	cut4	1.810***	1.212***
		(26.08)	(4.97)
	cut5	3.515***	3.053***
		(30.66)	(11.86)
	N	2735	2735
	Pseudo R-Square	0.007	0.098
	Chi-Square	65.683	902.105

Note: t statistics in parentheses * p<0.10 **p<0.05 *** p<0.01

Source: Author's Estimation

Table 3 - Results of IV Logic and Math Cognitive

No	Explanatory Variables	Logic Cognitive Coefficient	Logic Cognitive Coefficient	Math Cognitive Coefficient	Math Cognitive Coefficient
1	Predicted Stunting Status in 2014	-0.737***	-0.302***	-0.218***	-0.120***
		(-7.26)	(-3.91)	(-4.54)	(-3.09)
2	Poverty Status in 2014 (1= Poor; 0=Not Poor)		-0.061		-0.125
			(-0.29)		(-1.22)
3	Years of Schooling of HH Head in 2014 (in Years)		-0.002		-0.009
			(-0.17)		(-1.23)
4	Electricity Access in 2014 (1=having electricity; 0=other)		0.064		0.572**
			(0.12)		(2.25)
5	Distance to Water Supply in 2014 (Log)		-0.085**		-0.0003
			(-2.21)		(-0.02)
6	Protein Per Capita Consumption in 2014 (in Million Rupiah)		0.166		0.075
			(0.30)		(-0.23)
7	Logic Cognitive Score of Mother in 2014 (points)		0.308***		
			(9.04)		
8	Logic Cognitive Score of Father in 2014 (points)		0.195***		
			(5.83)		
9	Math Cognitive Score of Mother in 2014 (points)				0.103***
					(4.51)
10	Math Cognitive Score of Father in 2014 (points)				0.130***
					(5.89)
	Coefficient	6.761***	4.904***	2.370***	1.615***
		(47.84)	(8.87)	(36.04)	(6.25)
	N	2374	1922	2374	1922
	R-Square	0.025	0.130	0.010	0.056
	F-Stat	52.75	34.50	20.61	14.55

Note: t statistics in parentheses * p<0.10 **p<0.05 *** p<0.01

Source: Author's Estimation

Figure 9 – Pictures of Stunting Case in East Nusa Tenggara
Source: Bappenas (2018)

To support the results found from the regression analysis, we quoted the work of Bappenas (2018) field research in East Nusa Tenggara. East Nusa Tenggara is one of the provinces with the highest stunting cases in (Health Research and Development Agency, 2013) and the third highest poverty rate from all provinces in Indonesia (Badan Pusat Statistik, 2018). An interesting characteristic we observed is that East Nusa Tenggara has a high prevalence of smoking where smoking has been considered a normality. Some of the incomes of parents are used to pay for the cigarettes which subsitutes the main needs. This eventually will affect the nutritional intake of the children. Figure 9 shows a case where two children that are twins have different heights, where the older brother (yellow shirt) is shorter than the younger brother (pink shirt). Their height is also below the standards of WHO reference age height which means both suffer from stunting. Their father is a heavy smoker that can use up to 50% of their income for tobacco consumption. This causes the crowding-out of nutritional consumption, thus causing stunting and poverty for the family. The high exposure to the chemicals of smoking may also worsen the stunting situation. Thus, this case does support the findings of the regression analysis.

5. Conclusion and Recommendation

Smoking is still an ongoing issue as there has been an increase in smoking prevalence of young aged (21-30 years) from 14.5 percent in 1993 to 23.6 percent in 2014. This is an important warning for tobacco control as the young aged are in their productive phase and are beginning to have families. Smoking may induce health problems and interfere the productive phase as well as close family members will be affected by the smoking behavior.

An increase of tobacco expenditure proportions from 3.6 percent in 1993 to 5.6 percent in 2014, accompanied by a decrease of important expenditure such as carbohydrate and protein has created long-run impacts to children's stunting condition. Children with parents that smoke (chronic smokers) have a weight growth (on average) 1.5 kilograms less and a height growth (on average) 0.34 centimeters compared to children with parents that are non-smokers.

Children with parents that smoke have a probability to experience stunting 5.5 percent (percentage point from average) higher compared to children with parents that are non-smokers. This has been controlled with genetic, environment, and nutrition variables. On terms of household welfare, higher smoking expenditure does increase the probability of households to be continuously poor. 1 percent increase of tobacco expenditure will increase the probability of household being poor by 6 percent (percentage point from average).

Regarding the children cognitive, there has not been strong evidence that parental smoking behavior directly influences children cognitive. However, parental smoking behavior has been found to cause their children to experience stunting and stunting on children is an important factor that determines children cognitive (logic and math). Stunting children will have lower cognitive abilities.

Finally, we recommend that there is socialization on the expenditure usages of smokers. As seen in the early sections, tobacco expenditure will crowd-out other important expenditures such as protein, education, and medical expenditures. These expenditures are important for the development of human capital for the parent themselves and especially for the child who is still in his/her early development. The height, weight, cognitive of the child will be in jeopardy if these important expenditures are crowded-out. The socialization should imply the importance of these expenditures and they should not be crowded-out/substituted by tobacco expenditure.

It is also recommended that there must be stronger tobacco control policies through many ways, such as expensive cigarettes, anti-smoking areas, etc. as tobacco control is equal to saving the future of the country by creating a healthy and smart generation. This will enable Indonesia to avoid the middle-income trap.

"Those who smoke will reduce their consumption of nutritional food. This research supports the National Cancer Institute Tobacco Control Monograph. The highlight is the poor smoke more and this impacts poverty. If we want reduce tobacco consumption, we need to increase the tobacco taxes."

Jeremias N. Paul, Jr.
(World Health Organization)

"Tobacco control has always faced difficulties due to labor and revenues issues. Increasing tobacco taxes must be followed with the increase of cigarette prices. This research can complete the policy background to adjust tobacco taxes policy."

Dr. Nasruddin Djoko Surjono
(Ministry of Finance)

"Indonesia is heading towards a demographic bonus in 2030. There will be a boom of the Y and Z generation. Thus, we need to make education about the dangers of tobacco "cool" to attract the youth. We also hope the whole community makes efforts to minimalize tobacco consumption."

dr. Cut Putri Arianie, MHKes
(Ministry of Health)

"This research can advocate other ministries. For example, the Ministry of Villages that have huge funding can create programs that incentivises villages that succeed in creating regulations that ban smoking inside homes (decreasing smoking and children exposure to smokers) and giving compensations to the villages that ban tobacco advertising."

Theresia Sandra Diah Ratih, MHA
(Ministry of Health)

"This shocking fact must be taken seriously due to the issues of tobacco and cigarettes being potentially massive in the near future."

Nina Samidi
(The National Commission on Tobacco Control)

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Appendices

Appendix 1 – DID Results for Rice Per Capita Expenditure 2007-2014

Rice Per Capita Expenditure	2007	2014	DID
Smoker	45,000	85,000	
Non-Smoker	43,000	87,000	
	2,126	- 1,900	- 4,100

Source: Author's Estimation

Appendix 2 – DID Results for Protein Per Capita Expenditure 2007-2014

Protein Per Capita Expenditure	2007	2014	DID
Smoker	58,000	110,000	
Non-Smoker	74,000	140,000	
	- 16,000***	- 25,000***	- 9,000**

Source: Author's Estimation

Appendix 3 – DID Results for Education Per Capita Expenditure 2007-2014

Education Per Capita Expenditure	2007	2014	DID
Smoker	21,000	69,000	
Non-Smoker	28,000	87,000	
	-7,200***	-18,000***	-10,000***

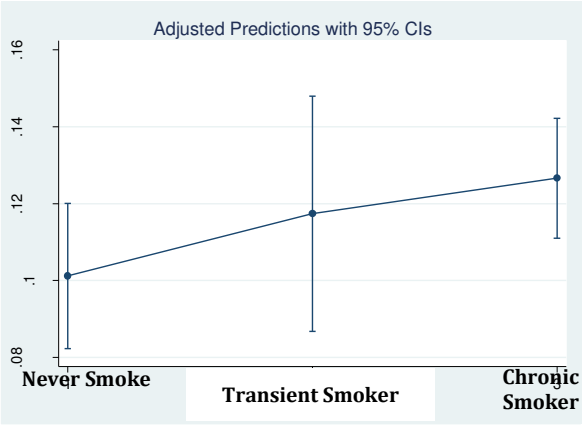
Source: Author's Estimation

Appendix 4 – DID Results for Health Per Capita Expenditure 2007-2014

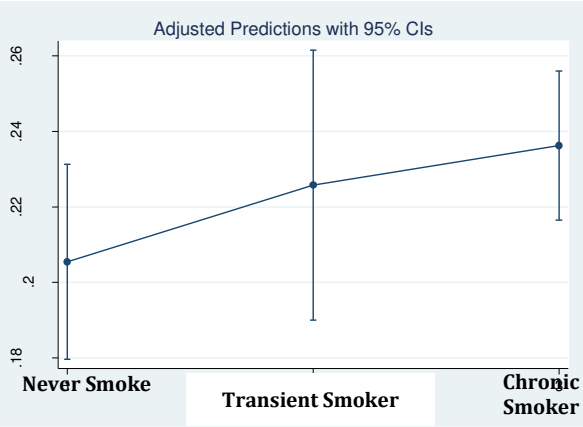
Health Per Capita Expenditure	2007	2014	DID
Smoker	8,854	19,000	
Non-Smoker	14,000	32,000	
	-5,100***	-13,000***	-7,600***

Source: Author's Estimation

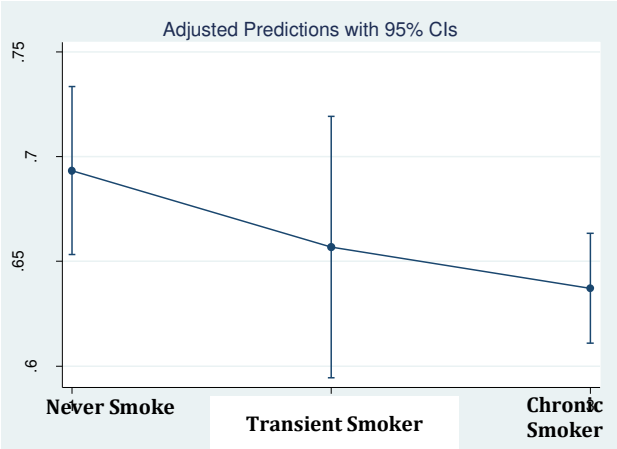
Appendix 5 – Marginal Effect of Parental Smoking Behavior to Stunting Incidence



Chronic Stunting



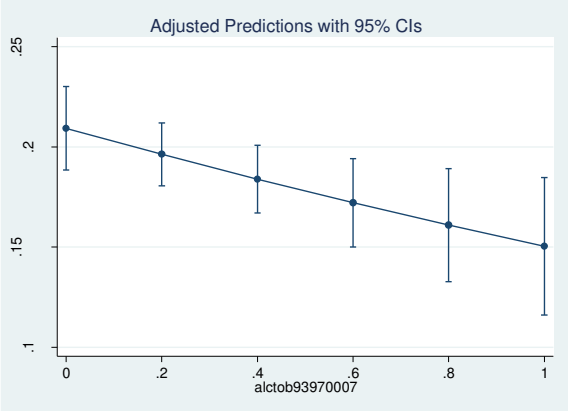
Transient Stunting



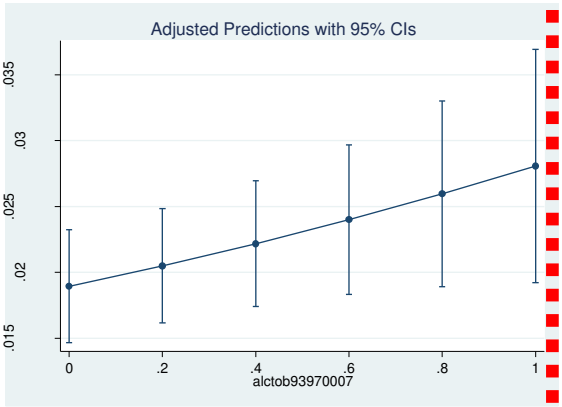
Never Stunting

Children with parents who smoke have the probability to experience stunting 5.5% higher compared to children with parents who are non-smokers.

Appendix 6 - Marginal Effect of Tobacco and Alcohol Expenditure to Poverty Incidence



Never Poor



Always Poor

An increase in percentage of tobacco expenditure will increase the probability of household being always poor.

Appendix 7 – OLS Regression of Logic and Math Cognitive

No	Explanatory Variables	Logic Cognitive	Logic Cognitive	Math Cognitive	Math Cognitive
		Coefficient	Coefficient	Coefficient	Coefficient
1	Parents Currently Smoking (1 = Smoking; 0 = Stopped Smoking)	-0.338***	0.002	-0.124**	-0.062
		(-2.93)	(0.02)	(-2.16)	(-1.00)
2	Stunting Status (1 = Stunting; 0 = Not Stunting)	-0.580***	-0.401***	-0.161***	-0.149**
		(-4.25)	(-2.90)	(-2.63)	(-2.25)
3	Poverty Status (1= Poor; 0=Not Poor)	-0.482***	-0.187	-0.213**	-0.179*
		(-2.65)	(-0.94)	(-2.45)	(-1.84)
4	Years of Schooling of HH Head (in Years)		0.003		-0.004
			(0.21)		(-0.57)
5	Electricity Access (1=having electricity; 0=other)		0.144		0.615**
			(0.28)		(2.42)
6	Distance to Water Supply (Log)		-0.081**		-0.004
			(-2.15)		(-0.28)
7	Protein Per Capita (in Million Rupiah)		-0.015		-0.097
			(-0.03)		(-0.33)
8	Logic Cognitive Score of Mother (points)		0.315***		
			(10.11)		
9	Logic Cognitive Score of Father (points)		0.179***		
			(5.75)		
10	Math Cognitive Score of Mother (points)				0.094***
					(4.39)
11	Math Cognitive Score of Father (points)				0.110***
					(5.22)
	Coefficient		5.319***	2.786***	1.848***
			(9.50)	(55.23)	(6.87)
	N	2482	2178	2482	2178
	R-Square	0.016	0.120	0.008	0.044
	F-Stat	12.809	34.575	6.35	12.482

Note: t statistics in parentheses * p<0.10 **p<0.05 *** p<0.01
Source: Author's Estimation

Appendix 8 – Logit Regression of Stunting for IV Regression

No	Explanatory Variables	Stunting
		Coefficient
1	Parents Active Smokers (1 = Active Smokers; 0 = Others)	0.228**
		(1.98)
2	Poverty Status in 2007 (1 = Poor; 0 = Non-Poor)	0.280***
		(2.40)
3	Child Weight in 2007 (in kg)	-0.095***
		(-2.89)
4	Mother Breastfeeds in 2007 (1 = Breastfeeds; 0 = No)	-0.215
		(-1.50)
5	Protein Expenditure Per Capita during 2007 (in Million Rupiah)	-5.84***
		(-4.32)
6	Height of Mother in 2007 (in cm)	-0.021**
		(-2.20)
7	Height of Father in 2007 (in cm)	-0.012***
		(-3.65)
8	Mother takes anemia pills in 2007 (1 = Takes Pills; 0 = No)	0.210
		(0.63)
	Constant	5.139***
		(3.29)
	N	2342
	Pseudo R-Square	0.0562
	Chi-Square	81.88

Note: t statistics in parentheses * p<0.10 **p<0.05 *** p<0.01

Source: Author's Estimation

Appendix 9 – Descriptive Statistics of Stunting Dynamics Data

Variable	Obs	Mean	Std. Dev.	Min	Max
Stunting Incidence	2767	0.478135	0.71104	0	2
Parents are Transient Smoker	2767	0.126129	0.332055	0	1
Parents are Chronic Smoker	2767	0.638959	0.480389	0	1
Poor in 2007	2767	0.308638	0.462015	0	1
Years of Schooling of Household Head	2767	8.464402	4.210746	0	18
Age of Household Head	2767	36.97976	10.25473	19	80
Electricity in 2007	2767	0.959523	0.197111	0	1
Distance to Source of Water In 2007 (Log)	2767	1.184057	1.795689	0	9.21034
Weight of Child in 2007	2699	12.14072	7.525817	1.5	115.2
Mom Breastfeed in 2007	2528	0.346123	0.475827	0	1
Average Protein Expenditure Per Capita	2698	0.392986	0.330412	0.00585	2.767917
Height of Mother in 2007	2756	150.6635	9.379649	15.3	175.4
Height of Father in 2007	2716	160.8191	14.1853	15.2	192.6
Mother Took Anemia Pills in 2007	2766	0.022415	0.148056	0	1

Source: Author's Calculation

Appendix 10 – Descriptive Statistics of Poverty Dynamics Data

Variable	Obs	Mean	Std. Dev.	Min	Max
Poverty Incidence Between 1993-2014	2741	1.87085	1.478345	0	5
Average Alcohol and Tobacco Expenditure Share 1993-2007	2735	0.243478	0.217385	0	1.7011
Average Medical Expenditure Share 1993-2007	2735	0.075391	0.112622	0	1.4384
Household Size in 1993	2741	4.723459	1.929636	1	14
Marital Status of Household head in 1993	2741	0.908428	0.288474	0	1
Sex of Household Head in 1993	2741	0.910981	0.284823	0	1
Years of Schooling of Household Head in 1993	2741	5.023349	4.11125	0	17
Change of Years of Schooling Between 1993 to 2007	2741	0.321416	0.467105	0	1
Urban in 1993	2741	0.354615	0.478484	0	1
Change of Urban Status between 1993-2007	2741	0.073331	0.260726	0	1
Distance to Water Source in 1993 (Log)	2741	2.224203	1.960454	0	9.21034
Change of Distance to Water Source between 1993-2007	2741	0.167822	0.373776	0	1
Electricity in 1993	2741	0.625684	0.484034	0	1
Change in Electricity Status 1993-2007	2741	0.335644	0.472301	0	1

Source: Author's Calculation

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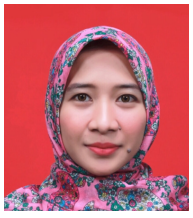

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