

**How to Cite:**

Hassn, H. M. A., Guzar, S. H., & Alhaideri, A. F. (2022). Blood lead levels and risk factors among adolescents in Karbala Province. *International Journal of Health Sciences*, 6(S2), 11706–11715. <https://doi.org/10.53730/ijhs.v6nS2.8127>

## Blood lead levels and risk factors among adolescents in Karbala Province

**Huda Mujbel Abdul Hassn**

College of Education for Pure Sciences, University of Karbala, Iraq  
Corresponding author email: [huda.mujbel@s.uokerbala.edu.iq](mailto:huda.mujbel@s.uokerbala.edu.iq)

**Sajid H. Guzar**

College of Education for Pure Sciences, University of Karbala, Iraq

**Amer Fadhil Alhaideri**

College of Medical, University of Karbala, Iraq

**Abstract**--Karbala provides theoretical assistance for lead pollution prevention by determining blood levels and identifying relevant risk factors among adolescents. Blood lead levels determine by Graphite Furnace Atomic Absorb piton Spectrometry (GFAAS) result. Methods blood samples were taken from both males and females. A total of 100 subjects (average age of 13-17 years, 8 females, and 92 males) were included. The arithmetic means, sample characteristics between two levels of lead concentrations (Less than 100µg/L lead concentration and more or equal 100µg/L lead concentration were patients their number 50 and control also 50 Mean ± SE 49.36 ± 6.61 patients mean ± SE 184.18 ± 6.61 control. Education, His relationship with his parents, Living, Smoking. (T= 7.79\*\*, 4.39\*\*, 4.30\*\*, 4.87\*\*, resp.), while Samples Patients and control (T=18.86\*\*).Conclusions. The levels of lead in the blood of adolescents 13 to 17 years in Karbala governorate were higher than in other areas due to leaving schools and working in different professions at an early age and living in unhealthy families.

**Keywords**--lead, blood BLLs, adolescents, graphite furnace, atomic absorption spectrophotometry.

### Introduction

Lead (P b) has a long history of damaging human health. Lead is neurotoxic with subversive properties. Environmental lead exposure is a major threat to human health. Millions of individuals have been affected by the many harmful consequences of this metal, especially in developed and rich nations, making the

widespread neurotoxicity a global public health concern [1]. Exposure to lead arises from drinking water, hobbies, occupation, and soil contamination. Moreover, researchers noted that different lifestyles such as smoking cigarettes, drinking alcohol, and drug abuse contributed to lead uptake in the body [2]. Toxic material buildup in the kidneys, liver, lungs, spleen, and brain can be fatal over time. Absorbed lead clings to contaminated cells and has a negative effect on IQ. [3], as per earlier studies, the amount of lead in the blood influences brain volume and fine motor skills [4, 5]. In addition, childhood lead poisoning indicates disturbing intellectual performance in young adulthood [6]. The negative impacts of lead on living organisms, particularly alterations in protein and gene function, have been shown [7]. The American Academy of Pediatrics defines lead poisoning as a blood lead level (BLL) of  $\geq 100 \mu\text{g/L}$ , which causes impairment to the urinary, hematological, and neurological systems [8] BLLs of  $< 100 \mu\text{g/L}$  have been linked to poor mental function, delayed puberty, and lower IQ in the U. S., according to the National Toxicology Program (NTP) [9]. Low-level lead poisoning (BLL20  $\mu\text{g/L}$ ) has been shown to affect children's intellectual capabilities in previous research [10]. Other analysis revealed that lower-level fetal lead poisoning impacted the aural memory recall of 2-month-old newborns [11]. A BLL reference point of  $> 50 \mu\text{g/L}$  is presently used by the American Center for Disease Control (CDC) to indicate lead poisoning [12]. Moreover, starting July 1, 2000, the Chinese government has mandated the use of unleaded gasoline to prevent the consequences of lead exposure. As a result, lead poisoning in children has fallen from 34% to 24%. At the same time, the problem persists in Iraq [13]. Karbala Province is known for lead poisoning as many factories and several small family projects dump trash and chemicals, and consequently, it leads to environmental pollution with lead. Exposure to lead is still common in Karbala Province. More scientific research is needed within the lead (P b) field to reduce the problem of lead poisoning. The primary goal of this study is to investigate BLLS in teenagers aged 13 to 17 years old due to lead-contaminated regions in Iraq's I Karbala Province and identify the key risk factors for BLLS [14].

## Materials and Methods

- "Ethics Statement": The Medical Ethics Committee of Karbala's Imam Hassan Hospital approved this research.
- "Subjects": From October 2021 to March 2022, this research was carried out at Karbala, Iraq. We established "BLLs of  $> 100 \mu\text{g/L}$  or  $10 \mu\text{g/dl}$ " Adults with increased BLLs met the Centers for Disease Control's lead poisoning criterion were used "i.e., a BLL of  $> 50 \mu\text{g/L}$  or  $5 \mu\text{g. /dl}$ " for children.
- "Questionnaire": Age, gender, connection with his parents, educational attainment, does he do drugs and consumes alcohol, does he have tattoos, does he reside in rural or urban regions, does he have past offenses, does he suffer from chronic conditions were all questions on the questionnaire.
- Methods: Blood samples were collected (3-5) ml of venous blood for children and adolescents, and the blood was placed in tubes that prevent clotting. The sample's serum was then separated, and preserved were, kept at a temperature of 4 until the analysis was performed.
- "Modifier Preparation (0.2% (v/v)  $\text{HNO}_3$  , 0.5% (v/v) Triton X-100® 0.2% (w/v)  $\text{NH}_4\text{H}_2\text{PO}_4$  ) (1) Stock solution 10% (v/v) Triton X-100 ® Using a volumetric pipette, transfer 10 mL of Triton X-100 ® to approximately 80

mL of deionized water, warmed slightly in a glass beaker. Mix Thoroughly using a magnetic stir bar for at least one hour. When cool, transfer to a 100-mL volumetric flask, and dilute to the mark".

- "Stock solution 20% (w/v)  $\text{NH}_4\text{H}_2\text{PO}_4$  : Dissolve 20 g  $\text{NH}_4\text{H}_2\text{PO}_4$  in approximately 75 mL of Deionized water in a glass beaker, dilute to 100 mL in a volumetric flask".
- "Modifier diluent": In a 500-mL flask, pour around 300 mL of deionized water. 1.00 mL, pure  $\text{HNO}_3$  in a Micropipette, gently added and swirled to combine. Dilute to 500 mL with deionized water by adding 25 mL of 10% Stock Triton X-100® and 5 mL of 20% Stock  $\text{NH}_4\text{H}_2\text{PO}_4$  Transfer the modifier diluent to a 500 mL opaque plastic container after proper mixing.

### Preparation of Standard Solution

Using the dilution law, it was taken from a stock of 1000ppm lead, and we extracted the required volume. From ppm, we converted it to ppb and a standard 1=10 ppb standard 2=30ppb standard 3=60 and using a Dilution low obtained (0.1, 0.3, 0.6) ml and completed size the mark Then (100  $\mu\text{L}$  prepared standard solutions +900  $\mu\text{L}$  modifier) and a calibration curve was made. Then we brought the blank (900 $\mu\text{L}$  of modifier+100 $\mu\text{L}$  of deionized water). The samples were prepared by mixing (100 $\mu\text{L}$  of Blood with900 $\mu\text{L}$ of modifier) by Graphite Furnace Atomic Absorb piton Spectrometry (GFAAS) [15, 16].

Table1 Instrument and analytical conditions

AAS	AA-6300withGFAX7i2
Lamp current	10Ma
wave length	238.3nm
Peak	283.30nm
Slit width	0.7
Lamp Mode	BGC-D2
Injection volume	20 $\mu\text{L}$

Analytical statistics IBM® SPSS® (SPSS Inc., IBM Corporation, NY, USA) Statistics Version 25 (2017) for Windows was used to analyze the data. In order to verify the normal distribution of data, the Shapiro-Wilk test was used (Shapiro-wilks, 1965 and Razali and Whai, 2011). Due to the data having normal distribution, parametric statistical tests were applied. Demographic data, gender, and age were described in count and percentages. On the other hand, variables like age were given as average standard error (SE). For qualitative information, description analysis has been done using frequency and percentage. For quantitative parametric data, arithmetic means were used to determine central tendency, whereas standard error was used to determine dispersion. To compare measures of two independent groups using quantitative parametric data, an independent student t-test was performed (patients and control).

The influence of four occupation groups on lead concentration in both control and patient groups was studied using analysis of variance (ANOVA) and Duncan post hoc. All statistical tests were two-tailed, and statistical significance was defined as

a p-value of less than 0.05. Furthermore, odds ratios (OR), standard errors, Wald tests, and p-values of variables predicting higher blood lead levels in teens were estimated using binary logistic regression.

## Results

The overall number of participants was 100. (Average age 13-17 years) The percentages of males and girls were 92 (92%) and 8 (8%), respectively. The BLLs ranged in size from (Less than 100 lead concentration and more or equal to 100 lead concentration). Table 2 lists the basic features of the adolescents and children who participated in the study. Gender, education, marital status, connection with his parents, crime, living, occupation, tattoos, smoking, drinking, drug usage, grain type, tapa, past crimes, history of illnesses, and age are represented in percentages.

Table 2: Main characteristics of the adolescents children included in the study

"Characteristics"		Count	Percentage %
Category variables			
Gender	Male	92	92.0%
	Female	8	8.0%
Education	Leave	34	34.0%
	Student	66	66.0%
Social status	Single	100	100.0%
His relationship with his parents	with his mother	21	21.0%
	with his parents	79	79.0%
Type of crime	Robbery	28	56.0%
	Scrimmage	10	20.0%
	Drug abuse	6	12.0%
	Other Crime	6	12.0%
Living	Urban status	58	58.0%
	Rural status	42	42.0%
Occupation	Not working	54	54.0%
	A builder	22	22.0%
	street hawker	10	10.0%
	Other Occupations	14	14.0%
Tattoo	No	19	38.0%
	Yes	31	62.0%
Smoking	No	53	53.0%
	Yes	47	47.0%
alcohol addiction	No	31	62.0%
	Yes	19	38.0%
Drug abuse	No	46	92.0%
	Yes	4	8.0%
Grain type	Not applicable	46	92.0%
	one-zero	2	4.0%
	Crystal	2	4.0%
Tapa	No	44	88.0%
	Yes	6	12.0%

History crime	No	35	70.0%		
	Yes	15	30.0%		
History diseases	No	30	60.0%		
	Yes	20	40.0%		
Numeric variable					
Variable		Patient Group	Control group	P-value	Sig.
Age	Range	13 – 17	13 – 17	0.37	N.S.
	Mean $\pm$ SE	16.18 $\pm$ 0.15	16.36 $\pm$ 0.13		

Table (3) Distribution of sample characteristics between two levels of lead concentrations (Less than 100 lead concentration and more or equal 100 lead concentrations)

Characteristics		Lead _ Level		Chi-square	P-value	Sig.
		Less than 100 lead conce	more or equal 100 lead conce			
		Count	Count			
Samples	Patients	0	50	100**	0.0001	H.S.
	Control	50	0			
Gender	Male	46	46	0.001	1	N.S.
	Female	4	4			
Education	Leave	0	34	51.52**	0.001	H.S.
	Student	50	16			
His relationship with his parents	with his mother	2	19	17.42**	0.001	H.S.
	with his parents	48	31			
Living	Urban status	18	40	19.87**	0.001	H.S.
	Rural status	32	10			
Occupation	Not working	38	16	23.17**	0.001	H.S.
	A builder	8	14			
	street hawker	0	10			
	Other Occupations	4	10			
Smoking	No	38	15	21.24**	0.001	H.S.
	Yes	12	35			

Note that Sig. = Significant, HS = Highly Significant, NS.= Not Significant and \*\* = significant at

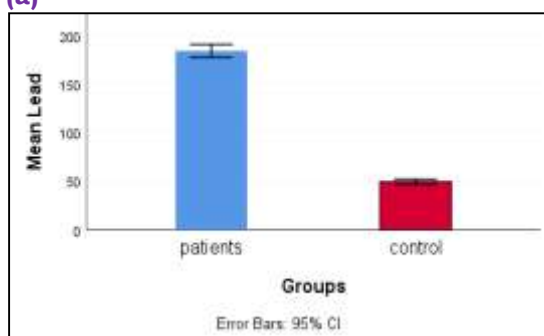
Table 4 shows results of the comparisons comparison between lead of content of samples, gender, education, his relationship with his parents, living and smoking using independent sample t-test. Results showed that, statistical highly significant differences existed in all traits levels of lead content of samples (patients and control), education (leave and education), his relationship with his parents (with his mother and with his father), living (urban and rural stats) and smoking (no and yes smoking) (p-value >0.05) traits gender (male and female) (p-value <0.94).

In general, high mean of lead content was recorded in adolescent children who smoking, live in urban status, leave education and live with mother.

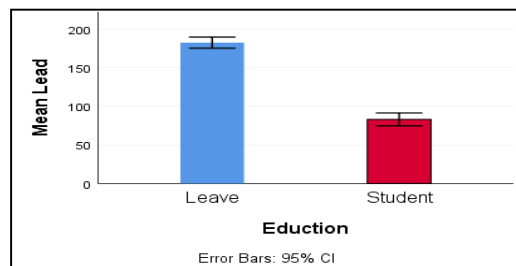
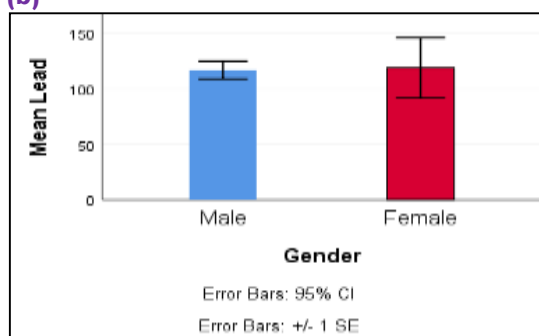
Table(4) : Independent sample t-test to comparison between lead of content of samples, gender education, his relationship with his parents, living and smoking

Characteristics		lead content	t-value	P-value	Sig.
		Mean $\pm$ SE			
Samples	Patients	49.36 $\pm$ 6.61	18.86**	0.001	H.S.
	Control	184.18 $\pm$ 6.61			
Gender	Male	116.60 $\pm$ 8.02	-0.07	0.94	NH.
	Female	118.75 $\pm$ 27.04			
Education	Leave	182.35 $\pm$ 7.20	7.79**	0.001	H.S.
	Student	82.98 $\pm$ 8.36			
His relationship with his parents	with his mother	176.62 $\pm$ 14.89	4.39**	0.001	HS.
	with his parents	100.86 $\pm$ 7.97			
Living	Urban status	142.59 $\pm$ 9.95	4.30**	0.001	H.S.
	Rural status	81.12 $\pm$ 9.65			
Smoking	No	152.51 $\pm$ 10.38	4.87**	0.001	H.S.
	Yes	85.08 $\pm$ 9.20			

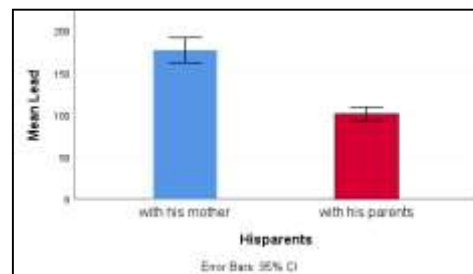
(a)



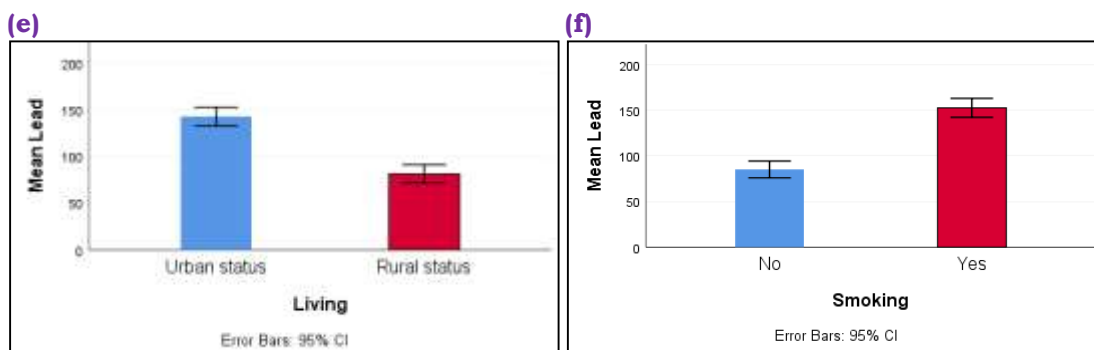
(b)



(c)



(d)



"Figure 1": Simple error bar chart showing the mean of lead-in (a) groups (patients and control), (b) gender (male and female), (c) education (leave and student), (d) His relationship with his parents (with his mother and with his parents), (e) living (urban status and rural status) and (f) smoking (no and yes) group

## Discussion

(P b) Toxicity is indeed a major public health issue in Iraq, and environmental activity is one of the main causes between many children and teens [17]. In Karbala, Iraq, where there is much p-b pollution, we discovered that students have higher BLLs than girls. This result is the same as what other studies in China have discovered about the BLLs of males and females. We found that the BLLs of male and female teenagers were 92% and 8%, respectively [18-19]. Figure (b) shows that boys have more contact with lead-contaminated environments than girls do ( $T = -0.07$ ;  $p > 0.05$  N.S.). This may be because boys act more independently and spend more time outside as they get older. The characteristics of the samples between two levels of lead concentration (less than 100 and more than or equal to 100). These levels are higher than the average BLLs in Karbala, and they are also higher than the levels found in the US [20]. The main things about the teenagers and children in the study Table 2 shows the percentage of people who Education (Leave 34%, Student 66%). As with other studies, the highest BLLs were found in children and teens [21, 22]. In this study, the level of education was inversely related to the BLLs of children and teens, meaning that the more they learned, the lower the BLLs were in their children and teens. This is because the education of children and teens is linked to what they know about lead poisoning, where " $T = 7.79^{**}$ ;  $p < 0.05$  HS". Likewise, other research in China is demonstrated in figure(c). His relationship with his parents (with his mother 21.0% while with his parents 79.0%) The study showed that children and adolescents who live with their parents are less exposed to lead because the child and adolescent are in a healthy family, both parents gather, reduce aggressive behavior, and the presence of the family is one of the ways to prevent crime by reducing exposure to lead, to prevent them from leaving for work at an early age, and thus reduce their exposure to lead in figure (d). were ( $T = 4.39^{**}$ ;  $p < 0.05$  H.S). This study corresponds to a study in the United States [23].

Table 2 shows that adolescents are linked to violent crimes, demonstrated by our study of the existence of crimes in different were percentages, respectively (56.0%, 20.0%, %12.0, 12.0%). These crimes are linked to addictive practices of

adolescents, such as taking drugs for various types of pills, drinking alcohol, tattooing, stripping, and smoking, and their percentages were respectively (8.0%, 38.0%, 62.0%, 12.0%, and 47.0%) In addition, there is some record of previous crimes and was the percentage (30.0%), and the results showed such as smoking were ( $T = 21.24^{**}p < 0.05$  HS). ] as shown in figure(f). Where high lead is linked to smoking because it is harmful to the health of adolescents, this study is consistent with another study in America and Brazil [24-27].( The living environment) showed Urban status 58.0% while Rural status 42.0%, were ( $T = 4.30^{**}p < 0.05$  H.S). Because of the presence of factories in cities and high lead pollution, in the countryside, lead pollution is very low because it is far from factories, car traffic, and polluted lead dust, and this is consistent with studies in China[28] as shown in figure(e). The association of occupations with high blood lead, such as a street hawker, often exposes lead, car movement, polluted gasoline, lead dust, and city congestion. There is a similar study [29-30]. Family history of patients, such as violence and tension transmitted by inheritance to the children and was the percentage (40.0%). There is a similar study[31]. We sought to explore what causes population studies to be done all over the globe, and we already wanted to see if there was a link between those risk factors and what is being done now to protect people's health.

We have found several main risk factors in teenagers who were shot dead in a polluted site in Iraq. You need to use these risk results to enhance public health in these areas so that bad health effects do not happen. For instance, policies should ensure families have a decent way to live and encourage teens to stop dealing with alcohol and live far from factories to cut down on lead pollution.

## References

1. Carrel, M., Zahrieh, D., Young, S. G., Olson, J., Rickman, K. K., Wels, B., & Suflas, A. (2017). High prevalence of elevated blood lead levels in rural and urban Iowa newborns: Spatial patterns and area-level covariates. *PloS One*, 12(5), e0177930.
2. Gabriel, H. A., Tesseræ, D. A., & Amble, A. (2014). Elevated blood lead levels among unskilled construction workers in Jimi, Ethiopia. *Journal of Occupational Medicine and Toxicology*, 9(1), 1-10.
3. Yang, Y., & Rained, A. (2009). Prefrontal structural and functional brain imaging findings in antisocial, violent, and psychopathic individuals: a meta-analysis. *Psychiatry Research: Neuroimaging*, 174(2), 81-88.
4. Olympia, K. P. K., Conclaves, C., Gunther, W. M. R., & Bokhara, E. J. H. (2009). Neurotoxicity and aggressiveness triggered by low-level lead in children: a review. *Revisit Pan Americana de Salud Publican*, 26, 266-275.
5. La-Lave-León, O., Pacheco, J. M. S., Martinez, S. E., Rodríguez, E. E., Juárez, F. X. C., Carrillo, A. S., ... & Substrata, J. D. (2016). The relationship between blood lead levels and occupational exposure in a pregnant population. *BMC Public Health*, 16(1), 1-9
6. Fadrowski, J. J., Navas-Acien, A., Tellez-Plaza, M., Gellar, E., Weaver, V. M., & Furth, S. L. (2010). Blood lead level and kidney function in US adolescents: The Third National Health and Nutrition Examination Survey. *Archives of internal medicine*, 170(1), 75-82.

7. Herrera-Moreno, J. F., Estrada-Gutierrez, G., Wu, H., Bloom Quist, T. R., Rosa, M. J., Just, A. C., & Barcarolle, A. A. (2022). Prenatal lead exposure, telomere length in cord blood, and DNA methylation age in the PROGRESS prenatal cohort. *Environmental Research*, 205, 112577.
8. Carrel, M., Zachariah, D., Young, S. G., Olson, J., Rickman, K. K., Wels, B., & Suflas, A. (2017). High prevalence of elevated blood lead levels in rural and urban Iowa newborns: Spatial patterns and area-level covariates. *PloS One*, 12(5), e0177930.
9. Ago, Z., Cao, J., Yan, J., Wang, J., Cain, S., & Yan, C. (2017). Blood lead levels and risk factors among preschool children in a lead polluted area in Taizhou, China. *Biomed research international*, 2017.
10. Stewart, T. (2021). An Assessment of Risk Factors and Government Policy Intervention on Childhood Lead Poisoning in the United.
11. Castellans, M. J., & Fuentes, A. (2016). The adverse effects of heavy metals with and without noise exposure on the human peripheral and central auditory system: a literature review. *International journal of environmental research and public health*, 13(12), 1223.
12. Handler, P., & Brabander, D. (2012). Increased incidence and altered risk demographics of childhood lead poisoning: predicting the impacts of the CDC's 5 µg/d L reference value in Massachusetts (USA). *International journal of environmental research and public health*, 9(11), 3934-3942.
13. Yan, C. H., Xu, J., & Shen, X. M. (2013). Childhood lead poisoning in China: challenges and opportunities. *Environmental Health Perspectives*, 121(10), A294-A295.
14. Baker, J. A., Ines, H. A., & Maugham, S. A. (2016). Determination of Strontium in Human Teeth and Fingernails of Healthy and Carious Patients Resident in Karbala, Iraq, ICP-OES. *Asian Journal of Chemistry*, 28(10), 2211-2216.
15. P. J. Parsons et al., "Analytical Procedures for Determining Lead in Blood and Urine," *Approv. Guidel. NCCLS Doc. C40-A*, pp. 11898-19087, 2001
16. A. Chua, Modesto, Parrenas, Kieruif, "Derict Determination of Pb in Whoie Blood by Graphite Furnace Atomic absorption Spectrophotometry," SHIMADZU, 2016
17. Krieger, N. (2011). *Epidemiology and the people's health: theory and context*. Oxford University Press.
18. Wong, T. M., Loeber, R., Slotboom, A. M., Bijleveld, C. C., Hipwell, A. E., Stepp, S. D., & Koot, H. M. (2013). Sex and age differences in the risk threshold for delinquency. *Journal of abnormal child psychology*, 41(4), 641-652. <https://doi.org/10.1007/s10802-012-9695-7>
19. Cao, J., Li, M., Wang, Y., Yu, G., & Yan, C. (2014). Environmental lead exposure among preschool children in Shanghai, China: blood lead levels and risk factors. *PloS one*, 9(12), e113297.
20. Levin, R., Brown, M. J., Kashtock, M. E., Jacobs, D. E., Whelan, E. A., Rodman, J., ... & Sinks, T. (2008). Lead exposures in US children, 2008: implications for prevention. *Environmental health perspectives*, 116(10), 1285-1293.
21. Li, M. M., Cao, J., Gao, Z. Y., Shen, X. M., & Yan, C. H. (2015). The trend of lead poisoning rate in Chinese population aged 0-18 years old: a meta-analysis. *BMC Public Health*, 15(1), 1-12.
22. Li, M. M., Cao, J., Xu, J., Cai, S. Z., Shen, X. M., & Yan, C. H. (2014). The

- national trend of blood lead levels among Chinese children aged 0–18 years old, 1990–2012. *Environment international*, 71, 109-117.
23. Henneberger, A. K., Tolan, P. H., Hipwell, A. E., & Keenan, K. (2014). Delinquency in adolescent girls: Using a confluence approach to understand the influences of parents and peers. *Criminal justice and behavior*, 41(11), 1327-1337.
  24. Heron, J., Maughan, B., Dick, D. M., Kendler, K. S., Lewis, G., Macleod, J., ... & Hickman, M. (2013). Conduct problem trajectories and alcohol use and misuse in mid to late adolescence. *Drug and alcohol dependence*, 133(1), 100-107.
  25. Fidalgo, T. M., Sanchez, Z. M., Caetano, S. C., Maia, L. O., Carlini, E. A., & Martins, S. S. (2016). The association of psychiatric symptomatology with alcohol, tobacco, and marijuana use patterns among Brazilian high school students. *The American Journal on Addictions*, 25(5), 416-425.
  26. Cerdá, M., Prins, S. J., Galea, S., Howe, C. J., & Pardini, D. (2016). When psychopathology matters most: identifying sensitive periods when within-person changes in conduct, affective and anxiety problems are associated with male adolescent substance use. *Addiction*, 111(5), 924-935.
  27. Harlaar, N., Spinath, F. M., Dale, P. S., & Plomin, R. (2005). Genetic influences on early word recognition abilities and disabilities: A study of 7-year-old twins. *Journal of Child Psychology and Psychiatry*, 46(4), 373-384.
  28. Pino, P., Walter, T., Oyarzún, M. J., Burden, M. J., & Lozoff, B. (2004). The rapid drop in infant blood lead levels during the transition to unleaded gasoline use in Santiago, Chile. *Archives of Environmental Health: An International Journal*, 59(4), 182-187.
  29. Kennedy, C., Yard, E., Dignam, T., Buchanan, S., Condon, S., Brown, M. J., ... & Breyse, P. (2016). Blood lead levels among children aged < 6 years—Flint, Michigan, 2013–2016. *Morbidity and Mortality Weekly Report*, 65(25), 650-654
  30. Akkus, C., & Ozdenerol, E. (2014). Exploring childhood lead exposure through GIS: a review of the recent literature. *International Journal of Environmental Research and Public Health*, 11(6), 6314-6334.
  31. Voith, L. A., Topitzes, J., & Reynolds, A. J. (2016). Violent victimization among disadvantaged young adults exposed to early family conflict and abuse: A 24-year prospective study of the victimization cycle across gender. *Violence and Victims*, 31(4), 767-784.