

T.R.
GEBZE TECHNICAL UNIVERSITY
GRADUATE SCHOOL

ESSAYS ON HEALTH ECONOMICS

Gökben AYDİLEK

A THESIS OF DOCTORATE
DEPARTMENT OF ECONOMICS

ADVISOR: ASSOC. PROF. HANIFE DENİZ YURTSEVEN

MAY 2024

T.R.
GEBZE TECHNICAL UNIVERSITY
GRADUATE SCHOOL

ESSAYS ON HEALTH ECONOMICS

Gökben AYDİLEK

A THESIS OF DOCTORATE
DEPARTMENT OF ECONOMICS

ADVISOR: ASSOC. PROF. HANIFE DENİZ YURTSEVEN
CO-ADVISOR: PROF. MURAT ANIL MERCAN

MAY 2024

T.C.
GEBZE TEKNİK ÜNİVERSİTESİ
LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

SAĞLIK EKONOMİSİ ÜZERİNE ÇALIŞMALAR

Gökben AYDİLEK

DOKTORA TEZİ
İKTİSAT ANABİLİM DALI

DANIŞMAN: DOÇ. DR. HANİFE DENİZ YURTSEVEN

2. DANIŞMAN: PROF. DR. MURAT ANIL MERCAN

MAYIS 2024



DOCTORATE JURY APPROVAL FORM

A thesis submitted by Gökben Aydılek defended on 29/05/2024 before the jury formed with the 20/05/2024 date and 2024/27 numbered decision of the GTU Graduate Administration Board, has been accepted as a DOCTORATE thesis in the Department of Economics.

JURY

MEMBER

(THESIS ADVISOR) : Assoc. Prof. Hanife Deniz YURTSEVEN

MEMBER : Assoc. Prof. Burcu DÜZGÜN-ÖNCEL

MEMBER : Asst. Prof. Abdullah ALTUN

MEMBER : Assoc. Prof. Tekin KÖSE

MEMBER : Asst. Prof. Pınar PİR

APPROVAL

Gebze Technical University Graduate Administration Board
...../...../..... date and/..... numbered decision.

SIGNATURE/SEAL

*To the Sun,
Thank you for always being there
to brighten our day...*

ABSTRACT

This thesis investigates how health investments across different stages of life shape the individual outcomes and generate disparities in human capital. Building upon the theories of health capital and human capabilities formation, this thesis explores three distinct periods of human life: (i) prenatal, (ii) childhood, and (iii) late adulthood. The first essay examines the impact of prenatal dietary disruptions on human capital formation. It utilises Ramadan observance as a natural experiment to assess the effect of foetal malnutrition on cognitive abilities of individuals measured by educational attainment and labour market outcomes. The results suggest that intrauterine dietary disruptions significantly alter long-term adult outcomes, and men prenatally exposed to Ramadan have lower educational attainment, especially when Ramadan coincides with summer. These findings highlight the crucial link between prenatal investments and human capital differences, emphasising the crucial role of early interventions to enhance the human capital formation. The second essay studies the relationship between maternal mental distress and the physical health of under-five children in Turkey. This study finds that children whose mothers suffer from depression are at a higher risk of infectious disease morbidity compared to children of non-depressed mothers. In addition, results suggest a protective role of maternal education against the detrimental effects of maternal depression. The third essay investigates the impact of age-specific COVID-19 lockdown measures on the chronic health conditions of senior women in Turkey. By employing a difference-in-differences methodology, findings demonstrate that age-specific strict curfews negatively affect the physical health of the elderly, through increased risks of cardiovascular and cardiometabolic diseases and dependence in the activities of daily living. Overall, by examining health investments across different stages, this thesis contributes to a deeper understanding of the importance of early interventions in improving individual outcomes and provides valuable insights for policymakers to address human capital disparities across individuals.

Keywords: Human Capital, Foetal Programming, Maternal Depression, Child Health, COVID-19, Elderly Health

ÖZET

Bu tez, yaşamın farklı aşamalarındaki sağlık yatırımlarının bireysel sonuçları nasıl şekillendirdiğini ve insan sermayesinde eşitsizlikler yarattığını araştırmaktadır. Sağlık sermayesi ve insan yeteneklerinin oluşumu teorilerine dayanan bu tez, insan yaşamının üç farklı dönemini incelemektedir: (i) doğum öncesi, (ii) çocukluk ve (iii) geç yetişkinlik. İlk makale, hamilelik döneminde annenin beslenme bozukluklarının beşerî sermaye oluşumu üzerindeki etkisini araştırmaktadır. Bu çalışmada, fetal malnütrisyonun, bireylerin eğitim düzeyi ve işgücü piyasası sonuçlarıyla ölçülen bilişsel yetenekleri üzerindeki etkisini değerlendirmek için Ramazan ayı oruç tutma davranışı doğal bir deney olarak kullanılmaktadır. Sonuçlar, intrauterin beslenme bozukluklarının uzun vadeli yetişkin beşerî sermaye çıktılarını önemli ölçüde etkilediğini ve doğum öncesi Ramazan'a maruz kalan erkeklerin, özellikle de Ramazan'ın yaza denk geldiği durumlarda, eğitim başarısının daha düşük olduğunu göstermektedir. Bu bulgular, gebelik dönemine yapılan yatırımlar ile beşerî sermaye farklılıkları arasındaki önemli bağlantıyı vurgulayarak, erken müdahalelerin beşerî sermaye oluşumunu artırmadaki kritik rolünü vurgulamaktadır. İkinci makale, Türkiye'de annelerin ruhsal sıkıntıları ile beş yaş altı çocukların fiziksel sağlığı arasındaki ilişkiyi incelemektedir. Bu çalışma, anneleri depresyon deneyimlemekte olan çocukların, depresyon deneyimlemeyen annelerin çocuklarına kıyasla bulaşıcı hastalık morbidite riskinin daha yüksek olduğunu ortaya koymaktadır. Ek olarak, elde edilen sonuçlar anne eğitiminin anne depresyonunun çocuk üzerindeki zararlı etkilerine karşı koruyucu bir rol oynadığını göstermektedir. Üçüncü makale, özellikle 65 yaş üstü yaşlılara uygulanan COVID-19 sokağa çıkma tedbirlerinin Türkiye'deki yaşlı kadınların kronik sağlık koşulları üzerindeki etkisini nedensellik ilişkisi ile araştırmaktadır. Farkların farkı (difference-in-differences) metodolojisi kullanılarak elde edilen bulgular, yaşa özel katı sokağa çıkma yasaklarının, artan kardiyovasküler ve kardiyometabolik hastalık riskleri ve günlük yaşam aktivitelerindeki bağımlılık nedeniyle yaşlıların fiziksel sağlığını olumsuz etkilediğini göstermektedir. Geniş çerçevede bu tez, yaşamın farklı dönemlerindeki sağlık yatırımlarını inceleyerek bireysel sonuçların iyileştirilmesinde erken müdahalelerin öneminin daha iyi anlaşılmasına katkıda bulunmakta ve politika yapıcılara bireyler arasındaki beşerî sermaye eşitsizliklerini ele alma konusunda değerli bilgiler sunmaktadır.

Anahtar Kelimeler: Beşerî Sermaye, Fetal Programlama, Anne Depresyonu, Çocuk Sağlığı, COVID-19, Yaşlı Sağlığı

ACKNOWLEDGEMENTS

It has been a long and arduous journey, filled with many challenges and discoveries. First and foremost, I would like to extend my deepest gratitude to my advisor, Assoc. Prof. Deniz Yurtseven for her invaluable supervision and encouragement throughout my studies. Although our paths only happened to cross in the very last years of my PhD, I am indebted to her for the guidance she has provided, particularly during times that I was totally overwhelmed by and lost in the very minute details of utterly distinct disciplines. Her insightful feedback has been the most instrumental for me to redefine my research question and navigate through the complexities of interdisciplinary work.

I would also like to thank Prof. Murat Anil Mercan, Assoc. Prof. Burcu Düzgün-Öncel, and Asst. Prof. Abdullah Altun for the helpful comments and insights they have provided during my studies.

My deepest appreciation goes to Prof. Reyn van Ewijk for his invaluable guidance and support during the development of 3rd Chapter of my thesis. Studying the effects intrauterine dietary disruptions on human capital formation could not have been possible without his guidance and valuable advice. I am also grateful for the opportunity to visit Johannes Gutenberg University of Mainz and thankful to the entire Department of Economics (especially the Chair of Statistics) for creating such a welcoming and supportive academic environment.

I would like to extend my very special thanks to Prof. Milena Nikolova, the editor of the Journal of Population Economics and the anonymous referees for their insightful comments and suggestions on the manuscript adapted from Chapter 3. Their constructive feedback significantly improved the quality of my research.

I am incredibly grateful to Eda Dilara, my amazing lifelong friend, for her unwavering support and for sharing countless experiences and discoveries with me along the way. I am also thankful to Emre, Pinar, Eren, Nergiz, Berk, Veciye, Ugur, Burçak, Ecem and many others for their friendship during my journey. A special thanks to Leandro P. for his profound impact on my life.

Finally, I would like to express my most sincere gratitude to my family for their countless encouragement, and my heartfelt thanks to Erbil Alp for being there for me. Without their support, completing this thesis would not have been the same.

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT	vi
ÖZET	vii
ACKNOWLEDGEMENTS	viii
TABLE OF CONTENTS	ix
LIST OF SYMBOLS AND ABBREVIATIONS	xi
LIST OF FIGURES	xii
LIST OF TABLES	xiii
1. INTRODUCTION	1
2. THEORY OF HEALTH CAPITAL FORMATION	5
2.1. The Grossman Model: The Human Capital Model of the Demand for Health	5
2.2. The Economics, Technology and Neuroscience of Skill Formation	9
3. THE EFFECT OF PRENATAL EXPOSURE TO RAMADAN ON HUMAN CAPITAL: EVIDENCE FROM TURKEY	13
3.1. Introduction	13
3.2. Background on Ramadan fasting during pregnancy	17
3.3. Literature Review	19
3.4. Data	21
3.5. Methodology	25
3.5.1. Identifying Exposure	25
3.5.1.1. Overlap between Ramadan and Pregnancy	26
3.5.1.2. Duration of Fasting	27
3.5.2. Empirical Framework	29
3.6. Results	31
3.6.1. Main Results	31
3.6.1.1. Effects of Prenatal Exposure to Ramadan on Educational Outcomes	31
3.6.1.2. Effects of Prenatal Exposure to Ramadan on Educational Outcomes	39
3.6.2. Robustness Analyses	42
3.6.2.1. Alternative Exposure Measures	42
3.6.2.2. Restricted Sample	45
3.6.2.3. Multiple Hypothesis Testing Correction	47
3.7. Discussion	50
3.8. Conclusion	51
4. THE FAR-REACHING LOW SPIRITS: MATERNAL DEPRESSION AND PHYSICAL HEALTH OF UNDER-FIVE CHILDREN IN TURKEY	53
4.1. Introduction	53
4.2. Literature Review	56
4.3. Data	58
4.3.1. Measures of Child Health	58
4.3.2. Assessment of Maternal Depression	59
4.3.3. Sociodemographic Variables	61
4.4. Methodology	61

4.5.	Results	62
4.5.1.	Descriptive Statistics Results	62
4.5.2.	LPM Results	66
4.5.2.1.	Maternal Depression and Child Physical Health	66
4.5.2.2.	Does Maternal Education Play a Protective Role?	71
4.5.2.3.	Multiple Hypothesis Testing	72
4.6.	Discussion	72
4.7.	Conclusion	73
5.	DOUBLE LOCKDOWN: UNRAVELLING THE IMPACT OF AGE-TARGETED COVID-19 RESTRICTIONS ON SENIOR WOMEN’S HEALTH	75
5.1.	Introduction	75
5.2.	Background	78
5.3.	Literature Review	80
5.4.	Data and Variables	81
5.4.1.	Data	81
5.4.2.	Variables	81
5.4.2.1.	Health Measures	81
5.4.2.2.	Demographic and Socioeconomic Variables	82
5.5.	Empirical Methodology	83
5.6.	Results	85
5.6.1.	Descriptive Statistics	85
5.6.2.	Trend Analysis	85
5.6.3.	DiD Regression Estimates and Robustness Analyses	91
5.6.3.1.	Baseline Sample	91
5.6.3.2.	Robustness Analyses	95
5.7.	Discussion	106
5.8.	Conclusion	106
6.	CONCLUSION	108
	REFERENCES	111
	BIOGRAPHY	127
	PUBLICATIONS AND PRESENTATIONS FROM THE THESIS	128
	APPENDICES	129
	APPENDIX-A: APPENDIX FOR CHAPTER 3	129
	APPENDIX-B: APPENDIX FOR CHAPTER 5	141

LIST OF SYMBOLS AND ABBREVIATIONS

Turkstat	: Turkish Statistical Institute
TFS	: Turkish Family Structure
THS	: Turkish Health Survey
ARI	: Acute Respiratory Infections
PHQ	: Patient Health Questionnaire
PHQ-8	: Patient Health Questionnaire (8-item)
DiD	: Difference-in-Differences
ITT	: Intention-to-treat
ATE	: Average Treatment Effect
WHO	: World Health Organisation
CDC	: Centres for Disease Control
LMICs	: Low- and Middle-Income Countries
EHIS	: European Health Interview Survey
DSM-IV	: Diagnostic and Statistical Manual of Mental Disorders, 4 th Edition
LPM	: Linear Probability Model
UTI	: Urinary Tract Infection
ADL	: Activities of Daily Living
IADL	: Instrumental Activities of Daily Living

LIST OF FIGURES

	<u>Page</u>
Figure 3.1: Assigning intrauterine Ramadan exposure to individuals born in 1976-1977.	26
Figure 3.2: Provinces and regions map of Turkey.	28
Figure 3.3: The overall effect of prenatal exposure to Ramadan with male interactions.	32
Figure 3.4: The trimester specific effects of prenatal exposure to Ramadan with male interactions.	33
Figure 3.5: Point estimates of trimester specific duration of exposure and the 95% confidence intervals for women and men.	37
Figure 5.1: Parallel trends plot for self-assessed health scores (1 Very Good; 5 Very Bad).	86
Figure 5.2: Parallel trends plot for suffering from a chronic health problem (1 Yes; 0 No).	86
Figure 5.3: Parallel trends plot for suffering from coronary heart disease (1 Yes; 0 No).	87
Figure 5.4: Parallel trends plot for suffering from high blood pressure (1 Yes; 0 No).	87
Figure 5.5: Parallel trends plot for suffering from myocardial infarction (1 Yes; 0 No).	88
Figure 5.6: Parallel trends plot for suffering from Type II diabetes (1 Yes; 0 No).	88
Figure 5.7: Parallel trends plot for suffering from musculoskeletal diseases (1 Yes; 0 No).	89
Figure 5.8: Parallel trends plot for being overweight ^a (1 Yes; 0 No).	89
Figure 5.9: Parallel trends plot for being obese (1 Yes; 0 No).	90
Figure 5.10: Parallel trends plot for dependency in essential and/or instrumental activities of daily living (1 Yes; 0 No).	90

LIST OF TABLES

	<u>Page</u>
Table 3.1: Descriptive statistics of the study sample.	24
Table 3.2: Effects of hours of prenatal Ramadan exposure on educational outcomes by gender.	36
Table 3.3: Effects of hours of prenatal exposure to Ramadan on labour market outcomes.	40
Table 3.4: Effects of hours of prenatal exposure to Ramadan on labour market outcomes by gender.	41
Table 3.5: Effects of prenatal exposure to Ramadan on educational outcomes by gender.	43
Table 3.6: Effects of prenatal exposure to Ramadan on labour market outcomes by gender.	45
Table 3.7: Effects of full-month Ramadan exposure in utero on educational outcomes among males.	46
Table 3.8: Effects of full-month Ramadan exposure in utero on labour market outcomes among males.	47
Table 3.9: Multiple hypothesis testing (Romano-Wolf) for educational outcomes among males.	48
Table 4.1: Baseline characteristics of the THS 2019 study population.	63
Table 4.2: Effect of maternal depression on child general health and anaemia among children between 1 and 5 years old.	65
Table 4.3: Effect of maternal depression on infectious disease morbidity among children between 1 and 5 years old.	67
Table 4.4: Effect of maternal depression on the physical health of children between 1 and 5 years old.	70
Table 4.5: P-values for the effect of maternal depression on the physical health measures of children between 1 and 5 years old. ^a	72
Table 5.1: Descriptive statistics for the study sample by COVID-19.	84
Table 5.2: DiD Regression Results. ^a	92
Table 5.3: DiD Regression Results for the Restricted Sample. ^c	94
Table 5.4: Non-collapsed DiD Results for Self-Assessed Health of Senior Women (Baseline and Restricted Sample).	96
Table 5.5: Non-collapsed DiD Results for Chronic Health Problem Prevalence Among Senior Women (Baseline and Restricted Sample).	97
Table 5.6: Non-collapsed DiD Results for Coronary Heart Disease Prevalence Among Senior Women (Baseline and Restricted Sample).	98
Table 5.7: Non-collapsed DiD Results for High Blood Pressure Prevalence Among Senior Women (Baseline and Restricted Sample).	99
Table 5.8: Non-collapsed DiD Results for Myocardial Infarction Prevalence Among Senior Women (Baseline and Restricted Sample).	100
Table 5.9: Non-collapsed DiD Results for Type II Diabetes Prevalence Among Senior Women (Baseline and Restricted Sample).	101
Table 5.10: Non-collapsed DiD Results for Overweight Status Among Senior Women (Baseline and Restricted Sample).	102

	<u>Page</u>
Table 5.11: Non-collapsed DiD Results for Obesity Prevalence Among Senior Women (Baseline and Restricted Sample).	103
Table 5.12: Non-collapsed DiD Results for Musculoskeletal Disease Prevalence Among Senior Women (Baseline and Restricted Sample).	104
Table 5.13: Non-collapsed DiD Results for Dependence in Basic and/or Instrumental Activities of Daily Living Among Senior Women (Baseline and Restricted Sample).	105

1. INTRODUCTION

“The most valuable of all capital is that invested in human beings; and of that capital the most precious part is the result of the care and influence of the mother.”

Marshall (1890, p. 592)

This thesis comprises three essays investigating the multifaceted nature of individual level discrepancies through a health economics perspective. While each essay offers a comprehensive exploration of its respective subject independently, the concept of “health capital” as outlined in the Grossman Model (Grossman, 1972) and the Human Capabilities Formation Model (Cunha and Heckman, 2007; Heckman, 2007) serves as a unifying theme. Each essay explores a specific stage of life: Chapter 3 examines the prenatal period, analysing the effects of intrauterine dietary disruptions on human capital formation; Chapter 4 focuses on early childhood, investigating the relationship between maternal mental health and the physical health of under-five children; Chapter 5 studies late adulthood, examining the causal impact of age-specific COVID-19 lockdown measures on the physical health of senior women. By examining health investment across these distinct stages, this thesis aims to contribute to a deeper understanding of the impact of health investment on disparities in individual outcomes in various domains.

The theoretical foundation of this empirical thesis is presented in Chapter 2. Following the brief theoretical framework on “health capital formation”, Chapter 3 builds upon ‘Foetal programming’ hypothesis which suggests that what happens in utero has permanent effects on the offspring; in other words, changes in foetal nutrition and endocrine status lead to consequent adjustments in the foetus that result in irreversible transformations in the structure, physiology, and metabolism of the offspring. As a result, individuals are born with different assets of which some are already determined in the utero hence allowing only a rather narrow action set for the individual to compete with the others who have different foetal origins. This essay aims to analyse the effect of prenatal exposure to nutritional disruptions on human capital formation. In order to resolve the endogeneity driven by maternal dietary deficiencies, we use the Islamic holy month of Ramadan – during which observers abstain from eating and drinking

entirely from sunrise to sunset – as a natural experiment to assess the effects of foetal malnourishment on cognition. We treat the educational and labour market outcomes as proxies for individuals’ cognitive abilities. We compare schooling and employment measures of individuals who are prenatally exposed to Ramadan with those who are not by using the 2016 round of the “Turkish Family Structure” (TFS) Survey prepared by the Turkish Statistical Institute (TurkStat). Utilising the Romano-Wolf multiple hypothesis testing correction method, our results indicate that men who are exposed to Ramadan in utero in the first or third trimester complete 0.53 fewer years of schooling and are less likely to obtain middle school, high school, and college degrees while these effects are more robust when Ramadan coincides with summer.

Our research suggests a crucial link between prenatal well-being and human capital variation. Despite Ramadan observance being a form of intermittent fasting during the day, it still exerts a significant negative impact on academic outcomes, especially on males. This highlights the importance of early interventions, such as improved prenatal nutrition, to enhance human capital formation compared to traditional, later policy approaches in education. It is important to emphasise that these findings are applicable not only to the Muslim population but also to the developed and developing countries alike. Nutritional deficiencies, even those arising from common occurrences like morning sickness or skipping meals, can significantly disrupt cognitive development during the critical first and third trimester.

Chapter 4 explores the relationship between the health of pre-schoolers and maternal depression, which is the most prevalent mental health problem worldwide, especially in low- and middle-income countries. It impairs the cognitive, physical, and social abilities of mothers and disturbs effective parenting practices. Therefore, the consequences of mental, physical, and social suffering are not limited to the mother herself but are transmitted to future generations by negatively affecting the child’s health. By using the 2019 round of the “Turkish Health Survey” (THS) dataset prepared by TurkStat, we focus on the general health status, anaemia prevalence, morbidity of acute respiratory infections (ARI) and diarrhoea along with other common short-term childhood illnesses among under-five children. Maternal depression is assessed by the standardised eight-item version of the Patient Health Questionnaire (PHQ-8). We employ a linear probability model to examine the relationship between maternal depression and the physical health of under-five

children. In addition, we investigate the potential protective role of maternal education against the detrimental effects of maternal depression on child health. Since we are simultaneously analysing several outcome measures, in order to avoid any Type I error, we use the Romano-Wolf multiple hypothesis testing method. We find that children whose mothers suffer from mild to severe depression are at a 12 percentage points higher risk of contracting infectious diseases. Similarly, the total number of non-chronic illnesses a child falls victim to increases by one-third if the mother portrays depressive symptoms. In addition, our results suggest that completing at least high school reduces the burdens of maternal depression on children's physical health by 8 percentage points. Considering both the individual and societal burden of infectious disease prevalence, we conclude that the development of worldwide policies and initiatives aimed at decreasing maternal depression as much as increasing maternal education is essential for safeguarding the rights of both women and children, especially in developing countries.

Chapter 5 examine how the age-targeted COVID-19 restrictions affected the chronic health conditions of older individuals in Turkey, currently ranking 11th in total cases worldwide (Worldometers, 2024). Following the first COVID-19 case on March 11, 2020, Turkish government implemented several precautions, and frequently adjusted its policies based on the severity of the pandemic (*e.g.*, lockdowns, social distancing protocols, mask mandates, *etc.*). Given a specific focus on the elderly as the high-risk population, starting from March 21, 2020, seniors above 65 were imposed a strict curfew for a prolonged period. Although all individuals are affected from precautions, seniors are affected more since they face strict stay-at-home restrictions for over a year. This study aims to analyse how those restrictions affected the chronic health conditions of seniors, with a special focus on cardiovascular and cardiometabolical diseases, main factors of mortality (*e.g.*, coronary heart disease, chest pain, diabetes, obesity, *etc.*). We use a difference-in-differences (DiD) method to examine the impact of the pandemic on the physical health of women aged 65 years and older. The available fatality rates among senior citizens due to COVID-19 suggest a substantial gap between men and women (49 and 29 per cent, respectively). Therefore, to mitigate the potential bias driven by selective mortality, we solely focus on elderly females in our analysis. We utilise the 2014, 2016, 2019 and 2022 rounds of the THS. The observations from 2022 dataset are considered to be affected from the pandemic

conditions; the control group includes the individuals between 60 and 64 years old while the treatment group includes the individuals who are over 65. Common trends assumptions are tested for each specification and strength of our results are verified. We find that the age-specific curfew measures affect the physical health of senior women negatively. Our results indicate that strict curfew on the elderly cause an escalation in chronic health problems. Morbidity of coronary heart diseases is significantly higher among the affected women. In addition, they suffer from a significant increase in BMI and physical difficulties in activities of daily living which are substantial risks for mortality. Social distancing reduces the rate of transmission; however, it is evident that these restrictions caused drastic changes in the lifestyle and social behaviours of individuals leading to worsening health conditions among senior female which rises the additional concerns beyond the primary challenges posed by the pandemic.

Lastly, Chapter 6 summarises the main findings of these three essays, provides policy recommendations and discussion along with limitations of the studies and recommendations for potential future studies.

2. THEORY OF HEALTH CAPITAL FORMATION

This chapter briefly investigates the theoretical framework that has built the very foundations of these three empirical studies. First, it reviews the famous Grossman Model (1972) which conceptualises health as a form of a capital and then, redirecting the attention to the early developmental phases instead of adult health, investigates the recent theory of “human capital formation” by Cunha and Heckman (2007) and Heckman (2007).

2.1. The Grossman Model: The Human Capital Model of the Demand for Health

The roots of conceptualising the individual health as a stock capital reaches to earlier political economy discussions. Building upon Becker’s (1962) notion of health as a component of human capital and Mushkin’s (1962) proposition as an investment, Grossman (1972) introduced the now-ubiquitous concept of “health capital” and proposed a then-novel theoretical model to analyse the demand for good health. In this model, an individual is assumed to have a dual role towards health:

First, as a consumer, since health as a consumption good provides direct utility through improved well-being and second, as a producer, since investing in health facilitates further productivity. Therefore, Grossman (1972) posits health as a dual-purpose commodity, functioning both as a consumption and an investment good which naturally depreciates in time due to aging. However, individuals can invest in its maintenance and improvement through various means, including diet, exercise, and medical treatments.

The model assumes that an individual has the following intertemporal utility function:¹

$$U = U(\Phi_0 H_0, \Phi_1 H_1, \dots, \Phi_n H_n, Z_0, Z_n) \quad (2.1)$$

¹ Notations are adapted from Grossman (1972).

where H_0 represents the initial stock of health an individual inherits at birth, H_i denotes the individual's health stock at any given time period i (ranging from 1 to n), Φ_i signifies the service flow, and by operating on the health stock, $\Phi_i H_i$ determines the amount of health services consumed, h_i , and lastly, Z_i represents the total consumption of other goods by the individual in period i . Unlike the classical intertemporal utility functions where an individual's lifespan is predetermined right at the planning stage, this model treats the lifespan as an endogenous variable, meaning that the length of life is influenced by the factors within the model itself. In addition, an individual lives as long as her health stock remains above the minimum threshold (*i.e.* she dies when $H_i = H_{min}$). Consequently, the model aims to identify the optimal levels of health stock across different time periods that maximise an individual's utility.

The net investment in period i represents the net gain or loss in health stock between two consecutive periods. It is calculated as the difference between the gross investment in health during period i (the total resources that an individual dedicates to improving their health such as medical care, gym membership, adopting a healthy diet, *etc.*), referred as I_i , and the depreciation in health stock in period i (a natural decline in health stock due to aging, illness, *etc.*) at an external rate, δ_i :

$$H_{i+1} - H_i = I_i - \delta_i H_i \quad (2.2)$$

The rate of depreciation, δ_i , is assumed to be exogenous, and it depends on age, suggesting that younger individuals might face a slower decline in their health stock compared to the elderly. In this model, by using the following production functions, individuals determine the level of gross investment they would dedicate to health, I_i , and other goods, Z_i :

$$I_i = I_i(M_i, TH_i; E_i) \quad (2.3)$$

$$Z_i = Z_i(X_i, T_i; E_i)$$

where for I_i , the health investment function, M_i represents the resources allocated to medical services and treatments and TH_i captures the time devoted to health-related activities. Similarly, for Z_i , the function of investment in other goods, X_i refers to tangible resources used to produce goods other than health and T_i reflects the time

spent on activities related to other goods. The shared factor, E_i , is crucial for both production functions and it denotes the overall knowledge, skills and abilities of an individual, namely the level of human capital.

Ensuring that the present value of all expenditures on goods (both M_i and X_i) must not exceed the present value of the individual's resources over their lifetime (the total of wage earnings and initial assets), the model defines the individual's budget constraint as follows:

$$\sum \frac{P_i M_i + V_i X_i}{(1+r)^i} = \sum \frac{W_i T W_i}{(1+r)^i} + A_0 \quad (2.4)$$

where the prices for M_i and X_i are denoted with P_i and V_i , respectively; the individual works for a total number of hours referred as $T W_i$ at a wage rate of W_i and has a discounted property income depicted by A_0 . Both the expenditures and resources are discounted at the interest rate, r .

Grossman's model also incorporates a time constraint to account for the limited time an individual has available in each period:

$$T W_i + T L_i + T H_i + T_i = \Omega \quad (2.5)$$

This equation states that the total time available in any period, Ω , must be fully allocated between total working hours, $T W_i$; time lost due to sickness or injury, $T L_i$; time spent on health-related activities, $T H_i$; and time spent on other activities, T_i .

Expressing $T W_i$ from the definition of Ω in Equation (2.5) and plugging it into Equation (2.4) yields the full wealth constraint which is the sum of initial assets and the present value of potential lifetime earnings if the individual dedicated all their available time on working:

$$\sum \frac{P_i M_i + V_i X_i + W_i (T L_i + T H_i + T_i)}{(1+r)^i} = \sum \frac{W_i \Omega_i}{(1+r)^i} + A_0 = R \quad (2.6)$$

Equation (2.6) states that an individual's full wealth is allocated between market goods, non-market activities, and opportunity cost of sickness. With the net investment, the household production functions, and the full wealth constraints represented in Equations (2.2), (2.3) and (2.6), respectively, established, the model aims to find the optimal levels of H_i and Z_i by maximising the individual's utility

function in Equation (2.1). The key assumption that H_0 and δ_i are predetermined means that the crucial factor in determining an individual's health capital (H_i) lies in optimising their gross investment in health (I_i). To solve this optimisation problem in period $i-1$, the model utilises the following first-order conditions:

$$\frac{\pi_{i-1}}{(1+r)^{i-1}} = \frac{W_i G_i}{(1+r)^i} + \frac{(1-\delta_i)W_{i+1}G_{i+1}}{(1+r)^{i+1}} + \dots + \frac{(1-\delta_i)\dots(1-\delta_{n-1})W_n G_n}{(1+r)^n} + \frac{U h_i}{\lambda} G_i + \dots + (1-\delta_i) \dots (1-\delta_{n-1}) \frac{U h_n}{\lambda} G_n \quad (2.7)$$

where π_{i-1} signifies the additional cost associated with making a one-unit increase in health investment in period $i-1$; $U h_i = \frac{\partial U}{\partial h_i}$ measures the additional utility an individual derives from having one more healthy day and λ presents the marginal utility of wealth. $G_i = \frac{\partial h_i}{\partial H_i} = -(\frac{\partial T L_i}{\partial H_i})$ captures the additional number of healthy days one gains from having a higher level of overall health.

Assuming a positive value for gross investment in period i reformulates Equation (2.7) into

$$\frac{\pi_i}{(1+r)^i} = \frac{W_{i+1}G_{i+1}}{(1+r)^{i+1}} + \frac{(1-\delta_{i+1})W_{i+2}G_{i+2}}{(1+r)^{i+2}} + \dots + \frac{(1-\delta_{i+1})\dots(1-\delta_{n-1})W_n G_n}{(1+r)^n} + \frac{U h_{i+1}}{\lambda} G_{i+1} + \dots + (1-\delta_{i+1}) \dots (1-\delta_{n-1}) \frac{U h_n}{\lambda} G_n \quad (2.8)$$

Combining Equations (2.7) and (2.8) generates

$$\frac{\pi_{i-1}}{(1+r)^{i-1}} = \frac{W_i G_i}{(1+r)^i} + \frac{U h_i}{\lambda} G_i + \dots + (1-\delta_i) \frac{\pi_i}{(1+r)^i} \quad (2.9)$$

which can be rearranged as

$$G_i \left[W_i + \left(\frac{U h_i}{\lambda} \right) (1+r)^i \right] = \pi_{i-1} (r - \tilde{\pi}_{i-1} + \delta_i) \quad (2.10)$$

where $\tilde{\pi}_{i-1}$ represents the percentage change in the marginal cost of health investment occurring in the next period i . Equation (2.10) highlights the importance of balancing the benefits of health investment with the associated costs and essentially suggests that one should invest in their health up to the point where the extra benefit they get from being healthier just equals the total cost of maintaining that level of health.

2.2. The Economics, Technology and Neuroscience of Skill Formation

Suggesting that health serves a dual function, acting both as a consumption and investment commodity that naturally diminishes over time, Grossman's (1972) health investment model centres on adult investment strategies where there is a certain trade-off between the time allocation for health-improving behaviours and the associated opportunity costs. Though ground-breaking, the model exhibits a key limitation: it adopts an adult-centric perspective where health capital obtained in childhood as well as adult preferences are treated as exogenous factors.

Including the critical prenatal and early childhood stages into the equation, in the "Skill Formation Model" by Cunha and Heckman (2007), unlike adult health decisions, investments in childhood health involve parental choices with less emphasis on the concept of a child's opportunity cost. The capability formation is regulated by a multi-phase process akin to a production technology, with each phase aligning with a distinct developmental period in a child's life cycle (Heckman, 2007). The model proposes the concept of 'self-productivity' meaning that capabilities acquired during one developmental stage demonstrably enhances the abilities in subsequent phases. In addition, the principle of 'dynamic complementarity' suggests that previously obtained skills improve the marginal return on skill formation investments in the upcoming periods.

Cunha and Heckman (2007) utilise an overlapping generations model with altruistic parents who are willing to invest in their children. Each person lives for $2T$ years with the first half spent as a child and the latter as a parent of a child, themselves, and each family unit is comprised of an adult and their respective child. The number of people alive is constant at every age. With each individual possessing an inherent level of ability denoted by θ_1 , the production function for a child's skill development at age t is:

$$\theta_{t+1} = f_t(h, \theta_t, I_t) \quad (2.11)$$

where h reflects parental traits including level of intelligence, schooling, *etc.*, θ_t represents the skill set for the respective year t , and, from birth to adulthood, the

variable I_t denotes the resources allocated by the parent on the child at each age t (between the ages of 1 and T).

By iteratively applying Equation (2.11) to the skill development function for all preceding years $t, t-1, t-2, \dots, 1$, the child's skill level at time $t+1$ can be written in a form to capture the impact of all past investments:

$$\theta_{t+1} = m_t(h, \theta_1, I_1, I_2, \dots, I_t) \quad (2.12)$$

Self-productivity emerges when the skill production function yields a positive partial derivative with respect to the existing skill stock which translates into the scenario where the skill stock of an abler child becomes even greater in the next period.

$$\frac{\partial f_t(h, \theta_t, I_t)}{\partial \theta_t} > 0 \quad (2.13)$$

Dynamic complementary occurs when the second partial derivative of the skill production function with respect to the existing skill stock and parental investment is positive which implies that a stronger skill foundation in the previous period generates higher returns to investment in the following:

$$\frac{\partial^2 f(h, \theta_t, I_t)}{\partial \theta_t \partial I_t} > 0 \quad (2.14)$$

These two principles together imply the very famous saying: “*Skills beget skills and abilities beget abilities*” (Cunha and Heckman, 2007; Heckman, 2007) and reveal the reasons behind the substantial disparities in return to investments where early interventions yielding significantly greater improvements compared to later attempts during adolescence.

The model is characterised by two discrete stages of childhood where the first covers the time from birth to $T/2$ whereas the latter spans from $T/2$ to T . Therefore, θ_3 denotes the function of adult skill production which is determined by parental traits, endowed skills at birth, childhood stage-specific investments:

$$\theta_3 = m_2(h, \theta_1, I_1, I_2) \quad (2.15)$$

where I_1 and I_2 represent the parental investments made in the first and the second stages of childhood, respectively.

Following the mainstream economics literature which does not distinguish the prenatal and early developmental periods yields:

$$\theta_3 = m_2(h, \theta_1, \gamma I_1 + (1 - \gamma)I_2) \quad (2.16)$$

where the skill multiplier, $\gamma = 1/2$, suggests perfect substitution between periods. In this case, two hypothetical children, Alp and Ben, who are born with equal skills to different parents possessing the very same parental qualities but preferring to invest in opposite periods where Alp receives investment only in the first period and Ben gets only in the latter would have the very same capabilities as adults. This implies the timing of investments has no effect on skill generation, therefore neither stage is critical for adult outcomes.

In stark contrast to the previous scenario, perfect complementarity dictates that later life outcomes are heavily determined by the timing of investments:

$$\theta_3 = m_2(h, \theta_1, \min \{I_1, I_2\}) \quad (2.17)$$

Equation (2.17) implies that neglecting the first stage investment cancels out all the potential benefit that could arise from I_2 and similarly, not sustaining the investment in the second period squanders early gains. This requires a balanced investment in both stages.

To generalise the parental investment function, Cunha and Heckman (2007) use the constant elasticity of substitution:

$$\theta_3 = m_2(h, \theta_1, [\gamma I_1^\Phi + (1 - \gamma)I_2^\Phi]^{\frac{1}{\Phi}}), \text{ for } \Phi \leq 1 \text{ and } 0 \leq \gamma \leq 1 \quad (2.18)$$

Here, the skill amplifier, γ , reflects the effectiveness of first stage investments through the combined impact of the *self-productivity* by adult (parental) skill formation, θ_3 , and the *dynamic-productivity* by the increased returns to investments with higher skills. Whereas Φ quantifies the effectiveness of late interventions compared to early ones and that $\frac{1}{1-\Phi}$ denotes the elasticity of substitution between parental investments across developmental stages.

With $\Phi = 1$, investments in early and late stages become perfect substitutes and therefore, in theory, this allows for recovering from skill deficits accumulated in the first stage through later interventions. However, suppose that investing in the first stage costs £1 while with the interest rate of r , second stage investment costs $\text{£}[1/(1+r)]$. I_1 yields γ unit of human capital in response to £1 of investment and I_2 yields $(1+r)(1-\gamma)$ units in response to $\text{£}(1+r)$. Therefore, the ideal choice depends on whether the return from early investment outweighs the cost advantage of waiting:

$$\frac{\gamma}{1-\gamma} > (1+r) \quad (2.19)$$

With $\Phi = -\infty$, the investments are perfect compliments and thus level of investments should be equal in both phases.

For a general case where $-\infty < \Phi < 1$, the solution for the trade-off between the first and second stage parental investments is as follows:

$$\frac{I_1}{I_2} = \left[\frac{\gamma}{(1-\gamma)(1+r)} \right]^{\frac{1}{1-\Phi}} \quad (2.20)$$

With higher levels of investments in both periods, γ has less of an impact on the ideal shares of investment in early and late stages. However, it becomes more important if there are substantial differences between levels of investment in different periods where a higher value of γ necessitates greater share of I_1 in Equation (2.20).

3. THE EFFECT OF PRENATAL EXPOSURE TO RAMADAN ON HUMAN CAPITAL: EVIDENCE FROM TURKEY

3.1. Introduction

Disparities in children's well-being and cognitive and non-cognitive competencies arise in the initial periods of life and significantly modify adulthood outcomes. Current literature points out the fact that dietary deficiencies in early developmental phases, especially in utero, have the most significant detrimental impact on health as well as schooling and employment outcomes (Almond and Currie, 2011a, 2011b; Almond et al., 2018; Comfort, 2016; Greve et al., 2017; Schultz-Nielsen et al., 2016; Abiona and Ajefu, 2023; Neelsen and Stratmann, 2011; Chen et al., 2020; Bryce et al., 2008; de Rooij et al., 2010). Approximately 200 million children below the age of 5 will not be able to realise their whole capacity in the long run due to nutritional deficiencies (Grantham-McGregor et al., 2007). These findings and the immensity of the affected population emphasise the need to better understand the relationship between early prenatal exposure to shocks and later life outcomes and accordingly draw attention to the necessity of early investments in the prenatal period to improve human capital formation (Almond and Currie, 2011a; Doyle et al., 2009; Heckman, 2007).

Identifying the causal effect of exposure to in-utero shocks, however, is not straightforward. Experiencing prenatal nutritional deficiencies is not random; on the contrary, it carries unobservables such as maternal education, health, income, and so forth. In order to eliminate biased estimates and form a causal relationship between prenatal undernutrition and later life outcomes, the general practice in the literature is to utilise extreme natural experiments such as famines², natural disasters, or pandemics. The results show that early intrauterine exposure to these severe events poses a greater danger of obesity, coronary heart disease, metabolic and cognitive impairments, and unfavourable labour market outcomes (Almond and Currie, 2011b; Schulz, 2010; Scholte et al., 2015; Roseboom et al., 2006). These events capture causality since they are orthogonal to several unobservable factors affecting an

² For a comprehensive review of the relationship between intrauterine exposure to famines and adulthood outcomes, please see Lumey et al. (2011).

individual's health during gestation. Nevertheless, these are unusual circumstances that mainly occurred in the early 20th century.³ Therefore, the obtained findings are not suitable to apply to milder, daily events that affect millions of children, for instance, malnutrition due to prenatal dietary deficiencies to which hundreds of millions of children, particularly from developing nations, have fallen victim (Victora et al., 2008). In addition, since extreme unfortunate events are not in control of human behaviour, it highly limits the extent of policy interventions to curb the intensity of negative outcomes (Schultz-Nielsen et al., 2016).

In this study, we adopt a life-course approach and present new causal evidence on the detrimental effects of intrauterine exposure to nutritional deficiencies on individuals' educational attainment and labour market outcomes. An ongoing and less extreme form of nutritional shock or, from a broader perspective, an array of lifestyle changes that pregnant women face is observing Ramadan, the holiest month of Islam, during which each healthy adult Muslim should fast during daylight hours for around 30 days. We address the endogeneity problem of prenatal malnourishment by treating Ramadan observance as a natural experiment for a milder nutritional shock.⁴ Utilising the 2016 wave of TFS Survey prepared by TurkStat, we compare the educational and labour market outcomes of individuals who are prenatally exposed to Ramadan with those of their contemporaries. We use the intention-to-treat (ITT) approach to assess the impact of in-utero Ramadan exposure on human capital formation. In addition, since we are testing multiple hypotheses simultaneously, in order to prevent Type I errors, we employ the novel Romano-Wolf correction method as a robustness check and report the adjusted p-values (Clarke et al., 2020).

Being highly reviewed in epidemiological literature, recently there is a growing interest in the *foetal origins hypothesis* in the economics literature. Our study contributes to the multiple lines of research within the realms of health and developmental studies.

³ e.g., the 1918 influenza pandemic in the US (Almond, 2006; Almond and Mazumder, 2005); the Greek famine in 1941-42 (Neelsen and Stratmann, 2011); the Dutch hunger winter in 1944-1945 (Schulz, 2010; Brown et al., 2000); the Chinese famine in 1959-1961 (Meng and Qian, 2009).

⁴ Although not specifically obliged to, there is no clear exemption for pregnant women unless they find fasting harmful to themselves or their babies (Hossain et al., 2021). Please, see Section 3.2 for more information on Ramadan culture and literature.

First, to our knowledge, this is the first study to utilise the length of fasting for measuring the effects of intrauterine exposure to Ramadan on academic and labour market outcomes.⁵ Ramadan follows the lunar calendar instead of the widely used Gregorian, shifting 10 to 11 days backward each year. Thus, unlike the Equatorial countries (*e.g.*, Indonesia, Uganda), where daylight hours and temperatures are almost constant throughout the year, the changes in the timing of Ramadan mean that the duration of fasting in Turkey would range between 11 hours to 17.5 hours depending on the date as opposed to 12 hours on the equator. Since even skipping breakfast after overnight fasting causes dramatic changes in expectant mothers (Metzger et al., 1982), simply identifying someone as *exposed* might fail to recognise the importance of the length of nutritional disruptions during pregnancy. On the other hand, employing varying durations of daylight hours for an extended period allows us to capture the potentially detrimental effects of intrauterine dietary disturbances more precisely and improves the applicability of our findings. We address the differences in the length of fasting by using a relative measure of the moderated values of daylight hours for the first time and test the effect of exposure duration on human capital formation.

Second, the gap in the literature does not only arise from the number of studies analysing the relationship between prenatal conditions and human capital being very limited, but also that the existing narrow research mainly targets Muslim immigrants in developed countries and reports adverse outcomes for the exposed groups. Nevertheless, migrants do not represent a random sample and might differ at core levels from the residents in their countries of origin (Borjas, 1987). Thus, the obtained results might not be generalizable to other countries. Therefore, acknowledging the abovementioned critical risk of accelerated starvation among pregnant women, we believe it is crucial to examine if the picture drawn by the limited number of studies can apply in a developing Muslim country like Turkey– with 99 percent of Muslim citizens (CIA, 2022).⁶

⁵ Ramadan fasting starts with the morning prayer (*fajr*) and ends with the sunset. Depending on the date, *fajr* begins around 2 hours before sunrise. However, the contribution of our methodology does not arise from employing the duration of fasting. For more information, please see Section 3.5.1.2.

⁶ A survey conducted by a private research company presents that in 2017, 76% of people fasted during Ramadan in Turkey (KONDA, 2017). This rate was measured as 77% in 2012 and 2014, suggesting a relatively steady approach towards fasting. The share of fasting women is 8% higher than men. The percentages differ by 15 points between people with less than a high school and university degree.

Our findings suggest a high sensitivity of educational and labour market outcomes of individuals to prenatal conditions, and it is particularly gender-specific. Concerning the academic outcomes, similar to the previous literature, we find that intrauterine Ramadan exposure has more pronounced adverse effects when it overlaps with the first or third trimester. Men who are exposed to Ramadan in utero in the first or third trimester complete 0.53 fewer years of schooling and are less likely to obtain middle school, high school, and college degrees, while no evidence is present among females. This finding might be attributable to the differences between boys and girls in terms of their level of vulnerability to intrauterine shocks, as earlier literature states that boys are more easily and severely affected than girls by negative prenatal conditions (Eriksson et al., 2010; Di Renzo et al., 2007; Wang et al., 2023). Regarding the labour market outcomes, our results suggest an unexpected positive effect such that males who experienced Ramadan in utero in the second trimester are more likely to have a regular income, and those experiencing it in the third trimester are less likely to work at a precarious position. We suggest the social and governmental support mechanisms targeting individuals with disabilities as a possible explanation behind these findings, which we elaborate further while discussing the results.

Contrary to our estimates, by studying the impact of in-utero Ramadan exposure on the academic performances of 9th-grade Muslim immigrant students in Denmark, Greve et al. (2017) report negative effects of exposure only for females. These opposite findings might result from a potential selection bias among migrants, since they might not be a perfect representative of the population, and/or the seasonality caused by using the 1985-1995 birth cohorts. As Ramadan's adherence to the lunar calendar leads to an annual shift of 10 to 11 days backward, this timing change introduces seasonality problems into the analysis. It takes around 33 years for Ramadan to occur on the same date once again. This suggests that one needs to have at least 33 years of variation in Ramadan exposure to eliminate the biases in estimates caused by seasonal dietary, sunlight, and/or temperature differences. Since we have a broad sample of individuals between the ages of 33 and 97, following a similar approach to both van Ewijk (2011) and Almond and Mazumder (2011)⁷, we can separate the effect of Ramadan from

⁷ In their pioneering study, in addition to assessing the perinatal health differences among Muslim migrants in Michigan, Almond and Mazumder (2011) use Ugandan and Iraqi data with only the information on month and year of birth to examine whether there is a negative effect of intrauterine exposure to Ramadan on adult outcomes. They find no significant effects on schooling in Uganda. At

seasonality and provide healthier results. On the grounds that the season of birth significantly affects educational outcomes (Verachtert et al., 2010), it is imperative not to confuse the effect of Ramadan with that of the seasons of birth.

The rest of the paper is organised as follows: Section 2 summarises background information on Ramadan observance, Section 3 presents a brief literature review, Section 4 describes the data, Section 5 defines the methodology, Section 6 showcases the results and conducts robustness analysis, Section 7 discusses the findings and potential policy implications, and Section 8 concludes.

3.2. Background on Ramadan fasting during pregnancy

During Ramadan, the holy month of Islam, healthy adult Muslims must fast from dawn to dusk. Starting from sunrise, adult Muslims should abstain from certain activities, including eating, drinking, smoking, and sexual intimacy, until sunset; after that, they can break fasting together with their families and enjoy traditional foods and sweets. Though fasting is mandatory for healthy adult Muslims, people traveling, elderly or sick, and women on their periods are excused. In addition, pregnant or breastfeeding women can also be freed from the immediate obligatoriness of fasting if fasting is harmful to them or their babies. However, they have to make up for these days as soon as the health of theirs or their offspring allows before the next Ramadan (Rashed, 1992), or they have to make compensation for not fasting in terms of money or feed a disadvantaged person for each missed Ramadan day (Quran, Surah Al-Baqarah 2:184-185, n.d.).

Since the exemption for pregnant women is not clearly stated, many Muslim women continue to fast during pregnancy despite its potentially harmful consequences (Seckin et al., 2014; Safari et al., 2019). The very vague expression regarding the exemption of expecting mothers from fasting makes some Muslims think that it is imperative to fast during pregnancy (van Ewijk, 2011). Also, some pregnant women keep their fast

the same time, they note that, due to the limited number of birth cohorts (20 years of data), the Iraqi data is confounded by seasonality at a level that they could not conduct adequate analysis. While using the ITT methodology, it becomes crucial to have the exact date of birth of the respondents rather than only the month and year information to identify the exposure better. Since Ramadan lasts only one month, which is a relatively brief period compared to nine months of pregnancy, capturing the exposure more correctly might be crucial to reducing the noise in the analysis. Our dataset provides information for the respondents' exact dates of birth and allows us to have more accurate estimates of exposure.

on the grounds that they do not think of pregnancy as an illness to free them from the obligation; they think fasting is not harmful to a healthy woman or the foetus (Lou and Hammoud, 2016; Mubeen et al., 2012). Another motivating factor for Muslim pregnant women is that they find fasting spiritually relieving, while not fasting is spiritually disturbing for them (Robinson and Raisler, 2005). This emphasises the crucial role of religious judgments on health-associated routines (Padela et al., 2018). In addition, some women are concerned about the adverse consequences of observing the missed days right after delivery, *i.e.*, during lactation, since they believe fasting might decrease their breastmilk (Ertem et al., 2001). Further, the fact that Ramadan is traditionally observed with family and friends, although exempt, since they must compensate for the missed days later on, pregnant women might find it challenging to make up for those days alone afterward (Seiermann et al., 2021). Moreover, they might want to avoid paying compensation. Thus, if they find fasting not so hard during pregnancy, they might opt to observe it during Ramadan.

On the other hand, the most important reasons for expectant mothers to refrain from fasting are their fear of harming the foetus and/or themselves, feelings of weakness, lack of nutrition, not being able to carry out daily activities, dizziness, nausea, and hunger and/or thirst (Mubeen et al., 2012; Joosop et al., 2004; Awwad et al., 2012).

A recent qualitative medical study conducted in the western region of Turkey, interviewed 17 pregnant women in detail to analyse their thoughts and practices regarding Ramadan observance (Uludağ and Göral Türkcü, 2022). In this sample of 17 women, eight continued fasting during pregnancy. The ages of the respondents range from 19 to 30 years old. The education or socioeconomic status of those women does not seem to help explain their preferences for fasting decisions since the shares of high school and university graduate pregnant women are close to each other. They report similar motives listed above for the expectant mothers' decision to fast: believing that they are obliged to fast, fearing the necessity of compensating for the missed days alone afterward, feeling spiritual relief, considering it healthy and safe, and abiding by social pressure. The study discloses that women feel discomfort, feelings of embarrassment, and disrespect if they eat anything while the rest of the family is observing Ramadan. This social aspect is more prominent among women living in an extended family structure with parents, parents-in-law, or grandparents.

Considering the present-day approaches of pregnant women to fasting, the results suggest a strong resistance of religious beliefs both to time and medical knowledge.

Although in some studies there is a very slight decrease with the increased level of maternal education, the rate of pregnant women observing Ramadan is calculated between 60 to 90 percent among Muslims around the world.⁸ Though there are quite a few high-quality medical studies conducted in Turkey during Ramadan to monitor the differences in foetal development between fasting and non-fasting pregnant women, there is no data to suggest a percentage of fasting among expectant mothers. However, the High Council of Religious Affairs, which is the responsible government body for expressing opinions, answering religious questions, and informing the public about the practices of Islam in Turkey, approaches the subject in the same vague manner by suggesting pregnant women not fast if they fear of harm to themselves or their babies, and fast if both themselves and their babies are not at risk.⁹ Therefore, there is no particular reason to assume that the percentage of fasting during pregnancy will be dissimilar to other countries.¹⁰

3.3. Literature Review

The previous approach to adult degenerative diseases, suggesting only the genes and the living conditions of a person were responsible for the later life outcomes of individuals, was shaken to its foundations by the ground-breaking studies by Stein et al. (1972, 1975). The authors find that in-utero exposure to Dutch Famine results in negative adult health outcomes. Later, Barker (1990) proposes that *‘the womb may be more important than the home’*. He includes foetal life into the equation for the limitations of human capabilities and supports the ‘Foetal origins hypothesis’ which suggests that what happens in utero has permanent effects on the offspring. In this new model, changes in foetal nutrition and endocrine status lead to consequent adjustments in the foetus, resulting in irreversible transformations in the offspring’s structure,

⁸ 87.5% in Pakistan (Mubeen et al., 2012), 87% in Singapore (Joosop et al., 2004), 90.3% in Yemen (Makki, 2002), and 71% in Iran (Arab and Nasrollahi, 2001), where the fasting rate decreases from 78% in the first trimester to 64% in the third.

⁹ For further information, please, see: <https://kurul.diyenet.gov.tr/Cevap-Ara/548/kadinlar-gebelik-donemlerinde-oruc-tutabilirler-mi->

¹⁰ In addition to maternal fasting, even if we suppose that a pregnant woman opts for not fasting during Ramadan, her sleep patterns and nutritional intake get disrupted, which might, in return, affect the offspring negatively.

physiology, and metabolism (Barker, 1998). In other words, during pregnancy, while the foetus goes through ‘critical’ developmental phases, unfavourable in-utero conditions occurring at any of these stages might generate major negative effects on the health of the offspring and might alter several later life outcomes (Godfrey and Barker, 2001; Lumey et al., 2011; Brown et al., 2000). In short, ‘foetal programming’ suggests that smoking, stress, caffeine or alcohol consumption, or nutritional shocks such as famines or, at a less extreme level, inefficient maternal diet during pregnancy might put the child into a vulnerable position by hindering healthy foetal development which leads to detrimental consequences (Abu-Saad and Fraser, 2010; Rush, 2001; G. Wu et al., 2012).

Metzger et al. (1982) observe certain biomarkers¹¹ of 21 pregnant and 27 non-pregnant women in the morning after a 12-hour nightlong fast and at noon – 6 hours after the first test (they assess the 18-hour fast results). The authors report that the initial glucose levels of pregnant women are already lower than those of non-pregnant women and that while the biomarkers of non-pregnant women remained stable from morning to noon, pregnant women experienced *accelerated starvation*; in other words, their blood measures substantially deviated when fasting was prolonged for six more hours.

Every year, 60 to 90 percent of Muslim pregnant women practice fasting, 29 million Muslim babies get exposed to Ramadan prenatally, and currently, 1.2 billion Muslim population experienced it to some extent in utero (Majid et al., 2019; Karimi and Basu, 2018; Almond et al., 2018). However, despite the immensity of the affected population, though growing, the interest in the literature on Ramadan fasting is still scarce. Further, a larger part of the literature concentrates on differences in the health of exposed and non-exposed individuals either during childhood or adulthood and report worsened health among older people, higher rates of disabilities in adults, and lower birthweight and decreased growth in children (van Ewijk, 2011; Almond and Mazumder, 2011; Pradella and van Ewijk, 2018; Karimi and Basu, 2018; Karimi et al., 2021).

Studying the effects of maternal fasting on human capital outcomes, Almond et al. (2015) tests the effect of prenatal exposure to Ramadan on the academic achievement of 7-year-old immigrant children of Pakistani and Bangladeshi origins living in the

¹¹ These biomarkers include: Glucose, insulin, β -hydroxybutyrate, alanine, free fatty acids (FFA), and glucagon.

UK. They also use a control group of immigrant students from Caribbean in a difference-in-differences setup. Their findings suggest that the children who are prenatally exposed to Ramadan score substantially lower in math, reading, and writing tests. Similarly, Greve et al. (2017) checks for differences in academic performances of 9th grade students in Denmark who are prenatally exposed to Ramadan. They use the 1985-1995 birth cohort which brings the effect of seasonality into the analysis. In order to overcome this, they compare the Muslim students with those of non-Muslims who migrated from the countries in Asia. They find negative effect on female academic performance while the effect is more mixed and less robust for males. Their analysis also suggests that the predicted negative relationship between Ramadan exposure and academic performance is greater among children from low-income families. In addition, Schultz-Nielsen et al. (2016) analyses the labour market outcomes of Muslim males in Denmark who are exposed to Ramadan in utero and reported poor results among the exposed group.

One exception in the current Ramadan literature on human capital formation in a developing country context is Indonesia. Majid (2015) and Majid et al. (2019) consider the impact of intrauterine Ramadan exposure on children's test scores and adult labour market outcomes. Their findings present lower academic performances and working hours among the exposed individuals. However, as an equatorial country, fasting duration and temperature do not vary throughout the year in Indonesia unlike Turkey where the duration of fasting ranges between 11.5 hours to 17 hours.

3.4. Data

We use data from the TurkStat questionnaire of the TFS Survey in 2016, which includes 17,239 households with 35,475 individuals aged 15 and over. The survey provides information on the individuals' value judgments about 'the lifestyles of the family and individuals' according to variables such as gender, age, education status, employment status, family structure, income group of the household, and other characteristics in individual and household level provided in 12 regions. People who

did not report their exact birthdates are excluded from the analysis, which reduced the sample to 31,829 observations with people between the ages of 15 and 102.¹²

Our primary interest is to analyse the effect of prenatal exposure to Ramadan on the educational attainment and labour market outcomes of people in Turkey. We use six separate measures for schooling: illiteracy, not having any formal education, years of schooling, middle school, high school, and college completion. We also evaluate the following labour market outcomes: employment, earnings, having a regular income, and precarious employment.

Independent from their ages, we eliminate the individuals who continue their education. In addition, we control for the change in the education policy that would have resulted in significant biases in our estimates. In 1996, the Ministry of National Education of Turkey (MoNE) implemented a new law on compulsory schooling, which went into action in 1997 and obligated people who were in the fourth grade or lower in 1996 to complete eight years of schooling. The group of people who are affected most by the change in the law was born after January 1987. However, since there was no strictly implemented law on the school starting age in Turkey at that time, there were also people who started primary school one or two years later than their peers, or there were those who had to repeat grades before the change in the law. Therefore, in order to eliminate any effect of the change in the compulsory schooling law on the level of education that the people in our sample obtained, we limit our analysis to those older than 32 years of age at the time of the interview. In the remaining sample with complete birthdate information, there is some obvious heaping in specific dates of birth, among which January 1st consists of around 20.4 percent.¹³ Since the frequency of January 1st birthdates is excessively high, we exclude them from the sample entirely for the health of the analysis.¹⁴

¹² Individuals whose exact birthdate is unavailable are, on average, two years older, less likely to speak Turkish as their mother tongue, and more likely to grow up in a rural area compared to the remaining sample with complete birthdate information. Their educational and labour market outcomes are significantly worse than those of the latter group, whose exact date of birth is available. We should note that the latter group also includes those whose birthdates are reported as January 1st.

¹³ July 1st and 15th consist of 2.1 and 2.3 percent, respectively. 1st of February, March, April, and May consist of more than 1 percent of the sample with people above 32 years of age. The aforementioned birthdates are categorised into three groups based on their frequencies. Further dropping the individuals with the heaping frequencies of birth information does not change our results.

¹⁴ Individuals with the January 1st birthday are, on average, five years older, less likely to speak Turkish as their mother tongue, and more likely to grow up in a rural area compared to the remaining sample who are born on any other day. They complete three fewer years of schooling on average and,

Table 3.1 presents the descriptive statistics of the variables used in our analysis for the pooled sample and then for females and males separately. Note that for schooling outcomes, we focus on those older than 32 years old. However, since labour market trends change substantially after retirement, we restrict our sample to individuals in the working-age group, between 33 and 65 years old. The age cut-off being the sole difference, the demographics in both groups are quite similar other than the mean age, which is 50 in the first group and 46 in the second.¹⁵ The share of females and males is equal. Around 40 percent of our sample grew up in rural areas; other than a small group growing up abroad, the rest lived in urban or suburban areas till mid-adolescence.

accordingly, are less likely to achieve higher levels of education. In addition, they are at a disadvantageous position in the labour market compared to the rest of the sample, whose birthdate is not reported as January 1st. Individuals born on any other day are more likely to participate in the labour force, have higher earnings, obtain regular income, and hold a non-precarious job.

¹⁵ See Appendix Table A3.1 for the summary statistics for the age-restricted group.

Table 3.1: Descriptive statistics of the study sample.

Variables	All			Female			Male		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
<i>Demographics</i>									
Male	0.500	0.500	16893						
Age	50.089	12.732	16893	50.114	13.013	8446	50.063	12.445	8447
Area lived in till age 15:									
Urban	0.305	0.460	14963	0.306	0.461	7828	0.304	0.460	7135
Suburban	0.260	0.439	14963	0.259	0.438	7828	0.262	0.439	7135
Rural	0.412	0.492	14963	0.408	0.491	7828	0.418	0.493	7135
Abroad	0.023	0.148	14963	0.028	0.164	7828	0.017	0.129	7135
Region of residence:									
TR1: Istanbul	0.126	0.331	16893	0.126	0.331	8446	0.126	0.332	8447
TR2: Western Marmara	0.096	0.295	16893	0.098	0.298	8446	0.094	0.292	8447
TR3: Aegean	0.179	0.383	16893	0.178	0.382	8446	0.180	0.384	8447
TR4: Eastern Marmara	0.103	0.304	16893	0.103	0.304	8446	0.104	0.305	8447
TR5: Western Anatolia	0.143	0.350	16893	0.145	0.352	8446	0.140	0.347	8447
TR6: Mediterranean	0.099	0.298	16893	0.101	0.301	8446	0.097	0.296	8447
TR7: Central Anatolia	0.059	0.235	16893	0.055	0.229	8446	0.062	0.241	8447
TR8: Western Black Sea	0.060	0.237	16893	0.059	0.236	8446	0.060	0.238	8447
TR9: Eastern Black Sea	0.046	0.210	16893	0.047	0.212	8446	0.046	0.209	8447
TRA: Northeastern A.	0.046	0.210	16893	0.047	0.212	8446	0.046	0.209	8447
TRB: Mid. Eastern A.	0.020	0.141	16893	0.021	0.142	8446	0.020	0.140	8447
TRC: Southeastern A.	0.033	0.179	16893	0.033	0.177	8446	0.034	0.180	8447
<i>Educational outcomes</i>									
Illiterate	0.080	0.271	16893	0.138	0.345	8446	0.022	0.146	8447
No education	0.123	0.329	16893	0.196	0.397	8446	0.050	0.218	8447
Years of schooling	7.596	4.976	16893	6.564	4.990	8446	8.627	4.743	8447
Middle school completion	0.430	0.495	16893	0.340	0.474	8446	0.521	0.500	8447
High school completion	0.326	0.469	16893	0.262	0.440	8446	0.389	0.488	8447
College completion	0.163	0.369	16893	0.127	0.333	8446	0.199	0.400	8447
<i>Labour market outcomes</i>									
Labour force participation	0.512	0.500	12911	0.297	0.457	6755	0.747	0.435	6156
Log income	7.580	0.724	6206	7.340	0.899	1631	7.665	0.630	4575
Having regular income	0.630	0.483	6604	0.623	0.485	2004	0.632	0.482	4600
Precarious employment	0.106	0.307	6604	0.098	0.297	2004	0.109	0.312	4600

Data source: 2016 Turkish Family Structure Survey.

On average 8 percent of individuals in our sample are illiterate with a substantial difference between women and men, 14 and 2 percent, respectively. The gender

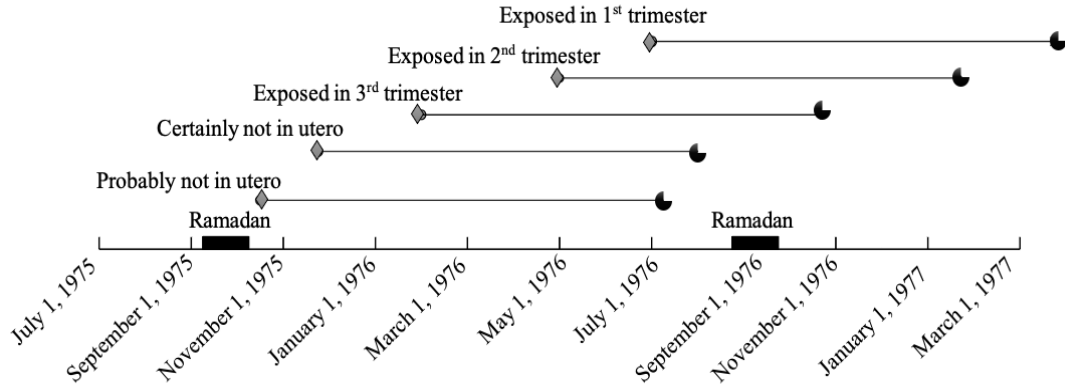
discrepancy remains in the uneducated group, constituting 12 percent of the whole group. Overall, the mean years of schooling is calculated as 7.6 years, with men obtaining two more years of education than women. Favouring the males, gender disparities persist regarding middle school, high school, and college completion rates, with mean percentage values of 43, 33, and 16, respectively, in the pooled sample. For the labour market outcomes, employment and income statistics vary between women and men, while having a regular income or working at a precarious job is similar. Observing the differences, we also run separate regressions for each group.

3.5. Methodology

3.5.1. Identifying Exposure

For determining prenatal exposure to Ramadan, the method used by van Ewijk (2011) is followed. The average duration of a human pregnancy is 266 days from conception; therefore, by calculating backward from the date of birth, we check whether the pregnancy overlapped with the corresponding Ramadan between 1913 and 1984.

Due to the nature of the timing of Ramadan, which shifts backward 10 or 11 days each year depending on the moon cycle, the base group of comparison is the ones conceived during a relatively brief period, which is approximately 60 days every Islamic year. Nevertheless, some pregnancies are longer than 266 days, so those who stayed longer in utero would be misclassified as not exposed while they instead were. In order to prevent the noise caused by this misclassification, we create a separate category for that group by setting a 3-week margin since pregnancies extending three weeks past their expected term are uncommon (Kieler et al., 1995). This category covers everyone whose mother's pregnancy lasted longer, and it also separates those conceived right after Ramadan since there might be differences between them and the others.



Note: Pies denote birth dates and, assuming the 266-day pregnancy length, diamonds mark the estimated days of conception. Accordingly, someone born in the first week of July 1976 was probably not in utero during the previous year's Ramadan, which started on August 28, 1975. However, if the person was born post-term, *i.e.*, if the pregnancy lasted longer than average, then she would have been misclassified as not exposed while, in reality, she was. On the other hand, someone who was born in August 1976 was undoubtedly not in utero during Ramadan; therefore, she belongs to the control group.

Figure 3.1: Assigning in-utero Ramadan exposure to individuals born in 1976-1977.

We generate two types of exposure variables:

3.5.1.1. Overlap between Ramadan and Pregnancy

For each person in our remaining sample, we create five binary variables to capture the overlap between the gestational periods and Ramadan. The first measure is a dummy variable for being certainly in utero, while the other three measures determine the trimester-specific exposure. The first trimester denotes the days of 1-89 in utero (266 - 177 days before birth), the second trimester represents the days of 90-178 in utero (176 - 88 days before birth), and the third trimester describes the days of 179-266 in utero (87 - 0 days before birth). Lastly, the fifth category is for those with a 3-week margin to reduce the noise caused by potential post-term births and post-Ramadan conception. It is worth pointing out that premature deliveries cannot be miscategorised as not exposed but can only be miscategorised as exposed since we assume the entire length of pregnancy is 266 days (Figure 3.1). Limited research has been conducted concerning the impact of maternal fasting during Ramadan on the length of gestation. By utilising data on pregnancy duration, Almond and Mazumder (2011) report a minor reduction in gestation length by roughly a day due to maternal fasting observance, while Karimi (2018) finds no particular evidence regarding the influence of Ramadan exposure on gestation duration.

3.5.1.2. Duration of Fasting

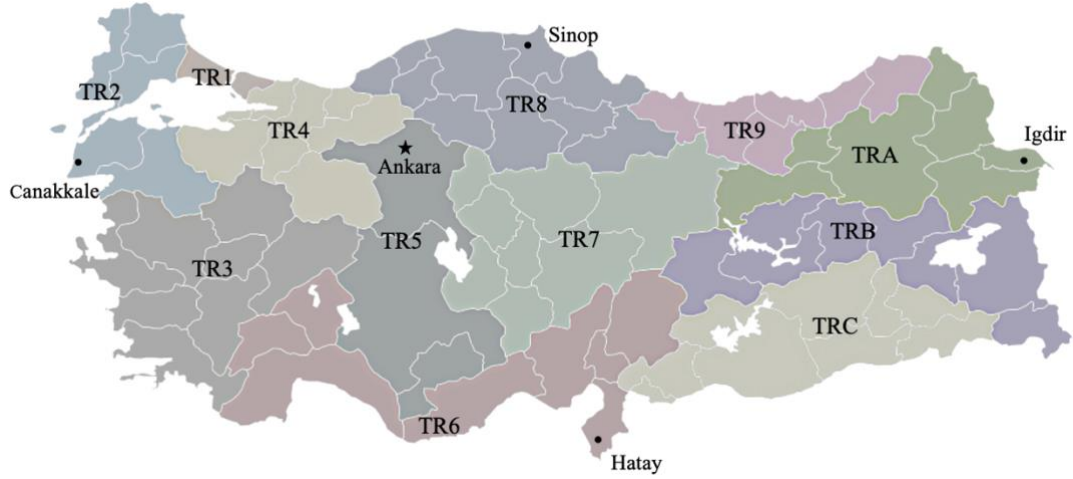
The duration of fasting changes depending on the hours of daylight, and in Turkey, it varies between 11 to 17.5 hours, depending on the season. As pregnant women suffer from *accelerated starvation* even after skipping breakfast, measuring prenatal exposure only based on the overlap between Ramadan and trimesters might not fully observe the effects of fasting at differing lengths. Therefore, we create an exposure variable based on the duration of fasting.

In order to account for the changes in the duration of fasting, previous studies use daylight hours rather than the actual duration of fasting while assessing the effect of exposure on health outcomes. However, fasting begins with the morning prayer (*fajr*) and, depending on the date, *fajr* might start up to 2 hours before sunrise.¹⁶ Nevertheless, the enhancement in our methodology does not stem from using the actual duration of fasting instead of daylight hours. Earlier literature addresses the changes in the duration of nutritional disruptions with an hours-of-exposure measure by summing up the daylight hours of all days overlapping with Ramadan during pregnancy (Almond and Mazumder, 2011; Karimi and Basu, 2018; Karimi et al., 2021). While employing the cumulative hours of exposure for each trimester is practical for interpretation, this approach could potentially yield inaccurate conclusions since it considers the exposure of Person A, who encounters Ramadan during the first trimester for a span of 20 days, with an average fasting period of 9 hours (resulting in a cumulative exposure of 180 hours) as equivalent to that of Person B who also undergoes Ramadan in the first trimester but for 10 days, during which the fasting period averages 18 hours (equating to 180 hours of exposure). This implies that in utero experience of fasting for 9 hours across 20 days holds the same implications as fasting for 18 hours across 10 days in terms of potential adverse effects.¹⁷ As

¹⁶ We should note that our approach yields equivalent results to the approach employing hours of daylight for fasting duration.

¹⁷ Differing from Karimi et al. (2021) and Karimi and Basu (2018), Almond and Mazumder (2011) employ a relative measure for exposure to analyse the differences in perinatal health outcomes among Muslim migrants in Michigan by proxying the hours of daylight for exposure. Then, by treating each day of the year as a candidate for a Ramadan day, the authors sum up the hours of daylight in the next 30 days overlapping with Ramadan and divide the total to the maximum hours of daylight in any 30 days in that area. Later, they assign those values to the beginning of each month during pregnancy. By doing so, instead of capturing the effect of the duration of daily fast, they capture the effect of fasting on average, which, according to their approach, would differ for two individuals even when they get exposed to the same Ramadan but have a one-week difference between the beginnings of their relevant gestational month.

accelerated starvation occurs a lot quicker in pregnant women, totalling the hours of fasting would be misleading in estimating the effect of the duration of nutritional disruptions.



Note: Adapted from ‘Vector version of NUTS Map of Turkey’ (Lasunncty, 2018).

Figure 3.2: Provinces and regions map of Turkey.

The timing of fasting is calculated based on the astronomical position of the Sun in the sky, thus it changes between longitudes. The solar elevation angle used for determining the astronomical twilight ranges between -15° and -20° across countries (Herdiwijaya, 2020). Turkey has adopted the -18° angle for the calculation of dawn.¹⁸ Considering its geographical coordinates, there is around a 70-minute difference at the beginning and end time of fasting (which depends on the longitude) between the easternmost city, Iğdir, and the westernmost city, Canakkale. In contrast, the duration of fasting (which depends on the latitude) is 25 minutes shorter or 55 minutes longer in the northernmost city, Sinop, than in the southernmost city, Hatay, depending on the season. In addition, the duration of fasting, conditional on the time of the year, increases or decreases in the same city by 30 minutes on average from the first day of Ramadan to the last day. However, our dataset does not provide individuals’ place of birth information. Therefore, also taking the population density into account, we choose Ankara as the weighted centre of Turkey to base our exposure variable for the length of fasting (Figure 3.2). Since the duration either increases or decreases for half an hour from the beginning to the end of Ramadan, we use the length of fasting on the 15th day of the

¹⁸ For further information, please see: <https://fazilettakvimi.com/sual-ve-cevaplar/13/>

relevant Ramadan days as the average duration of fasting. Then, instead of summing up the total hours of fasting, we create an exposed hours measure by dividing the length of fasting on the 15th day by the maximum hours of fasting a day in that year and assign that calculated percentage on trimesters overlapping with Ramadan. Having a value of 1 as the relative measure of exposure means that the individual got exposed to Ramadan in June when the duration of fasting is at its maximum, 17.5 hours.

3.5.2. Empirical Framework

The epidemiological literature analyses the differences in perinatal outcomes of fasting and non-fasting pregnant women by treating the preference over fasting as external. However, this approach fails to take self-selection bias into account since women who choose to fast might be different at base levels than those who choose not to. Therefore, instead of building upon the individual's decision to fast, we follow the ITT methodology for identifying intrauterine exposure, which is the commonly used method in this flourishing literature where we check if Ramadan coincides with pregnancy (van Ewijk, 2011; Almond and Mazumder, 2011; Almond et al., 2015; Greve et al., 2017; Schultz-Nielsen et al., 2016). ITT approach eliminates the endogeneity caused by treating the fasting preferences of pregnant women as exogenous, thus turning Ramadan exposure into a natural experiment for mild nutritional disruptions during pregnancy. Consequently, those whose prenatal period did not overlap with Ramadan constitute the control group.

We should point out that our data does not have information on the fasting behaviour of pregnant women (please see Section 3.2 for Ramadan observance during pregnancy). Therefore, the ITT approach allows us to capture the impact of Ramadan overlapping with pregnancy rather than the effect of confirmed fasting. We assume that there is no selective timing of pregnancy present; in other words, Ramadan and pregnancy randomly coincide with each other (*i.e.*, exogenous), yet the decision to fast is endogenous.¹⁹ Then, it becomes possible to measure the differences between the educational and labour market outcomes of individuals who experienced Ramadan in utero and those who did not. The fact that not all women whose pregnancy overlapped

¹⁹ Our data does not allow us to check for the selective timing of pregnancies. However, existing literature presents no apparent indication of selective timing (van Ewijk, 2011; Almond et al., 2015; Schultz-Nielsen et al., 2016; Greve et al., 2017).

with Ramadan practiced fasting, but some of them certainly did to various extents, suggests that our ITT results are underestimated since the real impact is equally distributed among the sample consisting of both the fasting and non-fasting mothers, thus diluted. Therefore, if there is perfect compliance with observing Ramadan, ITT estimates would be equal to the average treatment effect (ATE). If women whose own health or infants' health are at a higher risk in case of fasting choose not to fast, then the underestimation of ATE would be more pronounced in the findings. On the other hand, if women who are in great health abstain from fasting, then the underestimation would be slight. In addition, as the percentage of pregnant women who choose to fast changes between trimesters, the level of underestimation of ATE varies accordingly as well. We address the issue of seasonality with data covering more than 33 years of birth cohorts and an additional variable for month-fixed effects.²⁰

For our analysis, we use the following four regressions for each outcome measure, y_{icm} :

$$y_{icm} = a_0 + \beta hours_exposed_{cm} + a_1 age_{icm} + a_2 age_{icm}^2 + a_3 age_{icm}^3 + a_4 age_{icm}^4 + \omega_c + \gamma_m + \theta X_{icm} + \delta sex_{icm} + \varepsilon_{icm} \quad (3.1)$$

$$y_{icm} = a_0 + \sum_{\tau=1}^3 \beta_{\tau} hours_exposed_trimester_{cm\tau} + a_1 age_{icm} + a_2 age_{icm}^2 + a_3 age_{icm}^3 + a_4 age_{icm}^4 + \omega_c + \gamma_m + \theta X_{icm} + \delta sex_{icm} + \varepsilon_{icm} \quad (3.2)$$

$$y_{icm} = a_0 + \beta exposed_{cm} + a_1 age_{icm} + a_2 age_{icm}^2 + a_3 age_{icm}^3 + a_4 age_{icm}^4 + \omega_c + \gamma_m + \theta X_{icm} + \delta sex_{icm} + \varepsilon_{icm} \quad (3.3)$$

$$y_{icm} = a_0 + \sum_{\tau=1}^3 \beta_{\tau} trimester_{cm\tau} + a_1 age_{icm} + a_2 age_{icm}^2 + a_3 age_{icm}^3 + a_4 age_{icm}^4 + \omega_c + \gamma_m + \theta X_{icm} + \delta sex_{icm} + \varepsilon_{icm} \quad (3.4)$$

where y_{icm} represents the outcomes of interest for the individual i , born in cohort c , and month m . We check for illiteracy, having no formal education, years of schooling, middle school, high school, and college completion for educational measures; employment, log of income, having a regular income, and precarious employment as the labour market outcomes. $hours_exposed_{cm}$ and $hours_exposed_trimester_{cm\tau}$ capture the duration of fasting as a fraction of the maximum length of fasting a day where the first measure assesses the overall exposure during pregnancy; the latter identifies trimester-specific variations in fasting duration. Similarly, $exposed_{cm}$ is the

²⁰ Tables A3.3 and A3.4 present the distribution of individuals born over a full Ramadan cycle of 33 years both for the pooled and gender-specific sample and the age distribution in five-year blocks, respectively.

dummy indicator, which takes the value of 1 if the individual was in utero during Ramadan, and $trimester_{cm\tau}$ is a binary variable for Ramadan overlapping or starting in the corresponding gestational period. Those who are certainly not exposed to Ramadan constitute our control group for the analyses. age_{icm} is the age of the respondent, ω_c and γ_m are the birth cohort and month fixed effects, respectively, X_{icm} is the individual level variables such as mother tongue, place the individual grew up till the age of 15, and the current region that the respondent resides. We also control for gender in the analysis with the variable sex_{icm} . Lastly, ε_{icm} shows the weighted error terms.

3.6. Results

We first analyse the effects of intrauterine Ramadan exposure on the educational outcomes of individuals by utilising the length of fasting as a fraction of the maximum duration of Ramadan fast a day. Observing the differential effects by gender, we check for the impacts separately for females and males. Next, we explore the labour market outcomes of individuals. Thereafter, we check whether our findings are robust to alternative exposure measures by using exposure dummies, which is the commonly addressed approach in the growing Ramadan literature. In addition, since we run multiple hypotheses simultaneously, in order to prevent the risk of erroneously rejecting the null hypotheses, we employ the novel Romano-Wolf method for multiple hypothesis testing to ensure robust and consistent estimations.

Table A3.2 in the Appendix presents the summary statistics of outcome measures for the exposed and not exposed individuals.

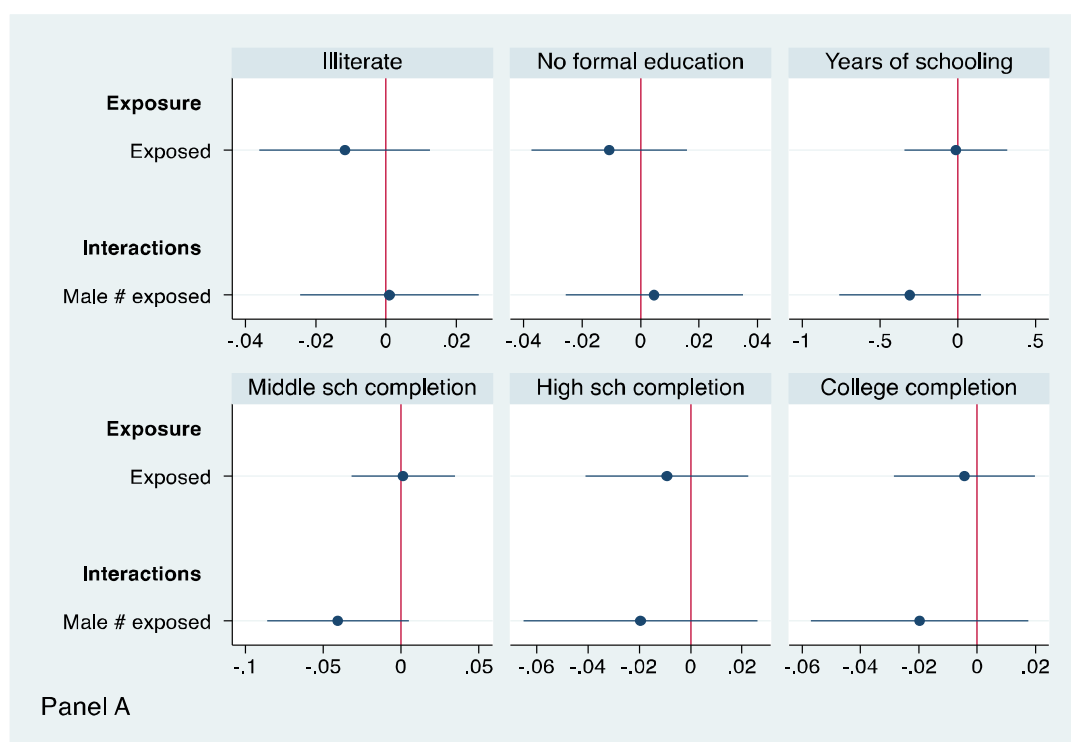
3.6.1. Main Results

3.6.1.1. Effects of Prenatal Exposure to Ramadan on Educational Outcomes

We utilise Equations (3.1) and (3.2) to analyse the effect of prenatal exposure to Ramadan on educational outcomes. Excluding those who reported their birthdays as January 1st, for all the remaining respondents who already completed their studies and are above the age of 32, the main results are mostly weak for the pooled sample (Table

A3.5). In order to assess the possible gender differences in terms of vulnerability to intrauterine shocks, we control for the interaction terms between the dummy variables of exposure and gender. Figures 3.3 and 3.4 present the point estimates of the interaction variables and the corresponding 95% confidence intervals, where complete results are reported in Table A3.6. With the additional male interaction terms, Figure 3.3 demonstrates the overall effect of intrauterine exposure to Ramadan. At the same time, Figure 3.4 compares the effects of Ramadan exposure in distinct stages of pregnancy with those who are not exposed at all.

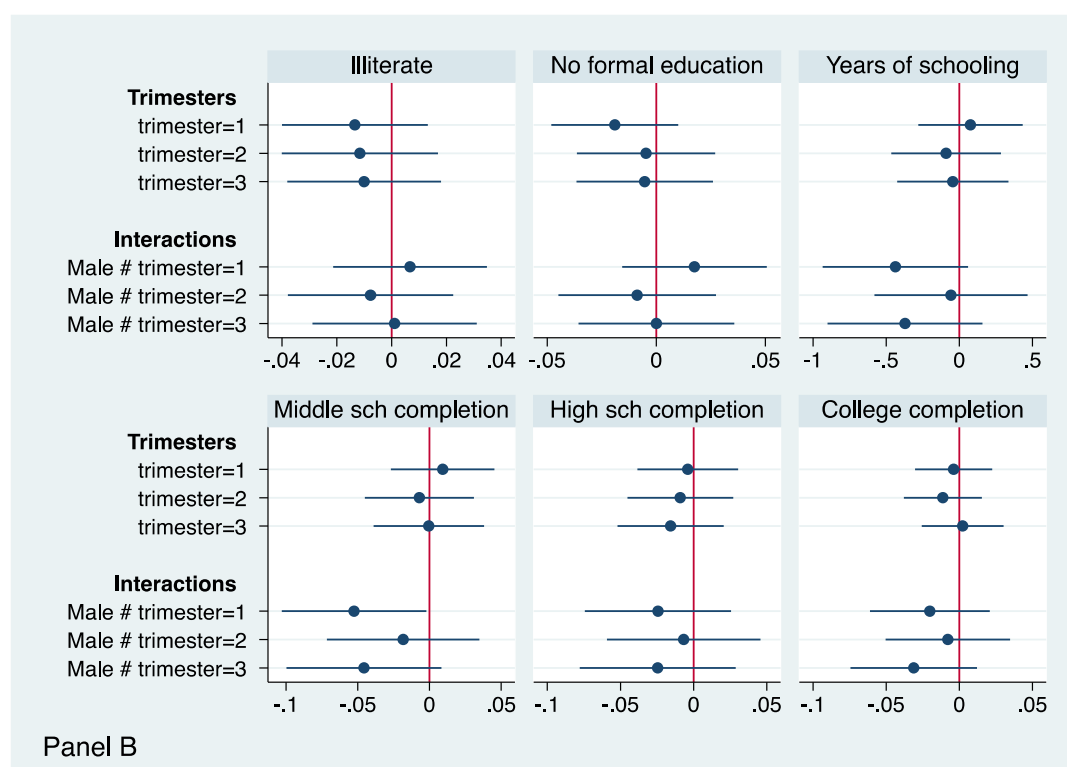
The obtained coefficients for the pooled sample suggest a differential male vulnerability to in-utero shocks, while the overall exposure estimates become insignificant following the introduction of interaction terms (estimation results without interactions are presented in Table A3.7). We find a significantly negative effect of being exposed to Ramadan in utero in the first or third trimester on years of schooling and completing at least middle school for males. This result is consistent with the findings of Majid (2015), who reports negative effects of exposure in the first and third trimesters on math scores.



Note: Panel A demonstrates the overall effect of intrauterine exposure to Ramadan on educational outcomes for the pooled sample. The plot shows points estimates and the 95% confidence intervals of exposure and male interaction variables.

Figure 3.3: The overall effect of prenatal exposure to Ramadan with male interactions.

One explanation behind this finding could be that maternal fasting in the third trimester alters cognition by failing to provide a favourable growth environment. To better understand the effect of Ramadan fasting on foetal health, Sakar et al. (2015) conducted a case-control study in Turkey with 166 pregnant women who were in their second or third trimester during the month of Ramadan in 2013. In that year, Ramadan occurred in the summer season when the duration of fasting ranged from 16 to 17 hours. Both the fasting and the non-fasting samples had 83 pregnant women. Doppler ultrasound was used to assess the foetal biometric measurements both at the beginning and the end of Ramadan. Their findings show that the amniotic fluid²¹, which is vital for the foetus to go through healthy developmental phases in the womb, built up substantially in a month among pregnant women who did not observe Ramadan compared to fasting pregnant women.



Note: Panel B demonstrates the trimester specific effects of intrauterine exposure to Ramadan on educational outcomes for the pooled sample. The plot shows points estimates and the 95% confidence intervals of trimesters and male interaction variables.

Figure 3.4: The trimester specific effects of prenatal exposure to Ramadan with male interactions.

²¹ For further information, please see: <https://medlineplus.gov/ency/article/002220.htm>

Though by the second trimester, all key brain structures have developed (Sur and Rubenstein, 2005), the third trimester is characterised by rapid brain advancement and enhancement of connections occurring across various domains (Kostovic and Vasung, 2009). When foetal blood flow is disturbed, the brain gets threatened by developmental impairment during the third trimester (McQuillen et al., 2010). Mirghani et al. (2005) conduct a cross-sectional study with 124 fasting and non-fasting pregnant women who are otherwise healthy. The authors collect blood samples and trace foetal heart rate. They find significantly lower numbers of large accelerations in foetal heart rates among fasting women. Therefore, another explanation for the negative impact of maternal nutritional disruptions in the third trimester on schooling outcomes could be the changes in the foetal heart rate caused by maternal fasting behaviour.

As both our estimates and the medical literature suggest that the severity of the effect of malnourishment during pregnancy on women and men differs, we test the outcomes for females and males separately. Table 3.2 presents the effects of intrauterine nutritional disruptions on schooling measures by gender while capturing the differences in the length of nutritional disruptions. Our results suggest no damaging impact of prenatal exposure to Ramadan on the educational outcomes among females. However, we find substantially detrimental effects of experiencing fast in-utero on schooling measures for males. Our findings in *Panel A* show that men who experience Ramadan in the summer season obtain over half a year less education compared to non-exposed males. Our *Panel B* results indicate that intrauterine exposure to Ramadan in the first or third trimester during summer results in 0.55 and 0.62 fewer years of education among men, respectively. For middle school completion, both first and third-trimester shocks pose a significant risk for males. Exposure in the third trimester presents a larger impact than the first, yet this minor difference is statistically insignificant ($p\text{-value} > 0.73$). Coming across a period of foetal malnourishment in the third trimester implies that a man would be less likely to complete high school. For finishing a graduate degree, both first and third-trimester conditions seem critical for men.

Prior to drawing attention to the gender differences, we should note that the limited number of studies focusing on in-utero programming within the context of Ramadan also report pronounced effects of the shocks experienced in the first or third trimester on academic outcomes (Almond et al., 2015; Majid, 2015; Greve et al., 2017).

Similarly, the key role of the initial and final trimester conditions on human capital formation is evident within various frameworks of the *foetal origins hypothesis* literature. For instance, middle school children in Sweden who were prenatally exposed to the Chernobyl disaster within the first five months are observed to have lower math scores and reduced likelihood of obtaining high school education (Almond et al., 2009). Likewise, Tian et al. (2022) note a negative impact of enduring the earthquake in the third trimester on high school completion rates in China. Rather than solely focusing on the negative, as an example of a positive shock, Field et al. (2009) analyse the success rate of prenatal iodine supplementation on schooling outcomes in Tanzania. The authors also report that supplementation during the first trimester of pregnancy results in an increase in schooling of around 0.5 years, and girls are found to benefit more.

Table 3.2: Effects of hours of prenatal Ramadan exposure on educational outcomes by gender.

VARIABLES	Females						Males					
	(1) Illiterate	(2) No formal education	(3) Years of schooling	(4) Middle school completion	(5) High school completion	(6) College completion	(7) Illiterate	(8) No formal education	(9) Years of schooling	(10) Middle school completion	(11) High school completion	(12) College completion
<i>Panel A</i>												
Hours exposed	-0.023 (0.016)	-0.026 (0.017)	0.142 (0.214)	0.014 (0.022)	-0.000 (0.020)	0.003 (0.016)	-0.004 (0.008)	0.005 (0.010)	-0.525** (0.250)	-0.057** (0.025)	-0.042 (0.026)	-0.042* (0.023)
<i>Panel B</i>												
Hours exp. 1 st tr. ^a	-0.025 (0.017)	-0.035* (0.019)	0.228 (0.229)	0.022 (0.023)	0.006 (0.022)	0.002 (0.017)	0.001 (0.008)	0.010 (0.011)	-0.554** (0.266)	-0.058** (0.027)	-0.040 (0.028)	-0.042* (0.024)
Hours exp. 2 nd tr.	-0.031* (0.018)	-0.024 (0.020)	0.083 (0.245)	0.005 (0.025)	0.001 (0.023)	-0.005 (0.017)	-0.008 (0.008)	0.001 (0.012)	-0.352 (0.282)	-0.042 (0.029)	-0.027 (0.030)	-0.038 (0.026)
Hours exp. 3 rd tr. ^b	-0.013 (0.018)	-0.013 (0.020)	0.065 (0.245)	0.012 (0.025)	-0.010 (0.023)	0.011 (0.018)	-0.008 (0.008)	0.001 (0.012)	-0.621** (0.279)	-0.068** (0.029)	-0.055* (0.030)	-0.047* (0.025)
Cohort-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7828	7828	7828	7828	7828	7828	7135	7135	7135	7135	7135	7135

Notes: The sample is limited to respondents of the TFS Survey in 2016 who are above 32 years old and not studying; individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the educational outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, mother tongue, and sex.

^a: 1st trimester includes those who were conceived during Ramadan as well.

^b: 3rd trimester includes those who were born during Ramadan as well.

Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Figure 3.5 plots the point estimates of trimester-specific duration of exposure and the 95% confidence intervals for women and men separately (Panel B results shown in Table 3.2).²² The figure makes the male disadvantage regarding the persistent effects of intrauterine dietary disruptions on cognition more evident, while female academic outcomes are not negatively affected. This might be a result of the already low level of education among women in Turkey (see Table 3.1), which might not be hindered further by the in-utero exposure to Ramadan. However, the explanation for the gender discrepancies regarding the outcomes of intrauterine shocks might not be straightforward. The epidemiological literature provides evidence that male foetuses are more vulnerable to unfavourable in-utero conditions. Similarly, Karimi et al. (2021) and Karimi and Basu (2018) examine the effect of prenatal exposure to fasting on height in Iran and also report negative results only among the exposed male children.

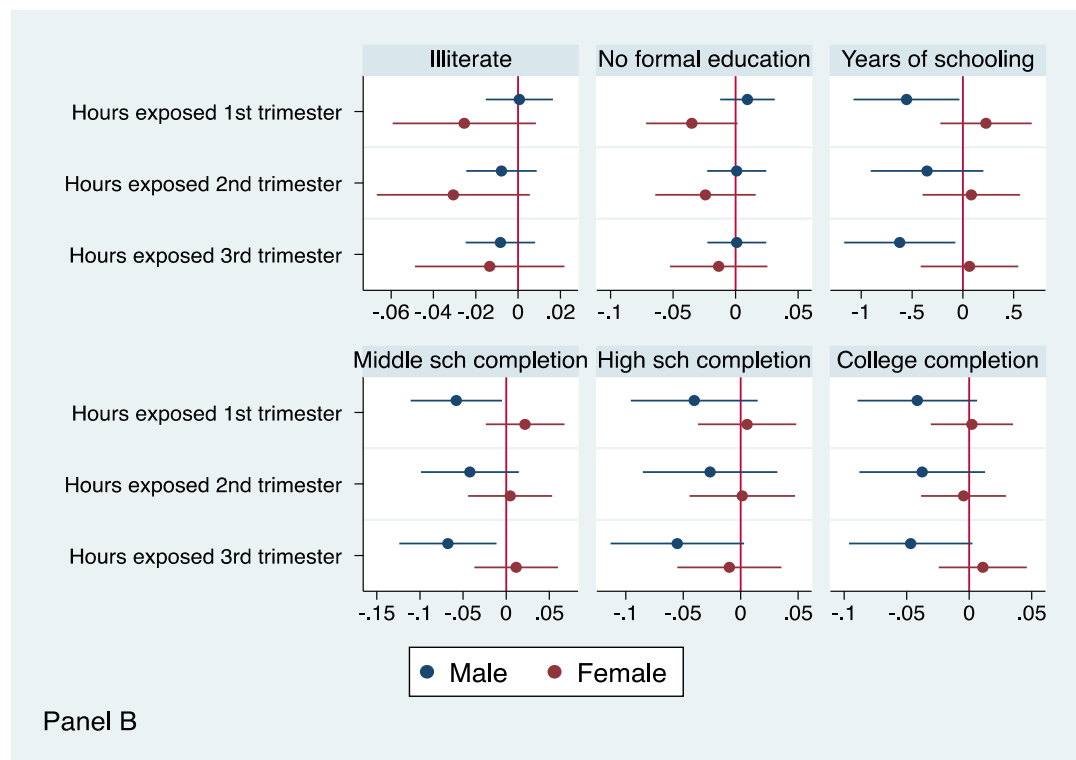


Figure 3.5: Point estimates of trimester specific duration of exposure and the 95% confidence intervals for women and men.

At conception, the ratio of males is higher than that of females. The reason for this could be attributable to the fact that the sperm with the Y chromosome – male sex – is

²² Figure A3.1 presents Panel A estimates reported in Table 3.2 and their 95% confidence intervals.

faster than the one carrying the X chromosome – female sex (Kraemer, 2000). In the case of in-utero shocks, however, this ratio is altered in favour of females, indicating that boys are more defenceless against external prenatal traumas than girls (Hansen et al., 1999). Even if they survive, adverse events during pregnancy are more likely to damage the male foetuses than females, and premature deliveries are more common if the baby is a boy (Di Renzo et al., 2007). One of the explanations behind this phenomenon is the foetal size differences between genders.

The foetuses optimise their development under the constraints of the finite nutritional resources that their mothers provide. At each stage of pregnancy, boys progress quicker and are taller than girls (Eriksson et al., 2010). Though this might seem like an evolutionary advantage, on the contrary, it puts males at a greater risk of foetal malnourishment compared to females since their increased placental size requires more dietary intake (Pedersen, 1980). In addition, the male brain is larger with a bigger hypothalamus, which is a potential result of elevated levels of testosterone secretion in the third trimester (Kraemer, 2000; Earls, 1987). Previously, the hypothalamus was only credited as a component of the limbic system; however, recent studies present that it is an integral part of cognitive functions (Burdakov and Peleg-Raibstein, 2020). Therefore, suffering from nutritional shortages in the third trimester might hinder the healthy cognitive development of infants, especially males, which might explain the pronounced gender discrepancies in our findings.

Moreover, there are some unexpected positive effects of prenatal Ramadan exposure on academic outcomes, and these are mostly present among females. Although women who experienced Ramadan in-utero on average have better educational outcomes compared to those in the control group, for males, exposure has a positive impact only on illiteracy, yet for the remaining outcomes, exposed men are at a disadvantageous position compared to non-exposed counterparts. One plausible pathway that we suggest for explaining these rather gender-specific unexpected positive effects of prenatal Ramadan exposure on educational outcomes is an early-life selection effect, which is also the proposed explanation by the studies conducted in a similar vein (Comfort, 2016; Greve et al., 2017). As suggested by the fragile male hypothesis, males are more vulnerable to in-utero shocks than females, and they struggle to survive

unfavourable prenatal conditions.²³ In addition, those boys who managed to survive cannot fully recover from the damages (Kraemer 2000; Almond and Currie 2011b).

Conversely, females who weather comparable shocks during the prenatal phase could initially be in better health conditions than their non-exposed counterparts. These intrinsic gender-based variations might clarify the unexpectedly positive impact of in-utero Ramadan exposure on schooling measures among females. For males, the minute number of non-exposed illiterate men (only 35 out of 1400 unexposed men are illiterate) could indicate that these individuals are initially disadvantaged, and they might not have survived in the first place should they have gotten prenatally exposed to Ramadan. Consequently, surviving males might initially fare better than illiterate men who were not prenatally exposed to Ramadan. However, at the same time, those who survived might be scarred at a level that, though they managed to attain literacy, the exposure might have hindered their pursuit of advanced degrees compared to their counterparts in the control group.²⁴

3.6.1.2. Effects of Prenatal Exposure to Ramadan on Educational Outcomes

The effects of in-utero Ramadan exposure on labour market outcomes are assessed by the following measures: (1) labour market participation, (2) log earnings, (3) having a regular income, and (4) precarious employment. We treat the variable of having a regular income as a financial security and working on a daily basis as an indicator of precarious employment. For the outcomes in the pooled sample, while we find no significant results for workforce participation and the logarithm of income, our results marginally suggest an unexpectedly positive effect on having regular income and job security among those who experienced maternal fasting in the third trimester.²⁵

²³ Since intrauterine stress might also alter the sex composition, we assess whether prenatal exposure to fasting has any effect on male survival. As we lack data on pregnancy loss or neonatal death, an unbalanced sex composition in our sample would indicate elevated mortality among male fetuses due to intrauterine Ramadan exposure. With equal shares of men and women in our sample, controlling for birth month, age, and birth cohort along with other variables, we find no effect of in-utero Ramadan exposure on male survival (Table A3.8).

²⁴ We should also note that in our sample, 14 percent of women are illiterate, while this rate is only 2 percent among men.

²⁵ In addition, the estimates of male interaction variables suggest an unexpected positive effect of exposure on having a regular income among males who experienced Ramadan in the second or third trimester (Table A3.9).

Table 3.3: Effects of hours of prenatal exposure to Ramadan on labour market outcomes.

VARIABLES	(1) Labour force participation	(2) Log income	(3) Having regular income	(4) Precarious employment
<i>Panel A</i>				
Hours exposed	0.002 (0.017)	0.037 (0.045)	0.029 (0.029)	-0.011 (0.020)
<i>Panel B</i>				
Hours exp. 1 st tr.	0.007 (0.019)	0.031 (0.048)	-0.002 (0.031)	0.013 (0.021)
Hours exp. 2 nd tr.	-0.007 (0.020)	0.066 (0.051)	0.050 (0.032)	-0.024 (0.023)
Hours exp. 3 rd tr.	0.002 (0.020)	0.024 (0.049)	0.057* (0.032)	-0.037* (0.021)
Cohort-month fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes
Observations	12911	6206	6604	6604

Notes: The sample is age restricted to individuals between the ages of 33 to 65 since the employment trends among the working-age participants and elderly differ substantially. Individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the labour market outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, mother tongue, and sex. Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

We then turn our attention to the gender differences in labour market outcomes given the estimates of the male interaction variables (Table A3.9) and the significant reduction in educational attainment due to intrauterine Ramadan exposure among men. Employing Equations (3.1) and (3.2), Table 3.4 presents the effects of exposure for females and males separately by accounting for variations in fasting duration. While no substantial effects are observed for females, the results indicate positive effects for males, where men who are prenatally exposed to Ramadan in the second or third trimester are more likely to have a regular income and secure employment.

Table 3.4: Effects of hours of prenatal exposure to Ramadan on labour market outcomes by gender.

VARIABLES	Female				Male			
	(1) Labour market partc.	(2) Log income	(3) Having regular income	(4) Precarious empl.	(5) Labour market partc.	(6) Log income	(7) Having regular income	(8) Precarious empl.
<i>Panel A</i>								
Hours exposed	0.033 (0.025)	0.126 (0.128)	-0.036 (0.049)	0.037 (0.032)	-0.025 (0.023)	0.010 (0.044)	0.044 (0.033)	-0.025 (0.024)
<i>Panel B</i>								
Hours exp. 1 st tr.	0.037 (0.028)	0.105 (0.136)	-0.030 (0.052)	0.048 (0.035)	-0.018 (0.024)	0.006 (0.047)	0.000 (0.036)	0.003 (0.026)
Hours exp. 2 nd tr.	0.026 (0.029)	0.078 (0.139)	-0.051 (0.057)	0.035 (0.038)	-0.037 (0.026)	0.063 (0.050)	0.077** (0.038)	-0.043 (0.027)
Hours exp. 3 rd tr.	0.036 (0.029)	0.188 (0.135)	-0.035 (0.055)	0.022 (0.034)	-0.026 (0.026)	-0.023 (0.049)	0.082** (0.038)	-0.053** (0.026)
Cohort-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6755	1631	2004	2004	6156	4575	4600	4600

Notes: The sample is age restricted to individuals between the ages of 33 to 65 since the employment trends among the working-age participants and elderly differ substantially. Individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the labour market outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, mother tongue, and sex.

Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

A possible explanation we can consider for these unforeseen outcomes is the presence of governmental and societal support mechanisms specifically aimed at assisting disabled individuals. Our dataset lacks information related to disabilities. Similarly, Schultz-Nielsen et al. (2016) also encounter a limitation of not having a direct measure of disability in the Danish dataset of male workers. To compensate for this, they utilise ‘early retirement’ as a proxy for disability and observe that Muslim immigrants who were exposed to Ramadan during the seventh month of gestation exhibit a higher likelihood of retiring early. In addition, Almond and Mazumder (2011) report increased rates of disability among Iraqi and Ugandan men who experienced Ramadan in utero in the ninth month. On the grounds of the recent literature, we think that

exposed males in our sample might also have a higher probability of disability compared to the unexposed individuals.

In Turkey, within the scope of Article 30 of the Turkish Labour Law No. 4857, public and private sector companies are obligated to employ persons with disabilities in a proportion of 4 and 3 percent, respectively (Turkish Employment Institution, 2023). The reported rates of male participation in the labour force are 72 percent for the general population and 35 percent for individuals with disabilities (Turkish Ministry of Family and Social Services, 2022). Based on the assumption that disability might be more prevalent at older ages, we first create interaction variables with age groups and exposure and then check for variations across age groups. The aforementioned Labour Law became effective in 2003. Therefore, we expect that the younger individuals with disabilities would benefit from this act the most and get employed by the public sector at higher rates as oftentimes there is a certain maximum age for employment in governmental positions (which provide a secure job and a regular income). The positive estimates for the exposed individuals from two age groups, those who were between 33-37 and 38-42 years old at the time of the interview, support our proposed explanation that the unforeseen labour market outcomes could be influenced by the higher prevalence of disability and the corresponding legislative measures in place.

3.6.2. Robustness Analyses

3.6.2.1. Alternative Exposure Measures

We run several robustness analyses to support our primary findings. Consistent with the common practice in the current Ramadan literature, we employ exposure dummies to assess the effect of in-utero exposure to fasting on human capital formation. Observing the gender discrepancies in terms of vulnerability to prenatal nutritional deficiencies (Table A3.6), using Equations (3.3) and (3.4), Table 3.5 presents estimates for the effect of prenatal exposure to Ramadan on educational outcomes for females and males separately.

Table 3.5: Effects of prenatal exposure to Ramadan on educational outcomes by gender.

VARIABLES	Females						Males					
	(1) Illiterate	(2) No formal education	(3) Years of schooling	(4) Middle school completion	(5) High school completion	(6) College completion	(7) Illiterate	(8) No formal education	(9) Years of schooling	(10) Middle school completion	(11) High school completion	(12) College completion
<i>Panel A</i>												
Exposed	-0.016 (0.013)	-0.017 (0.014)	0.138 (0.177)	0.014 (0.018)	0.002 (0.017)	0.009 (0.013)	-0.003 (0.006)	0.006 (0.008)	-0.475** (0.208)	-0.051** (0.021)	-0.038* (0.022)	-0.034* (0.019)
<i>Panel B</i>												
1 st trimester	-0.019 (0.014)	-0.026* (0.015)	0.226 (0.190)	0.021 (0.019)	0.008 (0.018)	0.009 (0.014)	0.001 (0.007)	0.010 (0.009)	-0.511** (0.222)	-0.054** (0.023)	-0.038 (0.024)	-0.033* (0.020)
2 nd trimester	-0.021 (0.015)	-0.015 (0.017)	0.087 (0.199)	0.006 (0.020)	0.003 (0.019)	0.003 (0.014)	-0.007 (0.007)	0.002 (0.010)	-0.325 (0.231)	-0.037 (0.024)	-0.026 (0.025)	-0.030 (0.021)
3 rd trimester	-0.008 (0.015)	-0.007 (0.016)	0.066 (0.201)	0.011 (0.020)	-0.006 (0.019)	0.014 (0.014)	-0.006 (0.007)	0.004 (0.010)	-0.553** (0.231)	-0.058** (0.024)	-0.050** (0.025)	-0.038* (0.021)
Cohort-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area grew-up in	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7828	7828	7828	7828	7828	7828	7135	7135	7135	7135	7135	7135

Notes: The sample is limited to respondents of the TFS Survey in 2016 who are above 32 years old and not studying; individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the educational outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, mother tongue, and sex. Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Notably, though the magnitudes differ, we reach similar conclusions using both approaches: while no significant effects are observed for females, the results indicate substantially negative effects for males. We should note that the current estimates are smaller compared to our baseline findings, where we address the potential *accelerated starvation* by employing differing durations of fasting. The exposure variable in *Panel A* points out that men who are exposed to Ramadan complete around 0.48 fewer years of schooling compared to those who are not exposed (while the initial approach suggests over half a year less education as a result of exposure in summer). They are also less likely to obtain middle school, high school, and college education. When we check for the impact of intrauterine exposure at different stages of pregnancy, our results in *Panel B* indicate that men experiencing Ramadan in the first or third trimester, on average, complete 0.53 fewer years of schooling (whereas employing hours of fasting measures denotes a decrease of 0.59 years of education on average). For middle school completion, experiencing the nutritional shock in the first or third trimester has similar degrees of negative impact (with a one percentage point difference from the previous approach), while for high school completion, though the level is similar, only the exposure in the third trimester is found to cause significant limitations for men. For college completion, our findings imply that, though slight, experiencing Ramadan in the first or third trimester has damaging impacts on males.

Subsequently, we employ the exposure dummies for the labour market estimates. Due to the apparent gender discrepancies regarding the vulnerability to intrauterine shocks (Table A3.9), Table 3.6 presents the effect of intrauterine nutritional shocks on employment measures for women and men separately. Our findings are notably robust to alternative measures of exposure where undergoing Ramadan during the second or third trimester yields unexpected positive effects on both having a regular income and improvement in job security among males.

Table 3.6: Effects of prenatal exposure to Ramadan on labour market outcomes by gender.

VARIABLES	Female				Male			
	(1) Labour market partc.	(2) Log income	(3) Having regular income	(4) Precarious employment	(5) Labour market partc.	(6) Log income	(7) Having regular income	(8) Precarious employment
<i>Panel A</i>								
Exposed	0.026 (0.021)	0.110 (0.103)	-0.029 (0.041)	0.029 (0.026)	-0.019 (0.019)	0.011 (0.036)	0.032 (0.028)	-0.024 (0.020)
<i>Panel B</i>								
1 st trimester	0.032 (0.023)	0.206 (0.173)	-0.023 (0.043)	0.039 (0.029)	-0.012 (0.021)	0.008 (0.039)	-0.003 (0.030)	-0.001 (0.022)
2 nd trimester	0.016 (0.024)	0.228 (0.181)	-0.042 (0.047)	0.026 (0.031)	-0.030 (0.022)	0.051 (0.041)	0.055* (0.031)	-0.037* (0.022)
3 rd trimester	0.028 (0.024)	0.100 (0.180)	-0.029 (0.046)	0.019 (0.028)	-0.021 (0.022)	-0.014 (0.040)	0.061* (0.031)	-0.045** (0.022)
Cohort-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6755	1631	2004	2004	6156	4575	4600	4600

Notes: The sample is age restricted to individuals between the ages of 33 to 65 since the employment trends among the working-age participants and elderly differ substantially. Individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the labour market outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, mother tongue, and sex.

Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

3.6.2.2. Restricted Sample

The initial sample we use includes individuals conceived or born during Ramadan. Therefore, we limit our sample to those who experienced a complete Ramadan in utero. We find no significant effect of a full month of Ramadan exposure on the educational outcomes for the pooled sample or females. Since illiteracy and lacking formal education are less common among men, we focus our attention on educational attainment. Table 3.7 presents estimates for males, which are similar to our baseline findings. Both the first and third trimesters remain significant in the restricted sample.

The negative effects of exposure in the first trimester are slightly larger than our initial findings if the individual experiences a full month of Ramadan in utero. Finding no effect on high school completion rates, our results show that men who experience a complete month of Ramadan in summer obtain 0.57 fewer years of education. In addition, they are less likely to complete middle school and college education.

Table 3.7: Effects of full-month Ramadan exposure in utero on educational outcomes among males.

Variables	(1) Years of schooling	(2) Middle school completion	(3) High school completion	(4) College completion
<i>Panel A</i>				
Hours exposed	-0.497** (0.253)	-0.053** (0.026)	-0.036 (0.027)	-0.043* (0.023)
<i>Panel B</i>				
Hours exp. 1 st tr.	-0.572** (0.275)	-0.063** (0.028)	-0.041 (0.029)	-0.042 (0.025)
Hours exp. 2 nd tr.	-0.347 (0.283)	-0.038 (0.029)	-0.025 (0.030)	-0.039 (0.026)
Hours exp. 3 rd tr.	-0.560* (0.298)	-0.056* (0.031)	-0.042 (0.032)	-0.052* (0.027)
Cohort-month fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes
Observations	5972	5972	5972	5972

Notes: The sample is limited to respondents of the TFS Survey in 2016 who are above 32 years old and not studying; individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the educational outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, and mother tongue.

Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Similarly, we observe no notable impact of an entire month of Ramadan exposure on labour market results for either the combined group or for females. However, for men, consistent with our baseline findings, experiencing a complete Ramadan in summer overlapping with the second or third trimester yields unexpected positive results regarding the consistency of their earnings (Table 3.8).

Table 3.8: Effects of full-month Ramadan exposure in utero on labour market outcomes among males.

VARIABLES	(1) Labour force participation	(2) Log income	(3) Having regular income	(4) Precarious employment
<i>Panel A</i>				
Hours exposed	-0.023 (0.023)	0.024 (0.045)	0.044 (0.034)	-0.021 (0.025)
<i>Panel B</i>				
Hours exp. 1 st tr.	-0.009 (0.026)	0.008 (0.049)	-0.005 (0.037)	0.002 (0.027)
Hours exp. 2 nd tr.	-0.040 (0.027)	0.062 (0.050)	0.078** (0.038)	-0.042 (0.027)
Hours exp. 3 rd tr.	-0.023 (0.028)	0.006 (0.053)	0.091** (0.041)	-0.040 (0.029)
Cohort-month fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes
Observations	5136	3852	3872	3872

Notes: The sample is age restricted to individuals between the ages of 33 to 65 since the employment trends among the working-age participants and elderly differ substantially. Individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the labour market outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, and mother tongue. Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

3.6.2.3. Multiple Hypothesis Testing Correction

Due to the simultaneous testing of multiple hypotheses, the p-values obtained from Equations (3.1) – (3.4) could potentially be underestimated (Romano and Wolf, 2005b, 2005a). In order to mitigate the risk of erroneous rejection of null hypotheses, we utilise the Romano-Wolf correction technique to simultaneously test multiple hypotheses regarding the educational and labour market outcomes of men (Clarke et al., 2020).²⁶ Table 3.9 reports the model, resample, and Romano-Wolf step-down adjusted p-values computed by employing both continuous and dichotomous measures of exposure to maternal fasting.

²⁶ Since our initial findings suggest both the continuous and dichotomous measures of maternal fasting have substantial impact only on males, due to the effort to conserve space, we only report the adjusted p-values for men.

Table 3.9: Multiple hypothesis testing (Romano-Wolf) for educational outcomes among males.

Variables	(I) Hours of exposure				(II) Exposure Dummies			
	Coef.	Model p-value	Resample p-value	Romano-Wolf p-value	Coef.	Model p-value	Resample p-value	Romano-Wolf p-value
<i>Years of schooling</i>								
Ramadan exposure	-0.525** (0.250)	0.036	0.037	0.071	-0.475** (0.208)	0.023	0.027	0.043
Ramadan in 1 st tr.	-0.554** (0.266)	0.037	0.043	0.154	-0.511** (0.222)	0.021	0.024	0.098
Ramadan in 2 nd tr.	-0.352 (0.282)	0.213	0.207	0.347	-0.325 (0.231)	0.159	0.144	0.283
Ramadan in 3 rd tr.	-0.621** (0.279)	0.026	0.029	0.140	-0.553** (0.231)	0.017	0.014	0.083
Observation		7135				7135		
<i>Middle school completion</i>								
Ramadan exposure	-0.057** (0.025)	0.024	0.024	0.059	-0.051** (0.021)	0.017	0.016	0.040
Ramadan in 1 st tr.	-0.058** (0.027)	0.032	0.036	0.154	-0.054** (0.023)	0.019	0.016	0.091
Ramadan in 2 nd tr.	-0.042 (0.029)	0.146	0.127	0.347	-0.037 (0.024)	0.123	0.113	0.283
Ramadan in 3 rd tr.	-0.068** (0.029)	0.019	0.019	0.107	-0.058** (0.024)	0.016	0.017	0.083
Observation		7135				7135		

Table 3.9: Multiple hypothesis testing (Romano-Wolf) for educational outcomes among males (*Continued*)

<i>High school completion</i>								
Ramadan exposure	-0.042 (0.026)	0.116	0.113	0.113	-0.038* (0.022)	0.082	0.080	0.118
Ramadan in 1 st tr.	-0.040 (0.028)	0.152	0.144	0.347	-0.038 (0.024)	0.107	0.116	0.283
Ramadan in 2 nd tr.	-0.027 (0.030)	0.375	0.361	0.361	-0.026 (0.025)	0.295	0.288	0.288
Ramadan in 3 rd tr.	-0.055* (0.030)	0.063	0.057	0.238	-0.050** (0.025)	0.043	0.037	0.173
Observation		7135				7135		
<i>College completion</i>								
Ramadan exposure	-0.042* (0.023)	0.065	0.066	0.113	-0.034* (0.019)	0.072	0.073	0.118
Ramadan in 1 st tr.	-0.042* (0.024)	0.089	0.090	0.267	-0.033* (0.020)	0.097	0.101	0.283
Ramadan in 2 nd tr.	-0.038 (0.026)	0.142	0.147	0.347	-0.030 (0.021)	0.146	0.151	0.283
Ramadan in 3 rd tr.	-0.047* (0.025)	0.063	0.070	0.238	-0.038* (0.021)	0.068	0.071	0.234
Observation		7135				7135		

Notes: The sample is limited to male respondents of the TFS Survey in 2016 who are above 32 years old, and not studying; individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Group I shows results for the educational outcomes of males by employing the hours of fasting approach similar to Table 3.3 while Group II displays results exploiting the exposure dummies similar to Table 3.5. For each outcome, the variable Ramadan exposure presented above the dash-line is obtained from separate regressions using Equations (3.1) and (3.3) in Group I and Group II, respectively. The trimester specific variables below the dash-line for each outcome are estimated using Equations (3.2) and (3.4) in Group I and Group II, respectively. The first column of each Group shows the regression coefficients, followed by model p-values, sample p-values and Romano-Wolf adjusted p-values which account for multiple hypothesis testing correction. Each regression controls for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, and mother tongue. Robust standard errors are shown in parentheses (***) p<0.01, ** p<0.05, * p<0.1).

The Romano-Wolf step-down adjusted p-values demonstrate statistical significance in both models. Years of schooling and middle school completion rates remain significantly lower among men when gestation overlaps with Ramadan. Our findings indicate that men who are prenatally exposed to Ramadan during summer complete 0.53 fewer years of schooling, while exposure to maternal fasting implies a reduction of 0.48 years in education. Both approaches demonstrate the damaging impacts of intrauterine exposure to Ramadan on middle school completion. Though the trimester-specific duration of fasting measures become insignificant, using the alternative measure of exposure, we find robust evidence for the detrimental effects of intrauterine Ramadan exposure in the first or third trimester on educational outcomes among males. Our findings ensure the detrimental effects of maternal dietary disruptions on male cognition. On the contrary, the Romano-Wolf adjusted p-values are insignificant for the labour market outcomes (Table A3.11). Overall, we find that the results from different sample restrictions and methods are consistent with our baseline findings.

3.7. Discussion

The significant indication of our findings is that the differences in prenatal well-being might be one of the very explanations behind the varying levels of human capital among individuals. Although Ramadan observance is practically a form of daytime intermittent fasting, it is still potent enough to negatively affect academic and labour market outcomes. Therefore, for creating more qualified human capital, simple investments during pregnancy might be more effective than the conventional and late policy implications in the areas of education. We should note that our findings apply not only to the Muslim population but also to developed or other developing countries. Skipping meals or morning sickness is common during pregnancy, especially at the beginning of gestation, since pregnancy often goes unrecognised. However, nutritional deficiencies in the first trimester substantially disturb healthy cognitive development.

In addition, a study comparing the perinatal outcomes of new-borns to mothers who were exposed to Ramadan in utero and who were not finds lower birthweights and narrower placental sizes among the infants of exposed mothers (Alwasel et al., 2013). The fact that the effect of mild foetal nutritional disruptions extends beyond generations proves that simple investments during pregnancy would be more effective

than the conventional and late policy implications for creating more qualified human capital. Thus, simple interventions such as using media support to highlight the detrimental effects of maternal fasting, dieting, or skipping breakfast on the cognitive capacities of their babies might mitigate the potential losses among children. In addition, providing nutritional support to disadvantaged pregnant women becomes important, especially in developing countries where education is imperative for escaping the poverty cycle. Given the intergenerational transmission of education and socioeconomic status, the positive effects of such implications would be highly multiplied across generations.

In as much as we imply that our findings are induced by fasting, dietary disruptions are not the only changes occurring during Ramadan (Lessan and Ali, 2019). Changes in caloric intake, an increase in the consumption of fatty and sweet foods, disturbed sleep cycles, and dehydration could all affect the development of the offspring and shape the very assets that s/he will be born with, hence forming her/his future.

3.8. Conclusion

This study provides new evidence on the long-term effects of maternal nutritional disruptions on the human capital accumulation of the next generation. We utilise the Islamic holy month of Ramadan as a natural experiment to assess the effects of fasting during pregnancy on educational and labour market outcomes, which we treat as proxy variables for the cognitive abilities of individuals. Differing from the previous studies, we assess the effect of intrauterine Ramadan exposure on these measures by employing variations in the duration of fasting. Our findings present detrimental consequences of unfavourable in-utero conditions on human capital formation, and these effects are only robust among males, with no significant effect present among females. Our analysis indicates that men who are exposed to Ramadan in the first or third trimester obtain 0.53 fewer years of schooling on average and that this impact is stronger in summer. They are also less likely to attend middle school, high school, and college. These findings are robust both to alternative measures of exposure and the multiple hypothesis testing correction methods. Therefore, we present evidence that prenatal exposure to Ramadan in the first or third trimester onwards has a persistent negative effect on males.

These highly pronounced gender discrepancies regarding the vulnerability to intrauterine shocks could be explained by foetal programming. It is an organic phenomenon suggesting that the changes in the prenatal conditions induce alterations in the nutrition supply to the baby, which results in a process of long-lasting transformations (Barker and Thornburg, 2013). Though this might be beneficial in the womb, it dramatically fails when the outside environment is different than in utero. Male foetuses are bigger than females; this size difference requires higher levels of placental nutrition, and in return, it makes boys more vulnerable to foetal malnourishment compared to girls. Since pregnant women enter the accelerated starvation phase a lot quicker than non-pregnant women, even mild maternal dietary shortages might put the male foetuses at greater risk and limit cognitive advancement. Our results lend support to the idea that even a temporary and less severe form of dietary deficiency, such as Ramadan, might hinder the cognitive development of individuals and shape the partially fixed assets that they will be born with.

Thinking within the frame of the economics discipline, Heckman (2007) proposes different phases of child development as separate inputs that produce the ‘capacity’ of the child, where I_1 is the prenatal investment while I_2 is postnatal. According to his model, supported by medical literature, since early childhood cognitive development has its unique periods, I_1 and I_2 cannot perfectly replace each other. Therefore, the capacity cannot surpass the level set in the prenatal period. This very framework stresses the importance of foetal programming and prenatal investments and signals that such early interventions might be more efficient and economical both for the individual and the society as a whole (Almond and Currie, 2011a, 2011b; Doyle et al., 2009).

4. THE FAR-REACHING LOW SPIRITS: MATERNAL DEPRESSION AND PHYSICAL HEALTH OF UNDER-FIVE CHILDREN IN TURKEY

4.1. Introduction

Depression is the most prevalent psychological disorder affecting approximately 5 per cent of the adult population globally (World Health Organisation, WHO, 2021). It damages the sense of well-being and limits the affected person's ability to properly function at work, school or conduct daily activities (Hammer-Helmich et al., 2018). Ranked as the major leading cause of universal disability (WHO, 2017) and a great cost to the economy (Malik and Khan, 2016; Niu and Zhang, 2020), depression poses a major threat to public health both in developed and developing countries. With nearly 280 million individuals suffering from depression, women exhibit twice greater vulnerability to depressive symptoms in comparison to men (IHME, 2019), and it is notably more common among women of reproductive age (Guo et al., 2018). Around 13 per cent of mothers worldwide are burdened with depression (Fisher et al., 2012) while this rate can reach as high as 74 per cent in low- and middle-income countries (LMICs)²⁷(Ferreira et al., 2015). Though the prevalence rates differ across nations, these are moderate estimates since maternal depression persists to be a condition that is not reported or administered sufficiently (Heneghan et al., 2000). Nevertheless, its societal and economic repercussions remain far-reaching.

Maternal depression can inhibit a mother's ability to provide adequate child-care practices. Younger children are notably more susceptible to the damage of maternal mental health problems since a large proportion of them spend long periods of time with their mothers and primarily rely on them to meet their physical and socio-emotional needs. As mothers are often the primary caregivers, maternal distress not only causes adverse consequences on mothers' own well-being, but it also transmits

²⁷ The prevalence of maternal depression is reported as 22 – 28 per cent in Turkey (Gulseren et al., 2006; Karaçam and Ançel, 2009).

to the next generation by affecting the child's cognition, behaviour, growth, and overall health (Wachs et al., 2009).

Existing literature predominantly concentrates on the effects of antepartum and postpartum depression on infant outcomes. However, the persistent nature of maternal distress extends beyond the perinatal period (Milgrom et al., 2006) and following infancy, it plays a great role in child health (Johnson et al., 2019). This is of great importance since differences in early childhood health circumstances often extend to adulthood which makes the child well-being a key predictor of adult health and, in a broader sense, a major determinant of human capital (Currie & Almond, 2011). Therefore, especially in developing nations where children's human capital is integral in assisting to eliminate poverty and inequality, it is imperative to properly interpret the link between maternal mental health and the well-being of children. Only after understanding and identifying the components that illustrate this very relationship, one can formulate and implement successful population health strategies.

Therefore, given the importance of child health, to address the gap in the literature, this study investigates the relationship between maternal mental health and the physical health of children under five in Turkey, a middle-income, developing country. In this study, we exploit the 2019 round of THS prepared by TurkStat. We restrict our sample to children between the ages of 1 and 5 as infant diseases might differ from those of toddlers and pre-schoolers. Child health outcomes that we focus on throughout the study are as follows: General health status, anaemia morbidity, prevalence of communicable diseases such as ARI and diarrhoea, and other non-chronic childhood illnesses. Maternal mental health is assessed by calculating the mother's PHQ-8 Score, the standardised eight-item version of the Patient Health Questionnaire, including both emotional and somatic aspects. Our study contributes to the literature in four ways.

To our knowledge, this is the first study to address the relationship between maternal depression and child health outcomes in Turkey. In this study, we investigate whether toddlers and pre-schoolers are at a higher risk of morbidity against maternal depression like infants. In addition, while previous studies mostly focus on severe depression, we are able to examine whether mild to moderate maternal depression, which is more predominant in society, poses a threat against children's physical health. Hence, we believe that this study provides new evidence for the importance of mother-child interaction on child's physical health in a developing country setting.

Previous literature suggests that maternal education is beneficial for the health of children under-five by reducing infant mortality and increasing the overall physical well-being of children (Abuya et al., 2011; Güneş, 2015). In this study, we specifically investigate if the mother's high levels of education reduce the burden of her poor mental health on child's physical health. Testing for the potential protective role of maternal education against the detrimental effects of maternal depression on children's physical health, an interaction that is under-researched, constitutes the second important contribution of this study.

Third, since the findings from the previous literature are mostly obtained from severely and/or chronically depressed mothers in their postpartum periods, we additionally address the two remaining questions that whether not only infants but also toddlers and pre-schoolers are at a higher risk of morbidity against maternal depression, and whether, along with severe depression, mild to moderate maternal depression, which is more predominant in society, poses a threat against children's well-being. Lastly, our study provides new evidence for the importance of mother-child interaction on child health in a developing country setting. Since poor mental health, specifically, depression can be detected and diagnosed easily, children whose mothers are depressed can be classified under the at-risk category and addressed accordingly. As interventions during the initial stages of growth and development could potentially modify a potentially unfavourable path of results for children (Nores & Barnett, 2010), treating maternal depression would yield intergenerational benefits by treating the mother and consequently improving child health which is a significant determinant of adult outcomes (Heckman, 2007).

In the empirical analysis, we use a rich set of control variables together with maternal education to examine the relationship between maternal mental health and child's physical health. Our results suggest that children whose mothers suffer from mild to severe depression are at a 12 percentage points higher risk of contracting infectious diseases. Likewise, the total number of non-chronic illnesses a child falls victim to increases by one-third if the mother portrays depressive symptoms. Last, we find that completing at least high school reduces the burdens of maternal depression on children's physical health by 8 percentage points. Since we test for several outcome measures, in order to avoid any Type I error, in other words, to prevent false rejections

of null hypotheses, we use the novel Romano-Wolf multiple hypothesis testing method that produces robust and consistent estimates (Clarke et al., 2020).

The rest of this essay is organised as follows: Section 2 presents a brief literature review, Section 3 discusses the data, Section 4 introduces the methodology, Section 5 showcases the descriptive statistics and empirical results, Section 6 discusses policy recommendations and the limitations of the study, and, lastly, Section 7 concludes.

4.2. Literature Review

Poor maternal mental health is associated with impaired motor, cognitive and language development among children (Patel, 2003; Petterson and Albers, 2001; Quevedo et al., 2012) and an increased prevalence of behavioural problems and psychopathology (Billings and Moos, 1983; Goodman et al., 2011; Kim, 2017; Searle', 1987). Studies also demonstrate that children of distressed mothers are more likely to suffer from undernutrition and stunting, and are at a higher risk for birth defects, premature birth, and mortality (Deyessa et al., 2010; A. Stein et al., 2014; Surkan et al., 2011; Webb et al., 2005; Webb et al., 2008).

Non-chronic child diseases, especially communicable diseases such as respiratory infections and diarrhoea, are more common and pose a major health concern in LMICs where living conditions are more unfavourable compared to high-income countries. Nevertheless, the relationship between disturbed maternal mental health and the young child's general health and common childhood illnesses, *i.e.*, ARI, diarrhoea, iron deficiency anaemia, chickenpox, vitamin D deficiency, *etc.* received little attention in the literature. The few studies analysing these measures report increased risks for diarrhoea and other infectious diseases among children of depressed mothers, yet the results are inconclusive (Anderson et al., 2012; Nguyen et al., 2014; Rahman et al., 2004, 2007; Thompson et al., 2022).

The reason we target non-chronic childhood illnesses as our primary outcomes of interest is that, though compared to mortality, contracting infectious diseases might sound less severe, according to the Centres for Disease Control (CDC), 32 per cent of hospitalisation among children under five years of age is caused by respiratory illnesses or diarrhoea (Gordon et al., 2007). In addition to the economic burden that these illnesses create, more serious developmental and life-long outcomes might occur

such as asthma and hearing impairment due to recurrent ear infections. Studies show that an ear infection is often provoked by frequent respiratory infections, and such early onset of repetitive respiratory illnesses might lead to asthma later in life (Baggi et al., 2013; Nokso-Koivisto et al., 2006; Ramsey et al., 2007; Simon et al., 2015; Toivonen et al., 2016). Further, these reoccurring infections require administering the usage of antibiotics starting from an early age which might induce antibiotic resistance and aggravate subsequent infections later in life (Carey and Cryan, 2003; Austin et al., 1999). Moreover, the morbidity of infectious diseases or other common childhood illnesses is primarily influenced by present factors such as maternal depression and education. The causes of additional indicators of children's well-being such as chronic illnesses or stunting, however, might even reach in-utero conditions or develop over an extended timeframe (Barker, 1998; Ewijk et al., 2013) which necessitates detailed data to properly identify the underlying contributors. Nonetheless, short-term illnesses are more responsive to simple policy implications once the risks are identified, unlike chronic diseases or other mental or physical problems which are harder to address.

In addition to maternal mental health, studies present strong positive relationships between maternal education and various health outcomes such as healthy birth weight, increased height, immunisation, and being resistant to infectious diseases such as respiratory diseases and diarrhoea (Abuya et al., 2011; Glewwe, 1999; Schultz, 2002; Spencer, 2005). The mechanisms behind this success of maternal education are providing awareness to the potential mothers regarding prenatal and postnatal care, utilisation of health-care facilities, and having higher income by employment and/or matching a higher income partner (Currie and Moretti, 2003; Eika et al., 2019; Rowe et al., 2005). Therefore, observing the crucial role of maternal education, we investigate if it reduces the burden of mothers' poor mental health on under-five children's physical health.

4.3. Data

In this study, we utilise the THS 2019. It is a nationally representative household survey adapted from European Health Interview Survey (EHIS) and conducted through face-to-face interviews by TurkStat across 12 regions. The THS include a separate form for children between the ages of 0 and 14 which is missing in the original EHIS questionnaire. Therefore, including all age groups, the survey provides detailed information on child and adult health indicators. The questionnaire for children below 15 years of age contains a rich set of variables for children's health status such as infectious and chronic diseases, breastfeeding status, and parent-assessed general health as well as social and demographic characteristics. For adults, the dataset delivers more extensive measures in all domains such as health, family type, level of education, and employment status. Combining the two datasets allows us to study the effects of maternal mental health on children's physical health, and to further identify the potential layer of protection that maternal education might supply against the negative effects of poor maternal mental health.

The THS 2019 includes 8,166 households with 23,199 individuals between 0 to 98 years old. Individuals above 15 years of age are personally interviewed while their parents answer the questions for children below this age. Our primary interest is to assess the relationship between maternal mental health and physical wellness of children below 5 years old. Since post-partum depression is very common among mothers and the diseases that new-borns are at risk of substantially differ from those of toddlers and pre-schoolers, after matching them with their parents, we exclude the new-borns from the analysis. Consequently, our restricted sample contains 1,858 children between the ages of 1 and 5.

4.3.1. Measures of Child Health

During the interview, mothers are requested to evaluate their children's general health and provide information about breastfeeding status, chronic and infectious diseases, disabilities, limitations, disorders in the past six months. Our first health indicator is based on mothers' assessments of their children's general health status on a scale of one to five ranging from 'Very good' to 'Very bad'. We create a binary variable named 'very healthy' which takes the value of 1 for those who are reported to be at a 'very

good’ or ‘good’ health condition, and 0 otherwise. The additional measure of general health denotes whether the child suffers from iron deficiency anaemia or not.

The third indicator of child health is the recent morbidity of common childhood diseases. This measure of illness is elicited by the maternal recall of upper (such as tonsillitis, ear infection, pharyngitis, *etc.*) and/or lower (such as bronchitis, pneumonia, *etc.*) respiratory diseases, diarrhoea, or other infections (such as urinary tract infection, chickenpox, mumps, *etc.*) and non-chronic health problems (such as anaemia, vitamin D deficiency, dermatological problems, *etc.*) that their children experienced. We form an ARI variable by combining the upper and lower respiratory disease occurrence. For the ARI and diarrhoea, we create one dummy variable for each infectious disease where it takes the value of 1 if the mother reported that the child suffered from the infection recently, and 0 otherwise. We generate another dichotomous variable representing whether the child experienced ARI and/or diarrhoea. Experiencing a non-chronic health problem other than the most prevalent infectious diseases among children constitutes our fourth measure of well-being. Lastly, as comorbidity might be common, we compute a disease score for children by summing up the number of diseases they endured in that period.

4.3.2. Assessment of Maternal Depression

The prevalence of maternal depression is assessed by using the standardised eight-item version of the Patient Health Questionnaire (PHQ-8), inclusive of both emotional and somatic aspects (Kroenke et al., 2009). Among the many diagnostic tools developed in the last decades, PHQ is the first self-assessed questionnaire intended for use in general practice that genuinely identifies certain conditions using criteria from the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* (American Psychiatric Association, 2000). As a globally reliable and validated instrument, PHQ measures have been translated into over 60 languages to capture depressive disorders in general populations and clinical settings (Barrera et al., 2017; Razykov et al., 2012).

PHQ-8 addresses eight out of the nine criteria for diagnosing depressive episodes based on *DSM-IV* (American Psychiatric Association, 2000). The ninth item that is omitted in PHQ-8 evaluates the presence of suicidal or self-harming thoughts.

However, literature suggests that since only a very limited portion of the general population is at risk of suicide, excluding the ninth item results in an insignificant impact on the total score for depression. (Shin et al., 2019) Comparing the accuracy of PHQ-8 and PHQ-9 for capturing depressive disorders, studies report a correlation of 0.997 between these two measures (Razykov et al., 2012; Wu et al., 2020). Both governmental health departments and the recent literatures employ PHQ-8 instead of PHQ-9 to capture the severity of depressive symptoms to prevent the overestimation of suicidal risk based on item 9 (Kroenke et al., 2009).

As a subsection of the THS, PHQ-8 asks the following questions “Over the last two weeks, how often have you been bothered by [1] Little interest or pleasure in doing things; [2] Feeling down, depressed or hopeless; [3] Trouble falling or staying asleep, or sleeping too much; [4] Feeling tired or having little energy; [5] Poor appetite or overeating; [6] Feeling bad about yourself – or that you are a failure or have let yourself or your family down; [7] Trouble concentrating on things, such as reading the newspaper or watching television; [8] Moving or speaking so slowly that other people could have noticed or the opposite – being so fidgety or restless that you have been moving around a lot more than usual?” (Kroenke et al., 2009). On a four-point Likert scale between 0 and 3, individuals are asked to rate the frequency of each depressive symptom that they had in the last two weeks (where 0 = Not at all, 1 = Several days, 2 = More than a week, 3 = Almost every day). Adding up the frequencies of each item yields a total depression score between 0 and 24 points. While a total score of 0 to 4 portrays no significant depressive symptoms, any total score greater than 5 represents different degrees of severity in depressive symptoms: 5 to 9, mild depressive symptoms; 10 to 14, moderate; 15 to 19, moderately severe, and 20 to 24, severe (Kroenke et al., 2001). A cut-point of 5 is used to create a binary measure for maternal depression where it takes the value of 1 for mothers whose depression score is greater than 5 (mildly, moderately, moderately severely or severely depressed) and 0 otherwise (no depressive symptoms).

4.3.3. Sociodemographic Variables

Child, maternal and household characteristics are the potential confounders that affect the relationship between maternal poor mental health and infectious disease morbidity among children. These include the age and gender of the child, day-care centre attendance, breastfeeding status; household size, female headship²⁸, number of siblings under 6 years old; maternal age at birth, maternal education, marital status, employment, household income and region. However, the questionnaire does not provide information on family income for all individuals. In our sample, the wealth index is missing for 73 per cent of children between the ages of 1 to 5. Since those who do not report their income levels might differ from others, losing three-quarters of observations would lead to biased estimates. In addition, since health and income are strongly interrelated (Ettner, 1996; Fuchs, 2004), including them both in the analysis would complicate the identification of the individual effect of maternal mental health. Previous literature suggests that the effect of low socio-economic status is rather weak in explaining the infant physical health (Rahman et al., 2004). Also, by studying the relationship between household income and child health in the UK where health-care is publicly funded, Propper et al. (2007) finds no effect of income on child's physical health once maternal health, especially mental health, is controlled. Though as a developing country, it differs from the UK, health-care is publicly available for all children in Turkey as well. Therefore, we believe excluding the wealth index from our analysis would not diminish the robustness of our findings.

4.4. Methodology

For our analysis of the relationship between maternal depressive symptoms and children's physical health, we apply the following linear probability model (LPM) for each outcome variable, y_i :

$$y_i = \beta_0 + CC_i\beta_1 + HH_i\beta_2 + MC_i\beta_3 + \beta_4 MDepr_i + MDepr_i * MEdu_i\beta_5 + R_i\beta_6 + \varepsilon_i \quad (4.1)$$

²⁸ Based on the respondents' answers, the THS questionnaire identifies the head of the family for each household. A female headship in the family might represent single motherhood, and consequently a potential financial and/or social hardship.

where y_i denotes the health outcomes of interest for the child i , namely the parent assessed health, having anaemia, contracting ARI and/or diarrhoea, having other non-chronic illnesses, suffering from any common communicable diseases, and the number of short-term illnesses that the child suffered from prior to the survey. The vector CC_i stands for the characteristics of child i whereas HH_i portrays the household aspects. MC_i is the vector representing maternal features of child i . The binary variable $MDepr_i$ is an indicator of maternal depression which takes the value of 1 if the mother scored higher than 5 points in her PHQ-8 assessment, and 0 otherwise. The vector $MDepr_i * MEdu_i$ represents the interaction variables constructed by the product of maternal depression and three levels of schooling. It specifies the potential protective role of maternal education against the detrimental effects of maternal depression on child's well-being. We also control for the region fixed effects with the categorical variable R_i provided in 12 regions since some infections might be more common in certain parts of the country due to weather conditions or maternal hardship might be more pronounced in particular areas. Lastly, the vector ε_i shows the robust error terms for each child i .

Since we are simultaneously testing for multiple hypotheses, the uncorrected p-values might lead to the over-rejection of null hypotheses (Romano and Wolf, 2005a). In order to tackle this issue, it is crucial to manage the family-wise error rate (FWER), representing the likelihood of erroneously rejecting at least one valid null hypothesis at a predetermined significance level. Therefore, in addition to the traditional hypothesis testing methods, we use the Romano-Wolf multiple hypothesis testing technique to obtain stepdown adjusted p-values via bootstrap sampling (Clarke et al., 2020).

4.5. Results

4.5.1. Descriptive Statistics Results

The summary statistics for variables used in the analysis are presented in Table 4.1. Our sample consists of 1,858 children between the ages of 1 and 5 with relatively equal shares of girls and boys who are 3 years old on average. Almost all mothers reported breastfeeding their children. One-fourth of our sample attends day-care centres. The

average household size and the number of siblings are estimated as 4.4 and 1.4 people, respectively. In the 12 per cent of our sample, women are the head of the family where this rate is 15 per cent among families of depressed mothers and 10 per cent for others.

Table 4.1: Baseline characteristics of the THS 2019 study population.

Variables	Unit	All		By Maternal Depression			
		Mean	SD	Depressed	Not depressed	Diff.	p val.
				Mean	Mean		
Child characteristics							
Age	Years	3.021	1.432	3.048	3.011	0.037	0.625
Female	1=female; 0=male	0.484	0.500	0.480	0.485	-0.005	0.846
Breastfed	1=yes; 0=no	0.972	0.165	0.974	0.971	0.003	0.727
Day-care centre attendance	1=yes; 0=no	0.269	0.443	0.246	0.277	-0.031	0.181
Household characteristics							
Household size	Number	4.421	1.530	4.508	4.388	0.119	0.135
Female headship	1=yes; 0=no	0.117	0.321	0.155	0.103	0.052*	0.002
No. of siblings	Number	1.371	1.214	1.474	1.333	0.141*	0.026
No. of siblings under 6 years	Number	0.481	0.642	0.470	0.485	-0.015	0.655
Maternal characteristics							
Mother's age	Years	31.799	5.880	32.085	31.693	0.393	0.201
Mother's age at birth	Years	28.778	5.801	29.038	28.682	0.356	0.240
Mother's years of schooling	Years	8.167	4.914	7.504	8.414	-0.910***	0.000
Highest degree completed:							
Primary school or less	1=yes; 0=no	0.379	0.485	0.435	0.359	0.076**	0.003
Middle school	1=yes; 0=no	0.228	0.420	0.240	0.224	0.016	0.457
High school or above	1=yes; 0=no	0.392	0.488	0.325	0.417	-0.092***	0.000
Mother is married	1=yes; 0=no	0.983	0.130	0.970	0.987	-0.017*	0.011
Mother is employed	1=yes; 0=no	0.208	0.406	0.206	0.209	-0.003	0.900
Mother is depressed	1=yes; 0=no	0.271	0.445				.
Child health measures							
Mother assessed health	1=good; 0=poor	0.920	0.272	0.887	0.932	-0.045**	0.001
Anaemia	1=yes; 0=no	0.079	0.270	0.097	0.072	0.025	0.078
Acute respiratory infection (ARI) ^a	1=yes; 0=no	0.270	0.444	0.306	0.256	0.049*	0.033
Diarrhoea	1=yes; 0=no	0.322	0.468	0.373	0.304	0.069**	0.004
ARI and/or diarrhoea	1=yes; 0=no	0.461	0.499	0.516	0.440	0.076**	0.004
Other non-chronic diseases ^b	1=yes; 0=no	0.195	0.396	0.244	0.177	0.068**	0.001
All non-chronic diseases ^c	1=yes; 0=no	0.525	0.500	0.591	0.500	0.091***	0.000
Disease score	Number	0.890	1.081	1.077	0.821	0.257***	0.000
N		1858		504	1354		

^a ARI includes both upper (such as tonsillitis, ear infection, pharyngitis, etc.) and lower (such as bronchitis, pneumonia, etc.) respiratory infections.

^b Other non-chronic diseases include urinary tract infection (UTI), chickenpox, anaemia, vitamin D deficiency, dermatological problems, etc.

^c All non-chronic diseases include ARI, diarrhoea, UTI, chickenpox, anaemia, vitamin D deficiency, dermatological problems, etc.

*** p<0.01, ** p<0.05, * p<0.1

The mean maternal age at birth of the respective child is 28 years.²⁹ The mean value of maternal education is estimated as 8.17 years where 38 per cent of the mothers have low levels of education, *i.e.*, no formal education or at most primary school education, 23 per cent have a middle school degree, and 39 per cent completed at least high school. According to the PHQ-8 measures, 27 per cent of mothers exhibit mild to severe depressive symptoms. Depressed mothers completed 0.9 fewer years of schooling compared to not depressed mothers. Consequently, high school or university graduation rates are lower among those who suffer from poor mental health. One-fifth of mothers actively participate in the labour force.

Depressed mothers being slightly less likely than not depressed mothers to assess their children's general health status as 'very good', on average only 8 per cent of children in our sample is reported to have poor health. Similarly, anaemia is reported at the same frequency as poor health, with children of depressed mothers suffering from it at a 3 per cent higher rate than others. Over one-fourth of children got infected with ARI while one-third of them experienced diarrhoea in the recent past. Other than the most common infectious diseases, non-chronic health problems such as urinary tract infection, chickenpox, anaemia, vitamin D deficiency, *etc.* affected 20 per cent of the children under five. Approximately half of the children in our sample suffered from at least one infectious disease and/or non-chronic health condition prior to the survey. In any group of infectious diseases, children whose mothers are depressed are reported morbidity at a higher ratio than those children whose mothers do not exhibit depressive symptoms.

²⁹ We must note that the mean maternal age at birth of the respective child should not be confused with the mean maternal age at first birth (calculated as 24.5 years with 5.1 years being the standard deviation) which could be different for women who have older children. Around 35 per cent of our sample has 6- to 24-year differences between births.

Table 4.2: Effect of maternal depression on child general health and anaemia among children between 1 and 5 years old.

Variables	Mother-assessed Health				Anaemia			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	-0.014*** (0.004)	-0.014*** (0.004)	-0.014*** (0.004)	-0.017*** (0.006)	-0.003 (0.004)	-0.003 (0.004)	-0.003 (0.004)	-0.007 (0.006)
Female	0.028** (0.012)	0.030** (0.012)	0.030** (0.012)	0.030** (0.012)	-0.021* (0.013)	-0.022* (0.013)	-0.023* (0.013)	-0.023* (0.013)
# of siblings under 6 years old.	0.019* (0.010)	0.019* (0.010)	0.019* (0.010)	0.019* (0.010)	-0.009 (0.010)	-0.009 (0.010)	-0.009 (0.010)	-0.009 (0.010)
Female headship	-0.026 (0.022)	-0.025 (0.022)	-0.025 (0.022)	-0.025 (0.022)	-0.027 (0.018)	-0.027 (0.018)	-0.027 (0.018)	-0.028 (0.018)
Mother's age at birth	0.002** (0.001)	0.002** (0.001)	0.002* (0.001)	0.002** (0.001)	-0.002 (0.001)	-0.002 (0.001)	-0.002 (0.001)	-0.002 (0.001)
Mother is depressed	-0.038** (0.015)	-0.060** (0.026)	-0.060** (0.026)	-0.060** (0.026)	0.023 (0.015)	0.054** (0.025)	0.054** (0.025)	0.054** (0.025)
<i>Interactions^a:</i>								
Middle sch * depression		-0.021 (0.044)	-0.021 (0.044)	-0.022 (0.044)		-0.048 (0.040)	-0.048 (0.040)	-0.048 (0.040)
High educ * depression		0.078** (0.033)	0.077** (0.033)	0.078** (0.033)		-0.055 (0.034)	-0.055 (0.034)	-0.055 (0.034)
<i>Maternal education^b:</i>								
Middle school	0.025 (0.020)	0.031 (0.021)	0.031 (0.021)	0.030 (0.021)	-0.010 (0.019)	0.005 (0.022)	0.005 (0.022)	0.003 (0.022)
High school or college	0.046*** (0.015)	0.026 (0.016)	0.024 (0.017)	0.022 (0.017)	-0.023 (0.016)	-0.008 (0.017)	-0.005 (0.018)	-0.014 (0.018)
Mother is working			0.007 (0.015)				-0.010 (0.017)	
Day-care centre attendance				0.019 (0.019)				0.025 (0.019)
Constant	0.853*** (0.050)	0.858*** (0.050)	0.859*** (0.050)	0.865*** (0.051)	0.206*** (0.051)	0.195*** (0.051)	0.195*** (0.051)	0.204*** (0.053)
<i>Controlled for</i>								
Region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,858	1,858	1,858	1,858	1,858	1,858	1,858	1,858
R-squared	0.031	0.035	0.035	0.036	0.016	0.018	0.018	0.019

^a Base group for factor variables consists of depressed mothers with low levels of education.

^b Base group for maternal education consists of mothers with low levels of education.

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.10.

4.5.2. LPM Results

4.5.2.1. Maternal Depression and Child Physical Health

We begin analysing the relationship between maternal depression and child's well-being by first building our model on explicitly exogenous variables such as age, gender, and region of residence. After that, to avoid any potential endogeneity between variables, we gradually integrate each additional explanatory variable into our base analysis.³⁰ As there are only minor variations in the breastfeeding and maternal marital status values across individuals in our sample (mean values over 97 and 98 per cent, respectively), we exclude these variables in the analysis. Once our model is progressively established, Table 4.2 shows the main results for the regression in Equation (4.1), representing the effect of maternal depression on the mother-assessed child general health and anaemia among children between 1 and 5 years old.

When we check for the effects of maternal depression, our results represent a significantly detrimental effect of poor maternal mental health on the general health status of children. The significant effect of mother's poor mental health remains significant when we control for other maternal characteristics by gradually introducing them into our analysis. Having a mother with depressive symptoms decreases the probability of being in a good health condition by 6 percentage points. However, one concern could be that due to the nature of depression, distressed mothers might assess their children's overall well-being more negatively than non-depressed mothers. In order to mitigate this potential reporting bias, we employ iron deficiency anaemia as a less subjective health measure, and a similar impact is estimated for the risk of anaemia which increases by 5 percentage points if the mother is depressed.

³⁰ Complete tables for the seven separate regressions for each child health outcome, 56 regression models in total, are available upon request.

Table 4.3: Effect of maternal depression on infectious disease morbidity among children between 1 and 5 years old.

Variables	Acute Respiratory Infection (ARI)				Diarrhoea			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	0.004 (0.007)	0.004 (0.007)	0.003 (0.007)	-0.012 (0.009)	-0.044*** (0.007)	-0.044*** (0.007)	-0.044*** (0.007)	-0.056*** (0.009)
Female	0.012 (0.020)	0.011 (0.021)	0.012 (0.021)	0.010 (0.020)	-0.022 (0.021)	-0.021 (0.021)	-0.021 (0.021)	-0.022 (0.021)
# of siblings under 6 years	-0.030* (0.017)	-0.029* (0.017)	-0.029* (0.017)	-0.029* (0.017)	0.006 (0.019)	0.006 (0.019)	0.006 (0.019)	0.006 (0.019)
Female headship	0.021 (0.033)	0.020 (0.033)	0.019 (0.033)	0.017 (0.033)	-0.004 (0.033)	-0.005 (0.033)	-0.005 (0.033)	-0.007 (0.033)
Mother's age at birth	-0.004** (0.002)	-0.004** (0.002)	-0.004** (0.002)	-0.004** (0.002)	-0.010*** (0.002)	-0.010*** (0.002)	-0.010*** (0.002)	-0.010*** (0.002)
Mother is depressed	0.059** (0.024)	0.079** (0.034)	0.079** (0.034)	0.080** (0.034)	0.087*** (0.025)	0.071* (0.036)	0.071* (0.036)	0.072** (0.036)
<i>Interactions^a:</i>								
Middle sch * depr		0.019 (0.060)	0.020 (0.060)	0.017 (0.060)		0.043 (0.064)	0.043 (0.064)	0.042 (0.064)
High educ * depr		-0.069 (0.055)	-0.071 (0.055)	-0.068 (0.055)		0.015 (0.057)	0.015 (0.057)	0.016 (0.056)
<i>Maternal education^b:</i>								
Middle school	0.045 (0.029)	0.040 (0.033)	0.040 (0.033)	0.035 (0.033)	0.066** (0.031)	0.053 (0.035)	0.053 (0.035)	0.050 (0.035)
High school or college	0.134*** (0.025)	0.151*** (0.028)	0.138*** (0.029)	0.129*** (0.029)	0.096*** (0.025)	0.091*** (0.028)	0.088*** (0.030)	0.075** (0.030)
Mother is working			0.048* (0.028)				0.013 (0.029)	
Day-care centre attendance				0.090*** (0.030)				0.066** (0.031)
Constant	0.305*** (0.075)	0.300*** (0.075)	0.304*** (0.075)	0.333*** (0.076)	0.690*** (0.080)	0.697*** (0.080)	0.697*** (0.080)	0.721*** (0.081)
<i>Controlled for</i>								
Region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,858	1,858	1,858	1,858	1,858	1,858	1,858	1,858
R-squared	0.033	0.034	0.036	0.039	0.062	0.063	0.063	0.065

Notes: Ibid.

Turning to our third outcome of interest, common childhood disease morbidity among children under five, our results highlight the importance of maternal mental health as a significant predictor of infectious disease prevalence. Children of mothers with emotional distress are 8 percentage points more likely to contract ARI and 7 percentage points more likely to suffer from diarrhoea (Table 4.3). Similar to child general health, older maternal age at birth reduces the incidences of both diseases. Medical studies report a similar finding, especially for childhood respiratory diseases for which young maternal age poses a substantial risk factor (Bråbäck et al., 2003; Laerum et al., 2007; Sherriff et al., 2001).

Next, we group respiratory infections and diarrhoea into one variable to analyse the association between poor maternal mental health and contagious childhood diseases. In addition, we also check for other common non-chronic illnesses such as urinary tract infection, chickenpox, iron deficiency anaemia, vitamin D deficiency and dermatological problems along with a disease score generated from the total number of short-term illnesses, including the common infections, that the child recently contracted. Table 4.4 shows the regression results for these three outcome variables.

Children are at a significantly higher risk for common infections and other short-term illnesses if their mother suffers from emotional distress. Controlling for other factors, our findings suggest that poor maternal mental health aggravates the probability of catching respiratory diseases or diarrhoea as well as other non-chronic illnesses by 12 and 7 percentage points, respectively. Maternal depression also stands as a significant predictor of the sum of short-term diseases. The total number of non-chronic illnesses a child falls victim to increases by one-third if the mother portrays depressive symptoms.

Potential pathways through which maternal depression influences child physical health encompass adopting a lifestyle that is less conducive to well-being and decreased efforts to seek health care for their children. Because of the certain characteristics of depression such as lack of motivation and energy, depressed mothers might have difficulties in providing disease preventive activities while practicing child-care, for instance, frequent hand-washing, food preparation and storage, *etc.*, which would worsen the morbidity of childhood diseases, especially anaemia, ARI, and diarrhoea. In addition, deficiency in appropriate care-seeking behaviour might result in increased

suffering for children of depressed mothers. Though we cannot test these mechanisms directly, the Turkish Family Medicine System minimises the probability of a potential difference in health-care seeking and utilisation between depressed and healthy mothers.

In Turkey, children under the age of 18 are covered by the General Health Insurance and their premiums are paid by the state, regardless of their parents' registration. Therefore, all children in our sample have health insurance and a comprehensive free access to all healthcare services. Moreover, as the foundational element of healthcare, the Ministry of Health has initiated a "Healthy Child Monitoring" programme since 2007. It provides publicly funded family medicine and general health services and offers a *mandatory* child health monitoring both to the expectant mothers and all children starting from the prenatal period on a regular basis (Republic of Turkey, Ministry of Health, n.d.). These services involve overseeing the growth and development of all children, assessing their health, and providing preventive measures such as vaccinations and health education. Specifically, children between the ages of 1 and 3 receive a complete systematic medical evaluation including general health and anaemia status, common infections along with urinary tract infection, skin conditions and other communicable diseases every 6 months while pre-schoolers (age 4 to 6) get yearly follow-ups. These easily accessible regular health exams would reduce the burden on the mothers while utilising healthcare services for their children. In addition, by evaluating iron deficiency anaemia, infectious disease morbidity and other common illnesses, the family medicine centres provide health measures which are less subjective to the potential maternal reporting biases other than mother-assessed general health status of children.

Table 4.4: Effect of maternal depression on the physical health of children between 1 and 5 years old.

Variables	ARI and/or Diarrhoea				Other non-chronic illnesses ^c				Disease Score			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Age	-0.028*** (0.008)	-0.029*** (0.008)	-0.029*** (0.008)	-0.049*** (0.010)	0.003 (0.006)	0.003 (0.006)	0.003 (0.006)	-0.005 (0.008)	-0.028 (0.017)	-0.029* (0.017)	-0.029* (0.017)	-0.068*** (0.022)
Female	-0.012 (0.023)	-0.014 (0.023)	-0.013 (0.023)	-0.014 (0.023)	-0.017 (0.018)	-0.018 (0.018)	-0.019 (0.019)	-0.018 (0.018)	-0.013 (0.049)	-0.016 (0.049)	-0.015 (0.049)	-0.016 (0.049)
# of siblings under 6 years	-0.004 (0.019)	-0.004 (0.019)	-0.004 (0.019)	-0.004 (0.019)	-0.003 (0.015)	-0.002 (0.015)	-0.002 (0.015)	-0.002 (0.015)	-0.030 (0.044)	-0.028 (0.044)	-0.028 (0.044)	-0.029 (0.044)
Female headship	0.017 (0.036)	0.015 (0.036)	0.015 (0.036)	0.011 (0.036)	-0.011 (0.029)	-0.013 (0.029)	-0.013 (0.029)	-0.015 (0.029)	0.031 (0.077)	0.026 (0.077)	0.026 (0.077)	0.019 (0.077)
Mother's age at birth	-0.008*** (0.002)	-0.008*** (0.002)	-0.008*** (0.002)	-0.008*** (0.002)	-0.005** (0.002)	-0.005** (0.002)	-0.004** (0.002)	-0.005** (0.002)	-0.023*** (0.005)	-0.023*** (0.005)	-0.023*** (0.005)	-0.023*** (0.005)
Mother is depressed	0.094*** (0.026)	0.116*** (0.040)	0.116*** (0.040)	0.118*** (0.039)	0.071*** (0.022)	0.060* (0.034)	0.060* (0.034)	0.061* (0.034)	0.286*** (0.060)	0.284*** (0.092)	0.284*** (0.092)	0.287*** (0.092)
<i>Interactions^a:</i>												
Middle sch * depr		0.030 (0.066)	0.030 (0.066)	0.028 (0.066)		0.086 (0.057)	0.086 (0.057)	0.086 (0.057)		0.193 (0.156)	0.193 (0.156)	0.189 (0.156)
High educ * depr		-0.084 (0.060)	-0.086 (0.060)	-0.083 (0.060)		-0.027 (0.050)	-0.026 (0.050)	-0.027 (0.050)		-0.123 (0.137)	-0.124 (0.137)	-0.121 (0.137)
<i>Maternal education^b:</i>												
Middle school	0.074** (0.033)	0.066* (0.038)	0.066* (0.038)	0.060 (0.038)	-0.042 (0.027)	-0.068** (0.030)	-0.068** (0.030)	-0.070** (0.030)	0.048 (0.074)	-0.008 (0.080)	-0.008 (0.080)	-0.019 (0.080)
High school or college	0.160*** (0.027)	0.181*** (0.031)	0.173*** (0.032)	0.153*** (0.032)	-0.011 (0.023)	-0.006 (0.025)	0.001 (0.027)	-0.018 (0.027)	0.231*** (0.061)	0.259*** (0.066)	0.253*** (0.069)	0.202*** (0.070)
Mother is working			0.030 (0.031)				-0.026 (0.025)				0.021 (0.065)	
Day-care centre attendance				0.113*** (0.033)				0.045 (0.028)				0.224*** (0.075)
Constant	0.723*** (0.083)	0.718*** (0.084)	0.720*** (0.084)	0.759*** (0.084)	0.349*** (0.072)	0.355*** (0.072)	0.354*** (0.072)	0.372*** (0.073)	1.536*** (0.189)	1.545*** (0.189)	1.547*** (0.189)	1.626*** (0.192)
<i>Controlled for</i>												
Region	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,858	1,858	1,858	1,858	1,858	1,858	1,858	1,858	1,858	1,858	1,858	1,858
R-squared	0.056	0.058	0.058	0.064	0.022	0.024	0.025	0.026	0.048	0.050	0.051	0.056

Notes: Ibid.^c Such as UTI, chickenpox, iron deficiency anaemia, vitamin D deficiency, and dermatological problems.

4.5.2.2. Does Maternal Education Play a Protective Role?

Observing the detrimental effects of maternal emotional distress, we check whether the mother's level of schooling can play a protective role in children's physical health. We find that compared to children whose mothers have low levels of education, those with higher levels of maternal schooling are healthier and less likely to be anaemic. The coefficients of the interaction variables between mother's depression and level of schooling highlight the importance of maternal education even further as it provides a layer of protection against the damaging effects of maternal depression. The coefficient of 8 percentage points reveals that, despite having depressive episodes, mothers who graduated from high school or university manage their distress better than mothers with lower levels of education. Thus, they do not allow their poor mental health to fully reflect on and harm their children's well-being.

Similarly, for infectious disease morbidity, our results demonstrate the barrier that maternal education provides against the aftermath of poor maternal mental health.³¹ While maternal depression increases the likelihood of contracting infectious diseases by 12 percentage points, completing at least high school decreases the burden of emotional distress on children's health by 8 points ($p\text{-value} < 0.16$). The protective role of maternal education is also present when we check for the total number of recent illnesses. Although having a depressed mother increases the number of short-term diseases that the child recently suffered from by 30 per cent, the mother's graduation from high school or college reduces this damaging impact of maternal depression to 18 per cent. Thus, our findings hint for the layer of protection that higher levels of

³¹ Analysing the effect of maternal education on infectious disease prevalence, however, we find that having a mother who completed at least high school increases the probability of the child contracting an infectious disease. When we check for the potential channel behind this surprising adverse finding (in order to prevent higher levels of endogeneity, we include maternal employment and kindergarten attendance in separate regressions, see Tables 4.2-4.4.), our results point at the day-care centres which raises the incidence of respiratory infections and diarrhoea by 9 and 7 percentage points, respectively. In Turkey, public kindergartens are free for children completing 37 months of age. This policy supports female employment as women with higher levels of education are more likely to participate in the labour market. Confirming our explanation, maternal employment is a significant predictor of infections among children. In addition, even if they do not opt for employment, better-educated mothers are more aware of the benefits that the day-care centres provide to their children's cognitive, social, and behavioural development. These two motives result in children attending kindergartens where they catch infectious diseases more often than the children who stay at home (Hashimoto and Hashimoto, 2016; Kværner et al., 2000).

maternal education provide against the detrimental effects of poor maternal health on children's physical well-being.

4.5.2.3. Multiple Hypothesis Testing

Finally, as we test for multiple hypotheses simultaneously, in order to account for the over-rejection of null hypotheses, we calculate the Romano-Wolf step-down adjusted p-values. Table 4.5 presents robust and consistent p-values along with the traditional estimates. The corrected p-values obtained by the Romano-Wolf technique confirm our initial findings regarding the detrimental effects of maternal depression on the physical health outcomes of under-five children.

Table 4.5: P-values for the effect of maternal depression on the physical health measures of children between 1 and 5 years old.^a

	Mother-assessed health	Anaemia	ARI	Diarrhoea	ARI and/or Diarrhoea	Other non-chronic illnesses	Disease Score
Original p-value	0.022	0.030	0.019	0.046	0.003	0.074	0.002
Romano-Wolf p-value	0.093	0.093	0.093	0.097	0.018	0.097	0.013

^a For each outcome variable, the model used for the Romano-Wolf multiple hypothesis testing employs maternal depression as the treatment variable and controls for age, gender, number of children under 6 years old, female headship, maternal age at birth, maternal education, interaction variables for maternal depression and education, day-care centre attendance and region, the error terms are robust. Number of bootstrap replications is selected as 900.

4.6. Discussion

The nature of the burden is caused by two main factors, namely the maternal depression itself and the subsequent shortcomings in parenting qualities which result in negative childhood outcomes. Therefore, our policy recommendations aim at first decreasing the risk of the main contributor, the mother's emotional stress, and second, supporting healthy child-care practices. Recognising the existence of maternal depression constitutes the first step in improving the emotional well-being of mothers. Following the diagnosis, depending on its level of severity, depression can be efficiently treated by several types of interventions such as counselling, group therapy, cognitive behavioural therapy, or antidepressant usage (WHO, 2008) As perinatal depression is common, medication might not be the most preferred or the available

option for women which leaves psychosocial interventions as the first line of treatment. Therefore, as the first strategy, incorporating psychiatric care into standard maternal and paediatric health-care services can increase the accessibility to and availability of mental health treatments in developing countries and reduce the prevalence, duration, and severity of maternal depression. For instance, in Chile, economically disadvantaged mothers received complete intervention including medication and psychotherapy along with behavioural and cognitive education. The results suggest that treatment options are effective even in unfavourable conditions and at primary-care levels (Rojas et al., 2007).

For the second factor, interventions target enhancing the interaction between parents and children to promote better parenting qualities. In this regard, regular home visits or behavioural programs are well-proven on a wide scale. For instance, in Pakistan women with perinatal depression are clustered into two groups where the first group receives regular home visits from professionals while the control group receives home visits with the same frequency yet from community-based health workers. The results suggest improved mental health among depressed mothers without significant differences between the two groups (Rahman et al., 2008). In addition, *Triple P - Positive Parenting Program*, used in over 30 countries in the world, teaches not only mothers but also fathers cognitive behavioural therapy practices to enhance the child-parent connection (Goodman and Garber, 2017). Suggested strategies are expected to provide improvements in both factors, interchangeably.

4.7. Conclusion

In this study, we employ the novel Romano-Wolf multiple hypothesis testing method to investigate the relationship between mild to severe maternal depression and physical wellness of children under five years of age in Turkey. This is an under-researched area of particular importance for developing countries since common infectious diseases along with other non-chronic illnesses are more common in LMICs compared to high-income countries. To our knowledge, this is the first study to test the association between mother's emotional distress and child physical health measures in Turkey. We control for child, household and maternal characteristics, and further check for the potential protective role of maternal education against the detrimental effects of maternal distress on child health. Over one-fourth of mothers in our sample

represent mild to severe depressive symptoms. Our results suggest that children of depressed mothers are 6 percentage points less likely to be assessed as ‘healthy’ and 5 percentage points more at risk of suffering from anaemia. In addition, poor maternal mental health puts children at a higher risk for common infectious diseases such as ARI and diarrhoea along with other non-chronic childhood illnesses such as chickenpox, mumps, and vitamin D deficiency by 12 and 6 percentage points respectively. The total number of diseases that the child falls victim to increases by one-third if the mother suffers from emotional distress.

Our results also emphasise the importance of maternal education as a protective factor against the consequences of poor maternal health. We find that completing at least high school enables mothers to be better in charge of the extent of their depressive symptoms and reduces the burden of a mother’s emotional distress on her child’s well-being by 8 percentage points. Lastly, our analysis points to day-care centre attendance as a risk factor for increased susceptibility to communicable diseases. Children attending these facilities, at an age where their immune systems are not strong enough, face greater frequencies of infectious diseases than those staying at home (Hernández et al., 1999).

Our findings provide new evidence on the importance of mother-child interactions for child physical health in a developing country context and show that the debilitating effect of maternal depression is not limited to the mother herself, but it also transmits to the next generation by affecting the child’s health, a major determinant of future outcomes (Almond and Currie, 2010). The fact that mothers’ emotional distress is a preeminent issue that greatly contributes to the global burden of diseases, it becomes particularly important to develop sound policies to tackle this burden, especially in developing countries where capacities are scarce.

5. DOUBLE LOCKDOWN: UNRAVELLING THE IMPACT OF AGE-TARGETED COVID-19 RESTRICTIONS ON SENIOR WOMEN'S HEALTH

5.1. Introduction

Emerging in late 2019, the global number of COVID-19 cases which is caused by SARS-COV2 virus, escalated at a concerning rate in the subsequent months. This rapid human-to-human transmission led the WHO (2024) to designate the outbreak as a global pandemic in March 2020. Characterised by a respiratory illness with varying levels of severity, as of today, COVID-19 has affected over 704 million individuals globally, resulting in more than 7 million fatalities. In Turkey, the 11th highest total cases worldwide, 17 million people have been infected, leading to 102,174 deaths (Worldometer, 2024).

While the virus presented a threat for everyone, the pandemic demonstrably impacted certain populations more severely. Individuals suffering from chronic conditions, such as respiratory illnesses, heart problems, diabetes and obesity, faced a significantly higher risk of COVID-19 complications (CDC, 2023; Guerrero and Wallace, 2021). This vulnerability was particularly more pronounced among the elderly population as their weakened immune systems and age-related health complications made them more susceptible to severe illnesses, hospitalisation, and mortality due to the infection (Mueller et al., 2020). Indeed, over 81 per cent of deaths due to the disease were among people over the age of 65, and this age group experienced a mortality rate which was 97 times higher than those aged 18-29 (CDC, 2023). Similar to the US trends, available data on Turkey also suggests that seniors represent 11.3 per cent of the affected population, however, they account for 72.5 per cent of total deaths. Their fatality rate is 38.1 per cent while the mortality rates among the younger (those between 24-49 years old) and middle (between 50-64 years old) age groups are calculated as 0.7 per cent and 6.6 per cent, respectively (Uçar et al., 2020). Consequently, starting from the outbreak of the pandemic, COVID-19 was treated as

an urgent health concern which primarily affects the elderly population (Tyrrell and Williams, 2020).

The unavailability of vaccines in the initial stages of the pandemic required non-pharmaceutical strategies for controlling the transmission of the virus and safeguarding the vulnerable populations. Governments worldwide implemented a range of social distancing measures including lockdowns, mask mandates, and limitations on gatherings as well as protection programs to isolate and support the high-risk groups (Colucci et al., 2022). After the initial COVID-19 case on March 11, 2020, Turkish government implemented several precautions, and frequently adjusted its policies based on the severity of the pandemic (*e.g.*, lockdowns, social distancing protocols, mask mandates, *etc.*). Given a specific focus on the elderly as the high-risk population, starting from March 21, 2020, seniors above 65 were imposed a strict curfew for a prolonged period. Public compliance with the mandated movement restrictions were incentivised by the significant financial penalties levied on those who did not comply. These strict curfews, among the longest implemented globally in response to COVID-19, remained in place until July 2021 in an effort to curb mortality rates.³²

While prioritising the infectious disease control was a necessary public health response, chronic health problems such as cardiovascular and metabolic diseases are largely neglected. Although lockdowns unintentionally contributed to a decrease in physical activity among all age groups, older individuals are affected the most by these restrictions. The already disadvantageous position of the elderly deteriorated even further in Turkey when the government implemented the age-targeted COVID-19 restrictions for over a year. This study aims to analyse how those restrictions affected the chronic health conditions of seniors, with a special focus on cardiovascular and metabolic diseases which are the main factors of mortality (*e.g.*, coronary heart disease, myocardial infarction, diabetes, obesity, *etc.*).

We use a difference-in-differences (DiD) method to examine the causal impact of the curfews due to pandemic on the physical health of women over 65 years old. Data on COVID-19 suggests a notable gender disparity in mortality outcomes where fatality rates are nearly twice as high for senior men compared to women, 49 and 29 per cent,

³² See Section 5.2 for a more detailed timeline and information and on COVID-19 measures implemented in Turkey.

respectively (Uçar et al., 2020).³³ Therefore, to mitigate the potential bias driven by selective mortality, we solely focus on elderly females in our analysis. We utilise the 2014, 2016, 2019 and 2022 rounds of the THS. The observations from 2022 dataset are considered to be affected from the pandemic conditions; the control group includes the individuals between 60 and 64 years old while the treatment group includes the individuals who are over 65. We also examine the common trends assumptions for each specification and ensure the validity of our findings.

Employing a DiD approach, we find that the age-specific curfew measures affect the physical health of senior women negatively. Our results indicate that strict curfew on the elderly cause an escalation in chronic health problems. Morbidity of coronary heart diseases is significantly higher among the affected women. In addition, they suffer from a significant increase in BMI and become more physically and mentally dependent in doing the activities of daily living.

Our study contributes to the literature in several ways. While the negative consequences of social and physical isolation on health are widely recognised, existing research often faces limitations. Many prior studies may struggle to account for the possibility of reverse causality. This means factors like a person's overall health or individual preferences on confinement due to the pandemic could influence both their isolation and health outcomes, making it challenging to establish a clear cause-and-effect relationship. Our study addresses this by analysing the impact of an external event - a mandatory lockdown - on various health indicators. This approach allows us to more rigorously assess the causal link between reduced social and physical activity due to isolation and its impact on physical health.

Second, our findings help fill the gap in the literature on the effects of prolonged isolation on physical health indicators. The majority of previous literature focuses on mental health outcomes of the pandemic and physical health indicators, such cardiovascular or metabolic diseases and dependence in activities of daily living, received less attention since these are slower to respond to the immediate global shocks compared to mental health. The existing studies examining the physical health responses are mostly in the area of medicine, therefore both the sample sizes and the

³³ Authors' calculations based on available data provided by Uçar et al. (2020) on <https://turcovid19.com/acikveri/>.

study groups are limited. The cross-sectional THS questionnaires provide a much broader dataset with a rich set of physical health indicators.

Lastly, our research sheds light on the potential hidden costs of lockdown measures. If these restrictions implemented to protect public health inadvertently create a physical health crisis by increasing the risk of cardiovascular and metabolic diseases among the elderly, then additional policy responses may be necessary to mitigate these unintended consequences.

The rest of this chapter is organised in the following manner: Section 2 provides background information regarding COVID-19 lockdown measures enforced in Turkey; Section 3 presents a brief review of the literature; Section 4 outlines the data and variables utilised; Section 5 delves into the empirical approach employed; Section 6 showcases the findings, beginning with their impact on physical well-being of the elderly and verifying the results' reliability, it examines particular health conditions and indicators such as presence of a chronic health problem, certain cardiovascular and metabolic diseases including coronary heart disease, diabetes, and obesity, musculoskeletal diseases, respiratory diseases, and level of physical and mental dependence in activities of daily living. Section 7 presents a brief discussion for policy implications, and finally, Section 8 concludes.

5.2. Background

As the global outbreak gained momentum, Turkey confirmed its first case of COVID-19 on March 11, 2020 (CDC, 2023). The country's first death attributed to the virus followed a week later (Uçar et al., 2020). In line with the global trend at the time, Turkey implemented a range of measures to reduce the spread of COVID-19 including lockdowns, social distancing protocols, mask mandates, and limitations on gatherings. Demonstrating flexibility and adapting its policies to the evolving pandemic conditions, a defining characteristic of Turkey's approach since the outset has been prioritising the vulnerable populations, particularly the elderly and those with pre-existing health conditions.

With a specific focus on the targeted groups, the first curfew was implemented on March 21, 2020, and mandated a complete stay-at-home order for those over the age of 65 and who are at a higher-risk of complications. To support those affected by the

lockdown, the government established social support groups and ensured that those who were most vulnerable to the virus had access to the necessary resources, including food and medicine (The Turkish Ministry of Internal Affairs, 2020a). Additionally, wearing masks in public became mandatory for all individuals, and those who violated the regulations were fined by the local authorities (The Turkish Ministry of Internal Affairs, 2020g). Offering a glimmer of freedom, the initial strict curfew for those at highest risk from COVID-19 gradually eased starting in May. Only after about two months, the first relaxation came on May 10th, senior citizens were finally allowed four hours of masked walks outside observing the social distancing guidelines (The Turkish Ministry of Internal Affairs, 2020b). This window increased to six hours the following week (The Turkish Ministry of Internal Affairs, 2020c). The restrictions began to loosen further later in the month. On May 21st, elderly individuals were offered the option to relocate to designated areas for at least a month, allowing them to leave their homes entirely (The Turkish Ministry of Internal Affairs, 2020d). June 10th brought more relaxation on restrictions: those previously confined to their homes were granted unrestricted movement outdoors for a 10-hour window, stretching from morning to evening (The Turkish Ministry of Internal Affairs, 2020e). Later in summer, on June 24th, 2020, the travel limitations for seniors were lifted, allowing leisure trips (The Governorship of Istanbul, 2020).

Facing a rapid increase in the number of COVID-19 cases in the summer season, Turkish authorities reimplemented a series of restrictions on movement, specifically targeting individuals over 65 years old. These measures began in November 2020, with limitations on public transportation use during the day (The Turkish Ministry of Internal Affairs, 2020f). Further restrictions followed in April 2021, seniors could only go out during weekdays between 2 pm and 6 pm, with weekends designated as complete lockdown days (The Turkish Ministry of Internal Affairs, 2021b). With the increase in vaccinations and as the last step of the gradual normalisation period, from July 1, 2021, the curfew and related restrictions were finally lifted for all individuals after over a year (The Turkish Ministry of Internal Affairs, 2021a).

While social distancing demonstrably reduces transmission rates, it is equally clear that spending over a year under strict lockdown with very limited hours of freedom have led to drastic changes in lifestyle and social behaviours, potentially compromising the overall health of older adults. Aimed at protecting the vulnerable

population, lockdowns may have several detrimental effects on senior health, thus raise additional concerns beyond the immediate challenges posed by the pandemic itself.

5.3. Literature Review

The lockdown measures implemented in response to COVID-19 may have potentially increased the risk factors for chronic diseases and, consequently, adversely affected population health in multiple ways. As limited mobility during lockdowns can lead to a domino effect of negative health outcomes, reduced physical activity poses a notable concern. Literature suggests a robust association between sedentary behaviour and the onset or aggravation of chronic health problems including coronary heart disease, hypertension, type 2 diabetes and obesity (Bellettiere et al., 2019; Owen et al., 2010; Powell-Wiley et al., 2021). In addition, decreased physical activity among seniors is associated with diminished muscle mass, a condition known as sarcopenia, and impaired motor control which increases the risk of falls and fractures (Kirwan et al., 2020; Marcos-Pardo et al., 2022; Pelicioni and Lord, 2020).

Lockdowns can also exacerbate another vulnerability in seniors: social isolation. Restricted social interaction can lead to feelings of loneliness and severe psychological distress among older adults and may have also triggered changes in dietary habits (Altindag et al., 2022; García-Esquinas et al., 2021; Larson et al., 2021). In addition, research suggests that social isolation in older adults can trigger or worsen existing health conditions (Brodeur et al., 2021; Lekamwasam and Lekamwasam, 2020). The combination of physical inactivity and social isolation during lockdowns creates a double threat to the physical well-being of seniors, highlighting the need for strategies to promote physical activity and social connection even during periods of restricted movement.

5.4. Data and Variables

5.4.1. Data

In this study, we utilise the four latest rounds of the THS, conducted in 2014, 2016, 2019, and 2022. Adapted from the EHIS, these questionnaires are cross-sectional household studies carried out via face-to-face interviews by TurkStat across 12 regions. Encompassing a nationally representative sample of 35,153 households and 102,641 respondents, the THS offers a comprehensive set of health indicators along with socioeconomic and demographic characteristics of individuals.

The available fatality rates due to COVID-19 among senior citizens in Turkey suggest a substantial gap between men and women, 49 and 29 per cent, respectively (Uçar et al., 2020). These pronounced sex differences in terms of vulnerability to the novel coronavirus are also observed in both developed and developing countries, *e.g.*, in Italy, Spain, USA, France, UK, Mexico, Peru, Brazil, *etc.*, where males are at higher risk of mortality compared to women (Bienvenu et al., 2020; Chaturvedi et al., 2022; Jin et al., 2020; Nguyen et al., 2021; Pradhan and Olsson, 2020; Sharma et al., 2020; Yanez et al., 2020). As only the healthiest men would live long enough to be included in the sample, the surviving males might be at better health conditions than women. Therefore, to mitigate the potential bias driven by *selective mortality*, we solely focus on elderly females in our analysis.

5.4.2. Variables

5.4.2.1. Health Measures

The Module A of the questionnaire asks individuals about their health status, including any chronic health problems, medical conditions, physical and emotional limitations, functional abilities, and pain, whereas the last module collects information on certain health indicators such as body structure, and physical activity levels, *etc.*

For the physical health of individuals, we generate the following six binary variables: having a chronic health problem, cardiovascular diseases (*e.g.*, heart attack, myocardial infarction, angina, chest pain, palpitations, spasms, *etc.*), hypertension

and/or stroke, musculoskeletal diseases (*e.g.*, neck pain, back pain, arthritis, *etc.*), respiratory diseases (*e.g.*, asthma, bronchitis, allergies, *etc.*) and diabetes in the last 12 months prior to the survey which takes the value of 1 if the respondent answered ‘Yes’ to the respective question and 0 otherwise. Since prolonged confinement hinders one’s physical activity levels, we also check for morbidity of obesity and overweight as the potential instruments for adverse health outcomes.

In addition, we utilise the two widely used indexes in the gerontology literature to measure both the physical and cognitive dependency of the elderly in daily functioning. Katz Index (Katz et al., 1963) measures an individual’s level of independence performing the basic activities of daily living (ADL) such as eating, dressing and grooming, bathing, toileting, transferring (being able to get in and out of bed), and ambulating (being able to walk around or outside home). The Lawton Index (Lawton and Brody, 1969), on the other hand, assesses more complex skills required for completing the Instrumental Activities of Daily Living (IADL) including meal preparation, handling finances, house cleaning and maintenance, using a telephone, managing medications, shopping, and travelling. Respondents report their level of difficulty in completing each task on a scale of 1 to 4 with 1 indicating no difficulty and 4 representing complete inability. Based on the elicited ADL and IADL indexes, we form three binary indicators of independence where the first one demonstrates dependency in basic survival and well-being in ADL, the second demonstrates cognitive and/or physical decline in IADL, and the third measure identifies any dependency in either dimension.

5.4.2.2. Demographic and Socioeconomic Variables

The individual and household characteristics are potential factors affecting the adverse outcomes caused by the strict curfews. Therefore, we control for the age, marital status, level of education which is categorised as primary, middle school, high school, and university or higher education, number of people in the household, and region of residence.³⁴

³⁴ Household income is missing in 36 per cent of our sample. Since individuals who choose not to disclose their income levels may differ from others, losing over one third of observations could result in biased estimations. Therefore, we exclude the wealth index in our analysis.

5.5. Empirical Methodology

To measure the impact of age-specific COVID-19 curfews on physical health conditions of older individuals in Turkey, we use the following DiD model:

$$Y_{it} = \beta_0 + \beta_1 \text{Over65}_i + \beta_2 \text{Pandemic}_t + \beta_3 (\text{Over65}_i * \text{Pandemic}_t) + \theta X_{it} + \gamma_i + \delta_t + \varepsilon_{it} \quad (5.1)$$

where Y_{it} represents the health outcome for individual i at time t , including having a chronic health problem, cardiovascular diseases (*e.g.*, coronary heart problem), cardiometabolic illnesses (*e.g.*, diabetes, obesity, being overweight), musculoskeletal diseases (*e.g.*, chronic neck pain, back pain, shoulder pain), and dependence in basic and instrumental activities of daily living. Over65_i is a binary indicator for being 65 years old or older. Pandemic_t is the dummy variable which equals to 1 if the individual experienced the pandemic, meaning the observation comes from the latest wave, THS 2022, and 0 otherwise. The interaction variable $\text{Over65}_i * \text{Pandemic}_t$ identifies senior citizens who were subject to the age-specific COVID-19 restrictions. X_{it} represents covariates for individual i at time t such as age, education, marital status, and household size. The terms γ_i and δ_t control for regional and year fixed effects, respectively. Finally, ε_{it} shows the weighted error terms.

Isolating the effect of the treatment, our key coefficient of interest in this analysis is β_3 which presents the causal impact of age-targeted lockdowns on the physical health of the elderly. Focusing on senior citizens health, we restrict our sample to those who are over 60 years old for comparability. As the lockdown orders were issued to individuals who are above 65 years old in 2020 and 2021, affected respondents were 67 and 66 years old at time of the latest THS interview in August 2022, respectively. Therefore, those who are 65 at the time of the interview were not subject to the age-targeted curfew policies and excluded from the initial analysis. For the robustness check analysis, we further eliminate observations that lay on the very cut-points of stay-at-home orders and our results remained unchanged.

Table 5.1: Descriptive statistics for the study sample by COVID-19.

Variables	Unit	Pre-Pandemic					Post-Pandemic				
		60-64 years old		+65 years old		p-value	60-64 years old		+65 years old		p-value
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Demographics											
Age	Years	61.95	1.46	73.48	6.86		61.99	1.39	72.95	6.76	
Married	1=yes; 0=no	0.73	0.44	0.47	0.50	<0.001	0.73	0.45	0.51	0.50	<0.001
Household size	Number	2.46	1.45	2.35	1.63	0.012	2.50	1.35	2.24	1.33	<0.001
Highest degree completed:											
No education	1=yes; 0=no	0.40	0.49	0.61	0.49		0.25	0.43	0.51	0.50	
Primary school	1=yes; 0=no	0.45	0.50	0.30	0.46		0.52	0.50	0.36	0.48	
Middle school	1=yes; 0=no	0.05	0.21	0.03	0.17		0.07	0.25	0.04	0.19	
High school	1=yes; 0=no	0.05	0.22	0.03	0.18		0.11	0.31	0.05	0.22	
University or higher	1=yes; 0=no	0.05	0.22	0.03	0.16		0.07	0.25	0.04	0.20	
Health measures											
Self-assessed health	1=good; 5=poor	3.04	0.83	3.31	0.84	<0.001	2.91	0.72	3.14	0.77	<0.001
Chronic health problem	1=yes; 0=no	0.87	0.34	0.92	0.27	<0.001	0.84	0.36	0.92	0.27	<0.001
Cardiovascular diseases:											
Coronary heart disease	1=yes; 0=no	0.16	0.36	0.22	0.41	<0.001	0.14	0.34	0.20	0.40	<0.001
High blood pressure	1=yes; 0=no	0.53	0.50	0.64	0.48	<0.001	0.48	0.50	0.63	0.48	<0.001
Myocardial infarction	1=yes; 0=no	0.05	0.23	0.07	0.25	0.035	0.05	0.22	0.08	0.27	0.013
Metabolic diseases:											
Diabetes	1=yes; 0=no	0.31	0.46	0.32	0.47	0.272	0.35	0.48	0.35	0.48	0.956
Overweight	1=yes; 0=no	0.36	0.48	0.37	0.48	0.523	0.38	0.48	0.40	0.49	0.273
Obesity	1=yes; 0=no	0.44	0.50	0.35	0.48	<0.001	0.43	0.50	0.37	0.48	0.001
Musculoskeletal diseases	1=yes; 0=no	0.71	0.45	0.74	0.44	0.017	0.58	0.49	0.63	0.48	0.021
Dependence in... of daily living											
Basic activities (ADL)	1=yes; 0=no	0.64	0.48	0.81	0.39	<0.001	0.53	0.50	0.72	0.45	<0.001
Instrumental activities (IADL)	1=yes; 0=no	0.59	0.49	0.75	0.43	<0.001	0.46	0.50	0.62	0.48	<0.001
Dependence in Either activity	1=yes; 0=no	0.76	0.43	0.88	0.32	<0.001	0.62	0.49	0.79	0.41	<0.001
N		1818		4136			769		1699		

Data Source: THS 2014-2022

5.6. Results

5.6.1. Descriptive Statistics

Table 5.1 displays the summary statistics for our study sample before and after the pandemic for women who are eligible or non-eligible for the curfew orders, *i.e.*, who are over 65 years old or not.³⁵ The mean ages for each group are 61 and 73 years old, respectively. More than half of the women are married, and the average household size is 2. Around 90 per cent of women in each group are either illiterate or completed at most primary school. The post-pandemic sample displays better educational attainment in both groups compared to the pre-pandemic results. The mean score for self-assessed health in the sample is 3 which indicates that respondents rate their health as ‘not bad’. Chronic health problems are more common among senior females above 65 years old. Elderly individuals are more likely to suffer from cardiovascular and metabolic diseases in both periods compared to the control group. Interestingly, the level of dependence in daily activities are much lower among the post-pandemic sample in both groups compared to the observations from the previous datasets.

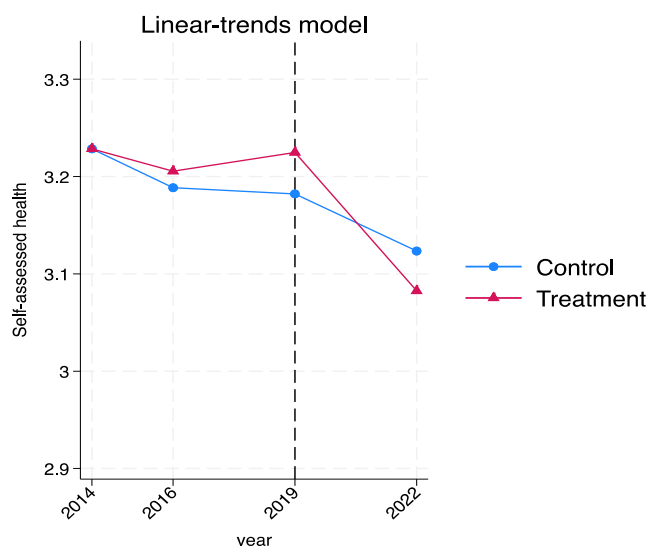
5.6.2. Trend Analysis

To ensure the validity of the subsequent DiD analysis, a preliminary trend analysis was conducted to assess the critical parallel trends assumption. This assumption underpins the DiD methodology and requires that, absent the treatment, the outcome variables for the treatment and control groups would exhibit parallel trends over time. This critical assumption enables DiD to account for time-invariant unobserved variables, which are the characteristics influencing the outcome variable but are not explicitly incorporated into the model. The parallel trends assumption ensures that these unobserved factors do not systematically affect the treatment effect estimate.

Directly testing the parallel trends assumption post-treatment is infeasible. However, in the pre-treatment period, it can be evaluated by graphically inspecting the outcome variables across multiple time points. This visual analysis aims to determine if the

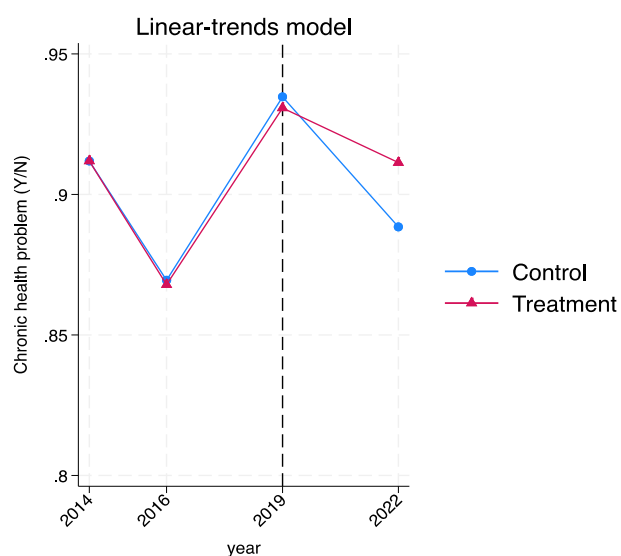
³⁵ Table B5.1 in the Appendix presents baseline characteristics of the study sample before and after the COVID-19 pandemic for women over 60 years old.

trends for the treatment and control groups remain parallel prior to implementing the treatment. Figures 5.1-5.10 present the prevalence of the health measures of interest for women during the pre- and post-pandemic periods.



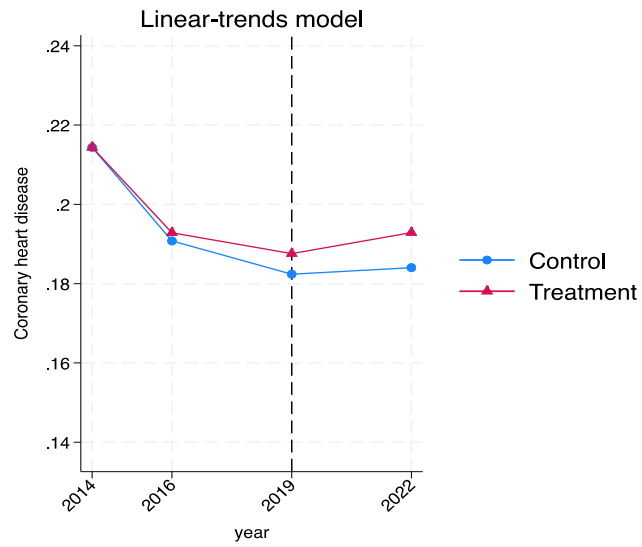
Note: The sample consists of women who are above 60 years old. Individuals who were 65 at the time of the interview are excluded from the analysis since they were not affected from the age-specific curfews implemented previous year.

Figure 5.1: Parallel trends plot for self-assessed health scores (1 Very Good; 5 Very Bad).



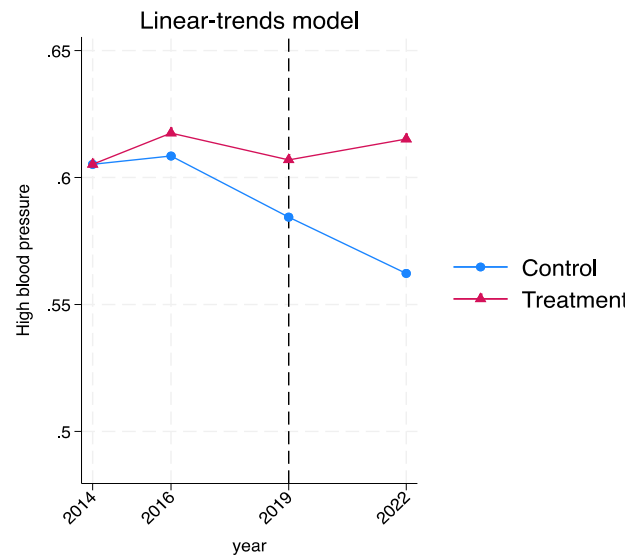
Note: Ibid.

Figure 5.2: Parallel trends plot for suffering from a chronic health problem (1 Yes; 0 No).



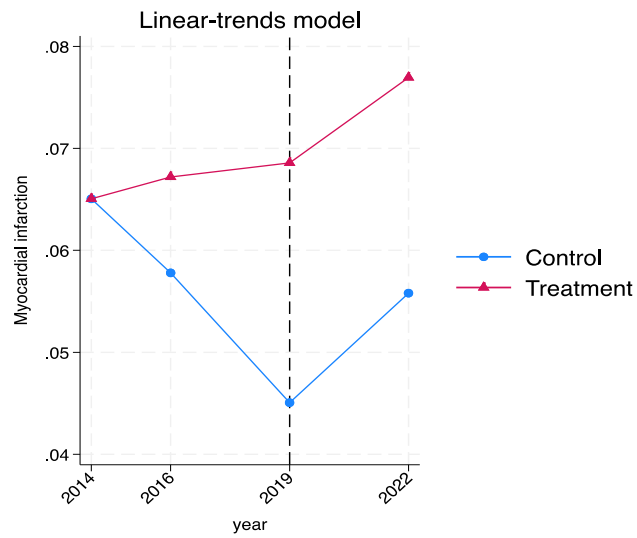
Note: Ibid.

Figure 5.3: Parallel trends plot for suffering from coronary heart disease (1 Yes; 0 No).



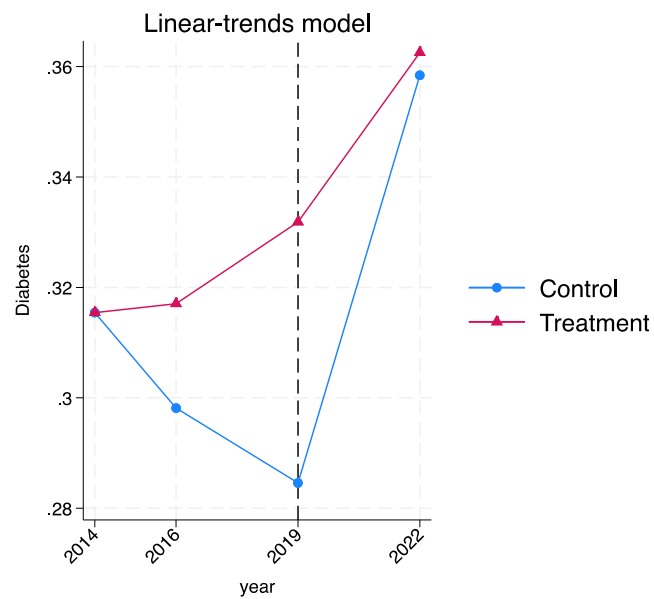
Note: Ibid.

Figure 5.4: Parallel trends plot for suffering from high blood pressure (1 Yes; 0 No).



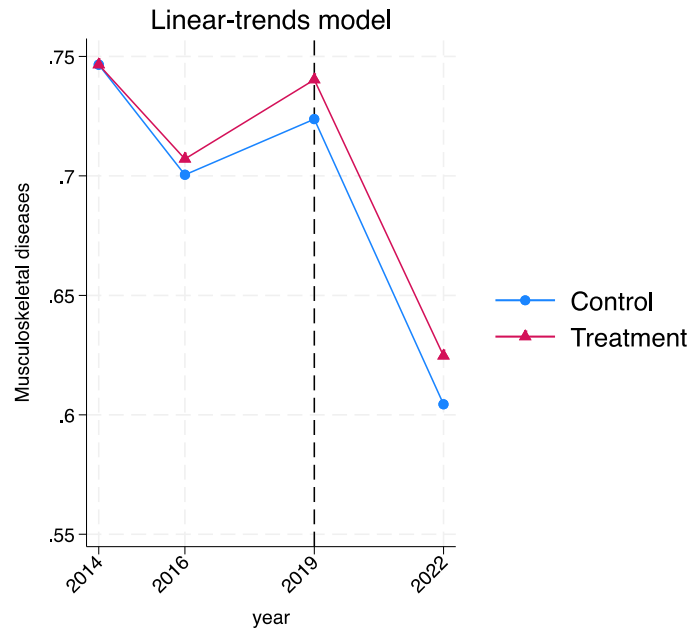
Note: Ibid.

Figure 5.5: Parallel trends plot for suffering from myocardial infarction (1 Yes; 0 No).



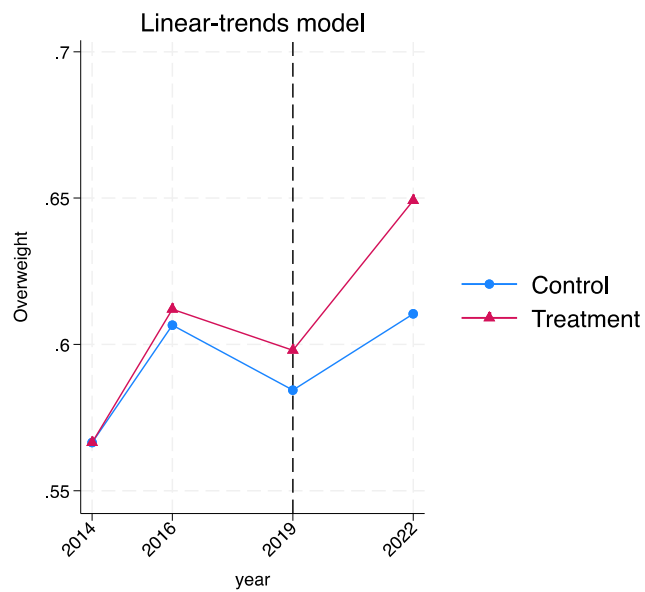
Note: Ibid.

Figure 5.6: Parallel trends plot for suffering from Type II diabetes (1 Yes; 0 No).



Note: Ibid.

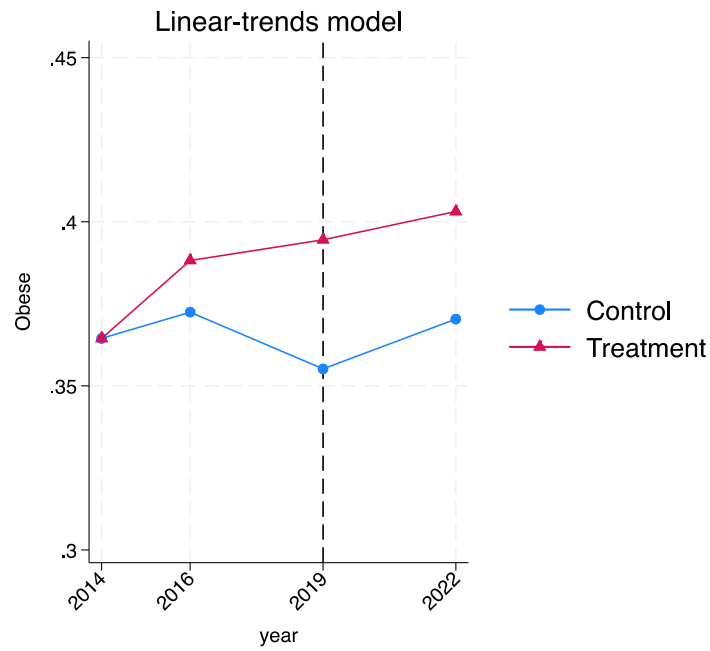
Figure 5.7: Parallel trends plot for suffering from musculoskeletal diseases (1 Yes; 0 No).



Note: Ibid.

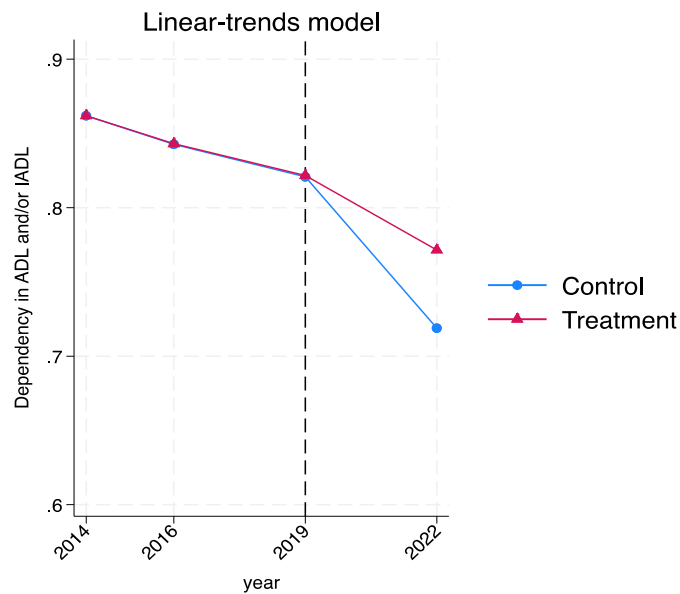
Figure 5.8: Parallel trends plot for being overweight^a (1 Yes; 0 No).

^a The sample excludes observations who are obese.



Note: Ibid.

Figure 5.9: Parallel trends plot for being obese (1 Yes; 0 No).



Note: Ibid.

Figure 5.10: Parallel trends plot for dependency in essential and/or instrumental activities of daily living (1 Yes; 0 No).

Graphical analyses shown in Figures 5.1-5.10 suggest that the control and treatment groups exhibit parallel trends for the outcome variables of chronic disease morbidity, coronary heart problem, being overweight and experiencing difficulties in the

activities of daily living during periods prior to the treatment. We think the differences in health measures might be driven by the age-specific lockdown measures implemented on elderly individuals who are 65 or older at the heat of the pandemic and utilise the DiD method for testing.

5.6.3. DiD Regression Estimates and Robustness Analyses

5.6.3.1. Baseline Sample

By controlling for age, marital status, level of education and region of residence, we employ a DiD analysis to estimate the treatment effects on the health outcomes of senior women. Our sample consists of female respondents who are above 60 years old. Since the strict stay-at-home orders were imposed on individuals who were 65 and older at the time of the pandemic, *i.e.* in 2020 or 2021, we exclude the observations who are 65 years old at the time of the interview, in 2022, since the youngest citizens who were subject to the lock-down measures would be 66 years of age during the interview.

Table 5.2 presents the regression results obtained by Equation (5.1) which captures the difference between physical well-being of senior women who were (would have been) subject to the lock-down measures before and after the pandemic. The dual objective of this analysis is to, first, quantify the treatment effect by controlling for individual level parameters along with time variables, and second, to assess the significance of the observed differences. In other words, we try to isolate the unique impact of age-specific lock-down measures on the health outcomes.

Table 5.2: DiD Regression Results. ^a

Variables	Senior Women				
	(1)	(2)	(3)	(4)	(5)
<i>Self-assessed health</i> (1 Very Good; 5 Very poor)					
Did (1 vs 0)	-0.027*** (0.000)	-0.028*** (0.000)	-0.027*** (0.000)	-0.058*** (0.000)	-0.064** (0.002)
<i>Chronic health problems</i>					
Did (1 vs 0)	0.030*** (0.000)	0.030*** (0.000)	0.030*** (0.000)	0.025** (0.001)	0.025*** (0.000)
<i>Coronary heart disease</i>					
Did (1 vs 0)	0.011*** (0.000)	0.011*** (0.000)	0.012*** (0.000)	0.007 (0.001)	0.007** (0.000)
<i>High blood pressure</i>					
Did (1 vs 0)	0.047*** (0.000)	0.047*** (0.000)	0.048*** (0.001)	0.041** (0.001)	0.043** (0.002)
<i>Myocardial infarction</i>					
Did (1 vs 0)	0.013** (0.000)	0.013** (0.000)	0.048*** (0.001)	0.041** (0.001)	0.043** (0.002)
<i>Type II diabetes</i>					
Did (1 vs 0)	-0.012** (0.000)	-0.012** (0.000)	0.048*** (0.001)	0.041** (0.001)	0.043** (0.002)
<i>Overweight^b</i>					
Did (1 vs 0)	0.037*** (0.000)	0.035*** (0.000)	0.034*** (0.000)	0.029** (0.001)	0.032* (0.004)
<i>Obesity</i>					
Did (1 vs 0)	0.017*** (0.000)	0.017*** (0.000)	0.018** (0.000)	0.010 (0.002)	0.014** (0.000)
<i>Musculoskeletal dis.</i>					
Did (1 vs 0)	0.023** (0.000)	0.023** (0.000)	0.024*** (0.000)	0.016* (0.001)	0.014 (0.003)
<i>Dependence in daily activities</i> (ADL and/or IADL)					
Did (1 vs 0)	0.065*** (0.000)	0.065*** (0.000)	0.066*** (0.000)	0.054** (0.002)	0.053** (0.002)
<i>Controlled for</i>					
Age	No	Yes	Yes	Yes	Yes
Marital Status	No	No	Yes	Yes	Yes
Education	No	No	No	Yes	Yes
Region fixed effects	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305

Notes: ^a The non-collapsed regression estimates including all the control variables for the respective outcome measures in the first column are presented in Tables 5.4-5.13.

^b For the estimate of overweight measures, obese respondents are excluded from the sample. Obsrv.: 5139
Robust standard errors are shown in parentheses (***) p<0.01, ** p<0.05, * p<0.1).

Our findings indicate that strict curfew on the elderly cause an escalation in chronic health problems. Morbidity of coronary heart diseases is notably higher among senior women who were subject to the strict lock-down measures which lasted above a year. This increase in cardiovascular problems could be attributed to several factors. The physical inactivity and social isolation are well-studied circumstances generating adverse outcomes in heart conditions. Curfews limited the few opportunities for the affected women to socialise and exercise, which are fundamental for cardiovascular health. Similarly, anxiety due to uncertainty might worsen the pre-existing heart problems. In addition, women who were subject to these strict lock-down conditions suffer from a significant increase in BMI. Limited activity, consequently, the limited calorie burns, and changing dietary habits due to increased levels of stress might cause weight gain, a significant determinant of heart problems. Finally, we find that affected females become more physically and mentally dependent in doing the activities of daily living. Reduced physical activity might cause a decrease in total muscle mass and eventually make it harder for individuals to carry their basic daily activities independently. In addition, anxiety, and the decline in socialisation in response to social isolation could reduce the motivation and capability to independently perform the instrumental activities of daily living. The set of potential causes might generate a vicious cycle where limited mobility and social limitations lead to worsened health outcomes and increased dependence and altogether imprison the senior citizens inside a double lockdown.

While the results also suggest significantly negative impacts of the prolonged stay-at-home orders on high blood pressure, myocardial infarction, type II diabetes, musculoskeletal diseases and obesity, failing to satisfy the parallel trends assumptions, we cannot reach to such causal interpretations for these health outcomes.

Table 5.3: DiD Regression Results for the Restricted Sample. ^c

Variables	Senior Women				
	(1)	(2)	(3)	(4)	(5)
<i>Self-assessed health</i> (1 Very Good; 5 Very poor)					
Did (1 vs 0)	0.007** (0.000)	-0.014** (0.001)	-0.013*** (0.000)	-0.048** (0.001)	-0.053** (0.002)
<i>Chronic health problems</i>					
Did (1 vs 0)	0.035*** (0.000)	0.033*** (0.000)	0.033*** (0.000)	0.027** (0.001)	0.028*** (0.000)
<i>Coronary heart disease</i>					
Did (1 vs 0)	0.014*** (0.000)	0.010** (0.001)	0.011** (0.001)	0.005 (0.002)	0.005* (0.001)
<i>High blood pressure</i>					
Did (1 vs 0)	0.061*** (0.000)	0.057*** (0.001)	0.058** (0.001)	0.051** (0.002)	0.052** (0.003)
<i>Myocardial infarction</i>					
Did (1 vs 0)	0.017*** (0.000)	0.015*** (0.000)	0.015*** (0.000)	0.013* (0.001)	0.012** (0.000)
<i>Type II diabetes</i>					
Did (1 vs 0)	-0.009** (0.000)	-0.006*** (0.000)	-0.005** (0.000)	-0.012** (0.001)	-0.011* (0.001)
<i>Overweight^d</i>					
Did (1 vs 0)	0.026*** (0.000)	0.034*** (0.000)	0.033*** (0.000)	0.029** (0.001)	0.033* (0.005)
<i>Obesity</i>					
Did (1 vs 0)	0.011** (0.000)	0.019** (0.000)	0.020** (0.001)	0.011 (0.003)	0.017* (0.001)
<i>Musculoskeletal dis.</i>					
Did (1 vs 0)	0.027*** (0.000)	0.026*** (0.000)	0.026*** (0.000)	0.019** (0.001)	0.017 (0.003)
<i>Dependence in daily activities</i> (ADL and/or IADL)					
Did (1 vs 0)	0.079*** (0.000)	0.070*** (0.000)	0.071*** (0.000)	0.058** (0.002)	0.057** (0.002)
<i>Controlled for</i>					
Age	No	Yes	Yes	Yes	Yes
Marital Status	No	No	Yes	Yes	Yes
Education	No	No	No	Yes	Yes
Region fixed effects	No	No	No	No	Yes
Observations	8128	8128	8128	8128	8128

Notes: ^c The non-collapsed regression estimates including all the control variables for the respective outcome measures in the first column are presented in Tables 5.4-5.13.

^d For the estimate of overweight measures, obese respondents are excluded from the sample. Obsrv: 5035
Robust standard errors are shown in parentheses (***) p<0.01, ** p<0.05, * p<0.1).

5.6.3.2. Robustness Analyses

To strengthen the robustness of these findings and minimise potential confounding factors, we employ the DiD approach on a restricted sample. In addition to the respondents who are 65 years old during the interview in 2022, we further exclude the seniors who are 66 years old at the time of the questionnaire since they were not affected by the initial curfews at the beginning of the pandemic, in 2020.

The DiD results obtained from the restricted sample ensure the robustness of our findings: there is a concerning causal relationship between strict curfews implemented on the elderly and an increase in chronic health problems. Prevalence of coronary heart diseases are higher among affected women who endured the year-long stay-at-home measures. These analyses underline the strong adverse impact of curfews on this vulnerable population which goes beyond the potential harms carried by the pandemic itself.

Table 5.4: Non-collapsed DiD Results for Self-Assessed Health of Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Self-assessed health (1 V. Good; 5 V. poor)</i>										
DiD (1 vs 0)	-0.027*** (0.000)	-0.028*** (0.000)	-0.027*** (0.000)	-0.058*** (0.000)	-0.064** (0.002)	0.007** (0.000)	-0.014** (0.001)	-0.013*** (0.000)	-0.048** (0.001)	-0.053** (0.002)
Age		0.022** (0.000)	0.021*** (0.000)	0.016*** (0.000)	0.018** (0.000)		0.022** (0.000)	0.021*** (0.000)	0.016*** (0.000)	0.017** (0.000)
Married			-0.038 (0.021)	-0.040 (0.011)	-0.047 (0.013)			-0.036 (0.020)	-0.038 (0.010)	-0.043 (0.012)
<i>Highest degree completed:</i>										
Primary school				-0.248* (0.036)	-0.170 (0.035)				-0.244* (0.034)	-0.167 (0.033)
Middle school				-0.432** (0.033)	-0.340* (0.038)				-0.428** (0.030)	-0.336* (0.036)
High school				-0.538** (0.019)	-0.443** (0.017)				-0.555*** (0.004)	-0.459*** (0.003)
University or higher				-0.635* (0.058)	-0.534* (0.063)				-0.638* (0.063)	-0.537* (0.067)
<i>Years</i>										
2016	-0.033** (0.002)	-0.032** (0.001)	-0.031** (0.001)	-0.027* (0.003)	-0.030 (0.008)	-0.033** (0.002)	-0.032** (0.001)	-0.031** (0.001)	-0.027* (0.003)	-0.030 (0.008)
2019	-0.051 (0.022)	-0.049 (0.026)	-0.048 (0.027)	-0.018 (0.023)	-0.019 (0.017)	-0.051 (0.022)	-0.049 (0.026)	-0.048 (0.027)	-0.019 (0.023)	-0.019 (0.017)
2022	-0.157** (0.008)	-0.157** (0.009)	-0.157** (0.010)	-0.083* (0.010)	-0.091** (0.006)	-0.157** (0.008)	-0.157** (0.009)	-0.157** (0.009)	-0.083* (0.010)	-0.091** (0.007)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: ^e For the baseline estimates in Column 1-5, the sample consists of women who are above 60 years old. Individuals who were 65 at the time of the interview are excluded from the analysis since they were not affected from the age-specific curfews implemented previous year.

^f For the restricted sample estimates, the sample consists of women who are above 60 years old yet individuals who were 65 and 66 years old at the time of the interview are excluded from the analysis since they were not affected from the age-specific curfews implemented in the first year.

Robust standard errors are shown in parentheses (***) p<0.01, ** p<0.05, * p<0.1)

Table 5.5: Non-collapsed DiD Results for Chronic Health Problem Prevalence Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Chronic health problem prevalence</i>										
DiD (1 vs 0)	0.030*** (0.000)	0.030*** (0.000)	0.030*** (0.000)	0.025** (0.001)	0.025*** (0.000)	0.035*** (0.000)	0.033*** (0.000)	0.033*** (0.000)	0.027** (0.001)	0.028*** (0.000)
Age		0.003** (0.000)	0.003 (0.001)	0.002 (0.001)	0.002 (0.001)		0.003** (0.000)	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)
Married				-0.007 (0.014)	-0.008 (0.013)			-0.003 (0.015)	-0.004 (0.012)	-0.005 (0.012)
<i>Highest degree completed:</i>										
Primary school				-0.026 (0.011)	-0.021 (0.011)				-0.024 (0.010)	-0.019 (0.009)
Middle school				-0.063* (0.007)	-0.056* (0.007)				-0.059* (0.005)	-0.053* (0.006)
High school				-0.093 (0.031)	-0.086 (0.028)				-0.096 (0.028)	-0.090 (0.026)
University or higher				-0.140 (0.028)	-0.130 (0.031)				-0.138 (0.028)	-0.129 (0.031)
<i>Years</i>										
2016	-0.044 (0.012)	-0.044 (0.012)	-0.044 (0.012)	-0.043 (0.011)	-0.043 (0.010)	-0.044 (0.012)	-0.044 (0.012)	-0.044 (0.012)	-0.043 (0.011)	-0.044 (0.010)
2019	0.015* (0.001)	0.015* (0.002)	0.015* (0.002)	0.020* (0.002)	0.020*** (0.000)	0.015* (0.001)	0.015* (0.002)	0.015* (0.002)	0.019* (0.002)	0.020*** (0.000)
2022	-0.035* (0.005)	-0.035* (0.005)	-0.035* (0.005)	-0.024 (0.004)	-0.025 (0.004)	-0.035* (0.005)	-0.035* (0.005)	-0.035* (0.005)	-0.024 (0.004)	-0.025* (0.004)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid.

Table 5.6: Non-collapsed DiD Results for Coronary Heart Disease Prevalence Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Coronary heart disease prevalence</i>										
DiD (1 vs 0)	0.011*** (0.000)	0.011*** (0.000)	0.012*** (0.000)	0.007 (0.001)	0.007** (0.000)	0.014*** (0.000)	0.010** (0.001)	0.011** (0.001)	0.005 (0.002)	0.005* (0.001)
Age		0.004* (0.000)	0.003* (0.000)	0.002 (0.000)	0.002* (0.000)		0.004* (0.000)	0.003 (0.000)	0.002 (0.000)	0.002* (0.000)
Married			-0.030*** (0.000)	-0.030** (0.001)	-0.030** (0.001)			-0.029** (0.001)	-0.028* (0.002)	-0.029** (0.002)
<i>Highest degree completed:</i>										
Primary school				-0.048* (0.005)	-0.039 (0.008)				-0.046* (0.004)	-0.038 (0.008)
Middle school				-0.072 (0.044)	-0.063 (0.048)				-0.067 (0.041)	-0.058 (0.046)
High school				-0.089 (0.019)	-0.080 (0.025)				-0.087 (0.018)	-0.079 (0.025)
University or higher				-0.102** (0.008)	-0.097* (0.013)				-0.102* (0.008)	-0.097* (0.014)
<i>Years</i>										
2016	-0.023 (0.005)	-0.023 (0.005)	-0.022 (0.005)	-0.022 (0.005)	-0.022* (0.003)	-0.023 (0.005)	-0.023 (0.005)	-0.022 (0.005)	-0.022 (0.005)	-0.022* (0.003)
2019	-0.037* (0.004)	-0.037* (0.005)	-0.036* (0.006)	-0.031 (0.005)	-0.028** (0.002)	-0.037* (0.004)	-0.037* (0.005)	-0.036* (0.006)	-0.031 (0.005)	-0.028** (0.002)
2022	-0.043* (0.003)	-0.042* (0.004)	-0.042* (0.004)	-0.029 (0.006)	-0.029* (0.003)	-0.043* (0.003)	-0.042* (0.004)	-0.042* (0.004)	-0.030 (0.005)	-0.029* (0.003)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid.

Table 5.7: Non-collapsed DiD Results for High Blood Pressure Prevalence Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>High blood pressure prevalence</i>										
DiD (1 vs 0)	0.047*** (0.000)	0.047*** (0.000)	0.048*** (0.001)	0.041** (0.001)	0.043** (0.002)	0.061*** (0.000)	0.057*** (0.001)	0.058** (0.001)	0.051** (0.002)	0.052** (0.003)
Age		0.005 (0.001)	0.004 (0.001)	0.003 (0.001)	0.003 (0.001)		0.004 (0.001)	0.004 (0.002)	0.003 (0.001)	0.003 (0.001)
Married			-0.024 (0.027)	-0.026 (0.025)	-0.027 (0.023)			-0.023 (0.027)	-0.024 (0.024)	-0.025 (0.023)
<i>Highest degree completed:</i>										
Primary school				-0.025 (0.006)	-0.024 (0.008)				-0.022 (0.008)	-0.022 (0.010)
Middle school				-0.055 (0.016)	-0.060 (0.016)				-0.047 (0.022)	-0.052 (0.022)
High school				-0.125** (0.002)	-0.124** (0.007)				-0.122*** (0.001)	-0.120** (0.004)
University or higher				-0.157* (0.013)	-0.160** (0.012)				-0.157* (0.013)	-0.160** (0.012)
<i>Years</i>										
2016	0.007 (0.003)	0.007 (0.003)	0.008 (0.003)	0.009 (0.002)	0.010* (0.001)	0.007 (0.003)	0.007 (0.003)	0.008 (0.003)	0.008 (0.002)	0.010* (0.001)
2019	-0.012 (0.011)	-0.012 (0.012)	-0.011 (0.012)	-0.006 (0.011)	-0.005 (0.009)	-0.012 (0.011)	-0.012 (0.011)	-0.011 (0.012)	-0.006 (0.010)	-0.005 (0.008)
2022	-0.050* (0.005)	-0.050* (0.005)	-0.049* (0.005)	-0.036* (0.003)	-0.035** (0.002)	-0.050* (0.005)	-0.050* (0.005)	-0.049* (0.005)	-0.036* (0.003)	-0.036** (0.002)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid.

Table 5.8: Non-collapsed DiD Results for Myocardial Infarction Prevalence Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Myocardial infarction prevalence</i>										
DiD (1 vs 0)	0.013** (0.000)	0.013** (0.000)	0.048*** (0.001)	0.041** (0.001)	0.043** (0.002)	0.017*** (0.000)	0.015*** (0.000)	0.015*** (0.000)	0.013* (0.001)	0.012** (0.000)
Age		0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002** (0.000)		0.002*** (0.000)	0.002*** (0.000)	0.001** (0.000)	0.002** (0.000)
Married			-0.016* (0.002)	-0.016* (0.002)	-0.017** (0.001)			-0.017* (0.001)	-0.017* (0.002)	-0.017** (0.001)
<i>Highest degree completed:</i>										
Primary school				-0.019 (0.004)	-0.010 (0.006)				-0.017 (0.003)	-0.009 (0.005)
Middle school				-0.028 (0.031)	-0.018 (0.034)				-0.026 (0.031)	-0.016 (0.034)
High school				-0.035 (0.009)	-0.024 (0.012)				-0.036 (0.011)	-0.026 (0.013)
University or higher				-0.031 (0.013)	-0.021 (0.009)				-0.034 (0.010)	-0.024 (0.007)
<i>Years</i>										
2016	-0.001 (0.009)	-0.001 (0.009)	-0.001 (0.009)	-0.000 (0.009)	-0.000 (0.008)	-0.001 (0.009)	-0.001 (0.009)	-0.001 (0.009)	-0.000 (0.009)	-0.000 (0.008)
2019	-0.005 (0.010)	-0.005 (0.011)	-0.004 (0.011)	-0.002 (0.011)	-0.003 (0.010)	-0.005 (0.010)	-0.005 (0.011)	-0.004 (0.011)	-0.002 (0.011)	-0.003 (0.010)
2022	-0.005 (0.007)	-0.005 (0.007)	-0.005 (0.007)	-0.000 (0.008)	-0.001 (0.007)	-0.005 (0.007)	-0.005 (0.007)	-0.005 (0.007)	-0.000 (0.008)	-0.001 (0.007)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid.

Table 5.9: Non-collapsed DiD Results for Type II Diabetes Prevalence Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Type II Diabetes prevalence</i>										
DiD (1 vs 0)	-0.012** (0.000)	-0.012** (0.000)	0.048*** (0.001)	0.041** (0.001)	0.043** (0.002)	-0.009** (0.000)	-0.006*** (0.000)	-0.005** (0.000)	-0.012** (0.001)	-0.011* (0.001)
Age		-0.004* (0.000)	-0.004* (0.001)	-0.005** (0.000)	-0.005* (0.000)		-0.004* (0.000)	-0.005* (0.001)	-0.006** (0.000)	-0.005* (0.000)
Married			-0.033 (0.013)	-0.035 (0.010)	-0.035 (0.011)			-0.034 (0.015)	-0.036 (0.011)	-0.036 (0.012)
<i>Highest degree completed:</i>										
Primary school				-0.020 (0.012)	-0.017 (0.015)				-0.017 (0.014)	-0.014 (0.017)
Middle school				-0.075 (0.043)	-0.077 (0.041)				-0.067 (0.038)	-0.070 (0.036)
High school				-0.136* (0.018)	-0.136* (0.020)				-0.134* (0.020)	-0.134 (0.022)
University or higher				-0.207* (0.026)	-0.210* (0.031)				-0.205* (0.027)	-0.208 (0.033)
<i>Years</i>										
2016	-0.005 (0.017)	-0.005 (0.017)	-0.004 (0.017)	-0.003 (0.015)	-0.004 (0.015)	-0.005 (0.017)	-0.005 (0.017)	-0.004 (0.017)	-0.003 (0.015)	-0.004 (0.014)
2019	-0.004 (0.023)	-0.005 (0.023)	-0.004 (0.023)	0.002 (0.021)	0.002 (0.018)	-0.004 (0.023)	-0.005 (0.023)	-0.004 (0.023)	0.002 (0.020)	0.002 (0.018)
2022	0.044 (0.014)	0.044 (0.014)	0.044 (0.014)	0.059 (0.011)	0.059* (0.008)	0.044 (0.014)	0.044 (0.014)	0.044 (0.014)	0.059 (0.011)	0.058* (0.007)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid.

Table 5.10: Non-collapsed DiD Results for Overweight Status Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Overweight^g</i>										
DiD (1 vs 0)	0.037*** (0.000)	0.035*** (0.000)	0.034*** (0.000)	0.029** (0.001)	0.032* (0.004)	0.026*** (0.000)	0.034*** (0.000)	0.033*** (0.000)	0.029** (0.001)	0.033* (0.005)
Age		-0.011** (0.000)	-0.010** (0.001)	-0.010** (0.000)	-0.010** (0.000)		-0.011** (0.000)	-0.010** (0.001)	-0.010** (0.001)	-0.010** (0.000)
Married			0.016 (0.015)	0.011 (0.009)	0.012 (0.010)			0.013 (0.016)	0.009 (0.011)	0.009 (0.012)
<i>Highest degree completed:</i>										
Primary school				0.072 (0.016)	0.063 (0.014)				0.068 (0.018)	0.060 (0.016)
Middle school				0.064* (0.009)	0.044** (0.003)				0.054** (0.003)	0.035 (0.008)
High school				-0.057*** (0.000)	-0.077** (0.003)				-0.061** (0.002)	-0.080** (0.004)
University or higher				-0.120 (0.030)	-0.139 (0.035)				-0.121 (0.032)	-0.140 (0.036)
<i>Years</i>										
2016	0.042 (0.008)	0.043 (0.007)	0.042* (0.007)	0.045 (0.012)	0.044 (0.010)	0.042 (0.008)	0.043 (0.007)	0.043* (0.007)	0.045 (0.012)	0.044 (0.011)
2019	0.029 (0.007)	0.028 (0.006)	0.028 (0.006)	0.028 (0.005)	0.028 (0.006)	0.029 (0.007)	0.028 (0.006)	0.028 (0.006)	0.028 (0.005)	0.028 (0.006)
2022	0.044*** (0.000)	0.046*** (0.000)	0.045*** (0.000)	0.049** (0.003)	0.049** (0.002)	0.044*** (0.000)	0.046*** (0.000)	0.045*** (0.000)	0.049** (0.002)	0.049** (0.002)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	5,139	5,139	5,139	5,139	5,139	5,035	5,035	5,035	5,035	5,035

Note: Ibid.^g Obese individuals are excluded.

Table 5.11: Non-collapsed DiD Results for Obesity Prevalence Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Obesity prevalence</i>										
DiD (1 vs 0)	0.017*** (0.000)	0.017*** (0.000)	0.018** (0.000)	0.010 (0.002)	0.014** (0.000)	0.011** (0.000)	0.019** (0.000)	0.020** (0.001)	0.011 (0.003)	0.017* (0.001)
Age		-0.009** (0.001)	-0.009* (0.001)	-0.010** (0.001)	-0.010** (0.001)		-0.009** (0.001)	-0.010* (0.001)	-0.010* (0.001)	-0.010** (0.001)
Married			-0.039 (0.029)	-0.044 (0.024)	-0.043 (0.021)			-0.041 (0.030)	-0.045 (0.025)	-0.044 (0.022)
<i>Highest degree completed:</i>										
Primary school				0.015 (0.011)	0.008 (0.011)				0.018 (0.013)	0.011 (0.013)
Middle school				-0.052 (0.023)	-0.070 (0.013)				-0.050 (0.026)	-0.067 (0.015)
High school				-0.188* (0.027)	-0.199** (0.013)				-0.186* (0.029)	-0.196* (0.016)
University or higher				-0.230 (0.068)	-0.245 (0.063)				-0.234 (0.065)	-0.249 (0.058)
<i>Years</i>										
2016	0.020 (0.008)	0.019 (0.008)	0.020 (0.008)	0.021 (0.005)	0.019 (0.006)	0.020 (0.008)	0.019 (0.008)	0.020 (0.008)	0.021 (0.005)	0.019 (0.006)
2019	0.013 (0.018)	0.012 (0.017)	0.013 (0.018)	0.018 (0.014)	0.018 (0.014)	0.013 (0.018)	0.012 (0.017)	0.013 (0.018)	0.018 (0.014)	0.018 (0.014)
2022	0.005 (0.009)	0.005 (0.008)	0.005 (0.009)	0.020* (0.003)	0.019 (0.005)	0.005 (0.009)	0.005 (0.008)	0.005 (0.009)	0.020* (0.003)	0.019 (0.004)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid (except ^e).

Table 5.12: Non-collapsed DiD Results for Musculoskeletal Disease Prevalence Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Musculoskeletal disease prevalence</i>										
DiD (1 vs 0)	0.023** (0.000)	0.023** (0.000)	0.024*** (0.000)	0.016* (0.001)	0.014 (0.003)	0.027*** (0.000)	0.026*** (0.000)	0.026*** (0.000)	0.019** (0.001)	0.017 (0.003)
Age		0.001* (0.000)	0.001 (0.000)	-0.000 (0.001)	0.000 (0.001)		0.001* (0.000)	0.001 (0.000)	0.000 (0.000)	0.000 (0.001)
Married			-0.014 (0.008)	-0.016 (0.003)	-0.018 (0.003)			-0.011 (0.006)	-0.013* (0.002)	-0.015* (0.002)
<i>Highest degree completed:</i>										
Primary school				-0.039 (0.031)	-0.022 (0.034)				-0.034 (0.029)	-0.018 (0.033)
Middle school				-0.082 (0.017)	-0.065 (0.030)				-0.083 (0.019)	-0.066 (0.033)
High school				-0.131* (0.012)	-0.116 (0.026)				-0.128* (0.010)	-0.113 (0.024)
University or higher				-0.218* (0.018)	-0.203* (0.029)				-0.209** (0.011)	-0.195* (0.024)
<i>Years</i>										
2016	-0.041 (0.018)	-0.041 (0.018)	-0.041 (0.018)	-0.039 (0.016)	-0.040 (0.015)	-0.041 (0.018)	-0.041 (0.018)	-0.041 (0.018)	-0.039 (0.016)	-0.040 (0.015)
2019	-0.019 (0.012)	-0.019 (0.012)	-0.019 (0.012)	-0.012 (0.013)	-0.010 (0.012)	-0.019 (0.012)	-0.019 (0.012)	-0.019 (0.012)	-0.012 (0.013)	-0.010 (0.012)
2022	-0.152** (0.010)	-0.152** (0.010)	-0.152** (0.011)	-0.135* (0.013)	-0.137* (0.013)	-0.152** (0.010)	-0.152** (0.010)	-0.152** (0.011)	-0.135* (0.013)	-0.137* (0.013)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid.

Table 5.13: Non-collapsed DiD Results for Dependence in Basic and/or Instrumental Activities of Daily Living Among Senior Women (Baseline and Restricted Sample).

Variables	Baseline Sample ^e					Restricted Sample ^f				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Dependence in daily activities (ADL and/or IADL)</i>										
DiD (1 vs 0)	0.065*** (0.000)	0.065*** (0.000)	0.066*** (0.000)	0.054** (0.002)	0.053** (0.002)	0.079*** (0.000)	0.070*** (0.000)	0.071*** (0.000)	0.058** (0.002)	0.057** (0.002)
Age		0.009*** (0.000)	0.008*** (0.000)	0.006** (0.000)	0.007** (0.000)		0.009*** (0.000)	0.008*** (0.000)	0.006** (0.000)	0.006** (0.000)
Married			-0.046* (0.005)	-0.049** (0.002)	-0.051*** (0.000)			-0.046* (0.004)	-0.048** (0.002)	-0.050*** (0.001)
<i>Highest degree completed:</i>										
Primary school				-0.068* (0.009)	-0.049* (0.004)				-0.065 (0.011)	-0.045* (0.006)
Middle school				-0.141* (0.016)	-0.116** (0.007)				-0.140* (0.016)	-0.115** (0.007)
High school				-0.214 (0.056)	-0.193 (0.049)				-0.217 (0.054)	-0.196 (0.047)
University or higher				-0.354** (0.020)	-0.336** (0.017)				-0.346** (0.027)	-0.328** (0.023)
<i>Years</i>										
2016	-0.022 (0.013)	-0.021 (0.013)	-0.020 (0.012)	-0.018 (0.009)	-0.018 (0.007)	-0.022 (0.013)	-0.021 (0.013)	-0.020 (0.012)	-0.018 (0.009)	-0.018 (0.007)
2019	-0.053** (0.002)	-0.052** (0.004)	-0.051* (0.005)	-0.039*** (0.000)	-0.041*** (0.000)	-0.053** (0.002)	-0.052** (0.004)	-0.051* (0.005)	-0.040*** (0.000)	-0.041*** (0.000)
2022	-0.168** (0.005)	-0.168** (0.006)	-0.168** (0.006)	-0.140*** (0.001)	-0.144*** (0.000)	-0.168** (0.005)	-0.168** (0.006)	-0.168** (0.006)	-0.140*** (0.001)	-0.144*** (0.001)
<i>Controlled for</i>										
Region fixed effects	No	No	No	No	Yes	No	No	No	No	Yes
Observations	8,305	8,305	8,305	8,305	8,305	8,128	8,128	8,128	8,128	8,128

Note: Ibid.

5.7. Discussion

These findings highlight the potential downsides of stringent lockdown measures, particularly for vulnerable populations. While these undeniably crucial restrictions are implemented with the noble aim of safeguarding the public health – with a special focus on the vulnerable population, they may inadvertently generate a physical health crisis in a relatively short period. The observed increase in cardiovascular and metabolic diseases along with dependence in daily living among the elderly women who went through the curfews strengthens this very concern. These findings point out the need for further policy interventions specifically designed to curb the unforeseen negative externalities of lockdowns on the physical health of the senior women.

5.8. Conclusion

This study examines the potential adverse effects of strict curfews imposed on elderly citizens in Turkey during the COVID-19 pandemic. Employing a DiD methodology, we investigate the causal impact of these age-specific restrictions on the physical health of senior citizens. As the available data proposes a pronounced differential mortality between elderly men and women due to the pandemic, to eliminate the selection bias driven by the discrepancies in fatality rates, we focus our analysis solely on senior women. Our findings reveal a concerning causality between prolonged curfews and a rise in chronic health problems within this vulnerable population.

We observe a statistically significant increase in overall report of chronic health problems. The prevalence of coronary heart disease among elderly women subjected to the lockdown measures are significantly higher compared to the control group. The results also identify a notable rise in BMI among senior women who adhered to the curfews. In addition, we find that these age-specific curfews lead to a heightened levels of physical and mental dependence in performing activities of daily living among the affected elderly citizens.

The observed negative health outcomes could be attributed to several factors associated with the restrictions. On one hand, limited mobility due to curfews likely led to decreased physical activity levels which is a well-established risk factor for heart diseases and weight gain. On the other, restricted social interaction might have

triggered feelings of loneliness and anxiety, potentially causing changes in dietary habits and worsening pre-existing health conditions. With these two potential mechanisms combined could have created a cycle of declining health and increased dependence among affected senior women.

As the first study to measure the causal impact of age-specific restrictions on physical health, this study underscores the importance of a comprehensive approach to the control of a pandemic. Acknowledging the unintended adverse consequences on physical health of the elderly emphasise the need of adopting a more balanced strategy that prioritises both the control of the pandemic and the well-being of high-risk populations. Further research is required to ensure the well-being of senior citizens during future public health emergencies.

6. CONCLUSION

This dissertation has investigated the very complex and dynamic interplay of factors determining the human capital variations among individuals. Building upon the unifying theme of “health capital formation” as conceptualised in the Grossman Model (1972) and Human Capabilities Formation Model (Cunha and Heckman, 2007; Heckman, 2007), each essay examine the health investments in three distinct stages of life: prenatal period, childhood, and late adulthood. Each chapter contributes to a richer understanding of how early interventions can substantially shape later outcomes. This concluding chapter summarises the main details and the key findings of each study, discusses health policy recommendations, comments on potential limitations, and proposes areas for future research.

Chapter 3 highlights the critical role of intrauterine conditions on human capital outcomes. By using Ramadan observance as a natural experiment for maternal dietary disruptions, we show that the detrimental long-lasting effects of unfavourable intrauterine conditions do not particularly arise due to extreme events such as famines, natural disasters, or pandemics but also due to less severe and daily dietary shocks which can respond to simple mediations. Prenatal malnutrition, especially on the first and third trimester, has detrimental consequences on educational attainment of males. Exposed men obtain 0.53 fewer years of education, and they are significantly less likely to obtain middle school, high school, and college degrees. Therefore, for creating more qualified human capital, simple investments during pregnancy might be more effective than the conventional and late policy implications in the areas of education or on-the-job training. We should note that our findings do not only apply to the Muslim population but also to developed or other developing countries since, in both country groups, skipping meals or morning sickness is also common during pregnancy, especially in the first trimester which is found to have damaging effects on the infant. Thus, simple interventions such as informing the public that fasting or skipping breakfast or meals during pregnancy has long-term negative cognitive effects on their children and/or providing nutritional support to disadvantaged pregnant women might change the well-being of the whole society easily, especially in developing countries where education is essential for breaking the poverty cycle.

Given the intergenerational transmission of education and socioeconomic status, the positive effects of basically creating awareness of the importance of maternal nutrition and/or delivering subsidies would be highly multiplied across generations.

Chapter 4 explores the intergenerational transmission of health through the robust link between maternal depression and the physical of health under-five children. We find an unfortunate association between maternal mental health and increased morbidity of infectious diseases and overall poorer health outcomes among pre-schoolers. This emphasises the intense need for investments in mental health screening and accessible treatment options for mothers, especially in LMICs where living conditions are harsher compared to the developed countries and that health capital is even more crucial for those children to be able to escape the poverty trap. In addition, promoting positive parenting programs and access to affordable childcare and early childhood education programs can potentially mitigate the impact of maternal depression on children's well-being. Moreover, since our findings suggest a mild level of protection of education, improving maternal education can offer some degrees of protection against the detrimental effects of maternal distress on child health.

Chapter 5 investigates the aftermath of age-specific lockdown measure in an effort to protect the vulnerable population against COVID-19. Using the DiD methodology, our findings reveal a concerning rise in chronic health problems, including cardiovascular diseases and increased BMI along with heightened dependence in daily living among the elderly women subjected to prolonged curfews. Reduced physical mobility and social isolation might be the main contributors to these adverse health outcomes. These findings underline the unforeseen consequences of prolonged lockdowns aiming to protect the elderly. The future pandemic action plans should also prioritise the well-being of vulnerable populations as well as protecting them. Policies promoting safe outdoor activities while observing the social distancing measures or encouraging low-impact exercises to eliminate muscle mass loss and improve cardiovascular health might reduce the burden of social isolation and improve physical conditions during strict curfews. In addition, public health screening programs targeting individuals who were subject to the prolonged stay-at-home orders can identify seniors whose health deteriorated significantly and take necessary and possible actions to potentially reverse the damage.

While this dissertation contributes to the understanding of health capital formation across the lifespan, the research derives conclusions on the Turkish context. In addition, with Chapters 3 and 5 exploring causality through unique experimental designs, each chapter utilises cross-sectional datasets, and in Chapter 4, we can only establish association between maternal depression and child health. However, we show that our results are robust by implementing the Romano-Wolf multiple hypothesis testing methodology. In order to expand the generalisability of these findings and establish a stronger causal relationship, future studies could analyse countries with diverse socioeconomic backgrounds and healthcare systems with longitudinal data. In addition, investigating the long-term consequences of intrauterine dietary disruptions, maternal depression on child health, and lockdown measures as well as exploring the effectiveness of proposed policy interventions aimed at improving health capital formation across the lifespan would be valuable.

This thesis underscores the essential nature of health investment throughout life for promoting individual well-being and reducing human capital disparities. By acknowledging the very critical role of early interventions and incorporating policies to specific needs across distinct life stages, we can build a healthier future for all.

REFERENCES

- Abiona, O., and Ajefu, J. B. (2023). The impact of timing of in utero drought shocks on birth outcomes in rural households: Evidence from Sierra Leone. *Journal of Population Economics*, 36(3), 1333–1362.
- Abu-Saad, K., and Fraser, D. (2010). Maternal Nutrition and Birth Outcomes. *Epidemiologic Reviews*, 32(1), 5–25.
- Abuya, B. A., Onsomu, E. O., Kimani, J. K., and Moore, D. (2011). Influence of Maternal Education on Child Immunization and Stunting in Kenya. *Maternal and Child Health Journal*, 15(8), 1389–1399.
- Almond, D. (2006). Is the 1918 Influenza Pandemic Over? Long-Term Effects of *In Utero* Influenza Exposure in the Post-1940 U.S. Population. *Journal of Political Economy*, 114(4), 672–712.
- Almond, D., and Currie, J. (2010). *Human Capital Development Before Age Five* (w15827; p. w15827). National Bureau of Economic Research.
- Almond, D., and Currie, J. (2011a). Human capital development before age five. In *Handbook of Labor Economics* (Vol. 4, pp. 1315–1486). Elsevier.
- Almond, D., and Currie, J. (2011b). Killing me softly: The fetal origins hypothesis. *Journal of Economic Perspectives*, 25(3), 153–172.
- Almond, D., Currie, J., and Duque, V. (2018). Childhood Circumstances and Adult Outcomes: Act II. *Journal of Economic Literature*, 56(4), 1360–1446.
- Almond, D., Edlund, L., and Palme, M. (2009). Chernobyl’s Subclinical Legacy: Prenatal Exposure to Radioactive Fallout and School Outcomes in Sweden *. *Quarterly Journal of Economics*, 124(4), 1729–1772.
- Almond, D., and Mazumder, B. (2005). The 1918 Influenza Pandemic and Subsequent Health Outcomes: An Analysis of SIPP Data. *American Economic Review*, 95(2), 258–262.
- Almond, D., and Mazumder, B. (2011). Health Capital and the Prenatal Environment: The Effect of Ramadan Observance During Pregnancy. *American Economic Journal-Applied Economics*, 3(4), 56–85.
- Almond, D., Mazumder, B., and van Ewijk, R. (2015). In Utero Ramadan Exposure and Children’s Academic Performance. *The Economic Journal*, 125(589), 1501–1533.
- Altindag, O., Erten, B., and Keskin, P. (2022). Mental Health Costs of Lockdowns: Evidence from Age-Specific Curfews in Turkey. *American Economic Journal: Applied Economics*, 14(2), 320–343.
- Alwasel, S. H., Harrath, A., Aljarallah, J. S., Abotalib, Z., Osmond, C., Omar, S. Y. A., Khaled, I., and Barker, D. J. P. (2013). Intergenerational effects of in utero

exposure to Ramadan in Tunisia. *American Journal of Human Biology*, 25(3), 341–343.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM-IV-TR)*. American Psychiatric Association.

Anderson, L. C., Tegegn, A., Tessema, F., Galea, S., and Hadley, C. (2012). Food insecurity, childhood illness and maternal emotional distress in Ethiopia. *Public Health Nutrition*, 15(4), 648–655.

Arab, M., and Nasrollahi, S. (2001). Interrelation of Ramadan Fasting and Birth Weight. *Medical Journal of Islamic Academy of Sciences*, 14(3), 91–95.

Austin, D. J., Kristinsson, K. G., and Anderson, R. M. (1999). The relationship between the volume of antimicrobial consumption in human communities and the frequency of resistance. *Proceedings of the National Academy of Sciences*, 96(3), 1152–1156.

Awwad, J., Usta, I., Succar, J., Musallam, K., Ghazeeri, G., and Nassar, A. (2012). The effect of maternal fasting during Ramadan on preterm delivery: A prospective cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology*, 119(11), 1379–1386.

Baggi, E., Semino, M., Bianchini, S., Fattizzo, M., Rosazza, C., Esposito, S., and Marchisio, P. (2013). Middle ear problems in children hospitalised because of lower respiratory tract infections: A comparison between two cohorts in Burundi and Italy. *International Journal of Pediatric Otorhinolaryngology*, 77(12), 1984–1986.

Barker, D. J. P. (1998). In utero programming of chronic disease. *Clinical Science*, 95(2), 115–128.

Barker, D. J. P., and Thornburg, K. L. (2013). The obstetric origins of health for a lifetime. *Clinical Obstetrics and Gynecology*, 56(3), 511–519.

Barrera, T. L., Cummings, J. P., Armento, M., Cully, J. A., Bush Amspoker, A., Wilson, N. L., Mallen, M. J., Shrestha, S., Kunik, M. E., and Stanley, M. A. (2017). Telephone-Delivered Cognitive-Behavioral Therapy for Older, Rural Veterans with Depression and Anxiety in Home-Based Primary Care. *Clinical Gerontologist*, 40(2), 114–123.

Becker, G. S. (1962). Investment in Human Capital: A Theoretical Analysis. *Journal of Political Economy*, 70(5, Part 2), 9–49.

Bellettiere, J., LaMonte, M. J., Evenson, K. R., Rillamas-Sun, E., Kerr, J., Lee, I.-M., Di, C., Rosenberg, D. E., Stefanick, M. L., Buchner, D. M., Hovell, M. F., LaCroix, A. Z., Rossouw, J., Ludlam, S., Burwen, D., McGowan, J., Ford, L., Geller, N., Anderson, G., ... Shumaker, S. (2019). Sedentary Behavior and Cardiovascular Disease in Older Women. *Circulation*, 139(8), 1036–1046.

- Bienvenu, L. A., Noonan, J., Wang, X., and Peter, K. (2020). Higher mortality of COVID-19 in males: Sex differences in immune response and cardiovascular comorbidities. *Cardiovascular Research*, 116(14), 2197–2206.
- Billings, A. G., and Moos, R. H. (1983). Comparisons of children of depressed and nondepressed parents: A social-environmental perspective. *Journal of Abnormal Child Psychology*, 11(4), 463–485.
- Borjas, G. J. (1987). Self-Selection and the Earnings of Immigrants. *The American Economic Review*, 77(4), 531–553.
- Bråbäck, L., Björ, O., and Nordahl, G. (2003). Early determinants of first hospital admissions for asthma and acute bronchitis among Swedish children. *Acta Paediatrica*, 92(1), 27–33.
- Brodeur, A., Clark, A. E., Fleche, S., and Powdthavee, N. (2021). COVID-19, lockdowns and well-being: Evidence from Google Trends. *Journal of Public Economics*, 193, 104346.
- Brown, A. S., van Os, J., Driessens, C., Hoek, H. W., and Susser, E. S. (2000). Further Evidence of Relation Between Prenatal Famine and Major Affective Disorder. *American Journal of Psychiatry*, 157(2), 190–195.
- Bryce, J., Coitinho, D., Darnton-Hill, I., Pelletier, D., and Pinstup-Andersen, P. (2008). Maternal and child undernutrition: Effective action at national level. *The Lancet*, 371(9611), 510–526.
- Burdakov, D., and Peleg-Raibstein, D. (2020). The hypothalamus as a primary coordinator of memory updating. *Physiology & Behavior*, 223, 112988.
- Carey, B., and Cryan, B. (2003). Antibiotic misuse in the community—A contributor to resistance. *Irish Medical Journal*, 96(2), 43–44, 46.
- CDC. (2023, May 11). *People with Certain Medical Conditions*. Centers for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html>
- Chaturvedi, R., Lui, B., Aaronson, J. A., White, R. S., and Samuels, J. D. (2022). COVID-19 complications in males and females: Recent developments. *Journal of Comparative Effectiveness Research*, 11(9), 689–698.
- Chen, X., Tan, C. M., Zhang, X., and Zhang, X. (2020). The effects of prenatal exposure to temperature extremes on birth outcomes: The case of China. *Journal of Population Economics*, 33(4), 1263–1302.
- CIA. (2022, August 1). *Turkey (Turkiye)*. The World Factbook. <https://www.cia.gov/the-world-factbook/countries/turkey-turkiye/>
- Clarke, D., Romano, J. P., and Wolf, M. (2020). The Romano–Wolf multiple-hypothesis correction in Stata. *The Stata Journal*, 20(4), 812–843.

- Colucci, E., Nadeau, S., Higgins, J., Kehayia, E., Poldma, T., Saj, A., and de Guise, E. (2022). COVID-19 lockdowns' effects on the quality of life, perceived health and well-being of healthy elderly individuals: A longitudinal comparison of pre-lockdown and lockdown states of well-being. *Archives of Gerontology and Geriatrics*, 99, 104606.
- Comfort, A. B. (2016). Long-term effect of in utero conditions on maternal survival later in life: Evidence from Sub-Saharan Africa. *Journal of Population Economics*, 29(2), 493–527.
- Cunha, F., and Heckman, J. (2007). The Technology of Skill Formation. *American Economic Review*, 97(2), 31–47.
- Currie, J., and Moretti, E. (2003). Mother's education and the intergenerational transmission of human capital: Evidence from college openings. *Quarterly Journal of Economics*, 118(4), 1495–1532. Scopus.
- de Rooij, S. R., Wouters, H., Yonker, J. E., Painter, R. C., and Roseboom, T. J. (2010). Prenatal undernutrition and cognitive function in late adulthood. *Proceedings of the National Academy of Sciences*, 107(39), 16881–16886.
- Deyessa, N., Berhane, Y., Emmelin, M., Ellsberg, M. C., Kullgren, G., and Högberg, U. (2010). Joint effect of maternal depression and intimate partner violence on increased risk of child death in rural Ethiopia. *Archives of Disease in Childhood*, 95(10), 771–775.
- Di Renzo, G. C., Rosati, A., Sarti, R. D., Cruciani, L., and Cutuli, A. M. (2007). Does fetal sex affect pregnancy outcome? *Gender Medicine*, 4(1), 19–30.
- Doyle, O., Harmon, C. P., Heckman, J. J., and Tremblay, R. E. (2009). Investing in early human development: Timing and economic efficiency. *Economics & Human Biology*, 7(1), 1–6.
- Earls, F. (1987). Sex differences in psychiatric disorders: Origins and developmental influences. *Psychiatric Developments*, 5(1), 1–23.
- Eika, L., Mogstad, M., and Zafar, B. (2019). Educational Assortative Mating and Household Income Inequality. *Journal of Political Economy*.
- Eriksson, J. G., Kajantie, E., Osmond, C., Thornburg, K., and Barker, D. J. P. (2010). Boys Live Dangerously in the Womb. *American Journal of Human Biology*, 22(3), 330–335.
- Ertem, I. O., Kaynak, G., Kaynak, C., Ulukol, B., and Gulnar, S. B. (2001). Attitudes and practices of breastfeeding mothers regarding fasting in Ramadan. *Child: Care, Health and Development*, 27(6), 545–554.
- Ettner, S. L. (1996). New evidence on the relationship between income and health. *Journal of Health Economics*, 15(1), 67–85.

- Ewijk, R. J. G. van, Painter, R. C., and Roseboom, T. J. (2013). Associations of Prenatal Exposure to Ramadan with Small Stature and Thinness in Adulthood: Results From a Large Indonesian Population-Based Study. *American Journal of Epidemiology*, 177(8), 729–736.
- Ferreira, C. R., Orsini, M. C., Vieira, C. R., do Amarante Paffaro, A. M., and Silva, R. R. (2015). Prevalence of anxiety symptoms and depression in the third gestational trimester. *Archives of Gynecology and Obstetrics*, 291(5), 999–1003.
- Field, E., Robles, O., and Torero, M. (2009). Iodine deficiency and schooling attainment in Tanzania. *American Economic Journal: Applied Economics*, 1(4), 140–169.
- Fisher, J., Cabral de Mello, M., Patel, V., Rahman, A., Tran, T., Holton, S., and Holmes, W. (2012). Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: A systematic review. *Bulletin of the World Health Organization*, 90(2), 139-149H.
- Fuchs, V. R. (2004). Reflections on the socio-economic correlates of health. *Journal of Health Economics*, 23(4), 653–661.
- García-Esquinas, E., Ortolá, R., Gine-Vázquez, I., Carnicero, J. A., Mañas, A., Lara, E., Alvarez-Bustos, A., Vicente-Rodriguez, G., Sotos-Prieto, M., Olaya, B., Garcia-Garcia, F. J., Gusi, N., Banegas, J. R., Rodríguez-Gómez, I., Struijk, E. A., Martínez-Gómez, D., Lana, A., Haro, J. M., Ayuso-Mateos, J. L., ... Rodríguez-Artalejo, F. (2021). Changes in Health Behaviors, Mental and Physical Health among Older Adults under Severe Lockdown Restrictions during the COVID-19 Pandemic in Spain. *International Journal of Environmental Research and Public Health*, 18(13), Article 13.
- Glewwe, P. (1999). Why Does Mother's Schooling Raise Child Health in Developing Countries? Evidence from Morocco. *The Journal of Human Resources*, 34(1), 124–159.
- Godfrey, K. M., and Barker, D. J. (2001). Fetal programming and adult health. *Public Health Nutrition*, 4(2b), 611–624.
- Goodman, S. H., and Garber, J. (2017). Evidence-Based Interventions for Depressed Mothers and Their Young Children. *Child Development*, 88(2), 368–377.
- Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., and Heyward, D. (2011). Maternal Depression and Child Psychopathology: A Meta-Analytic Review. *Clinical Child and Family Psychology Review*, 14(1), 1–27.
- Gordon, R. A., Kaestner, R., and Korenman, S. (2007). The Effects of Maternal Employment on Child Injuries and Infectious Disease. *Demography*, 44(2), 307–333.
- Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., and Strupp, B. (2007). Developmental potential in the first 5 years for children in developing countries. *The Lancet*, 369(9555), 60–70.

- Greve, J., Schultz-Nielsen, M. L., and Tekin, E. (2017). Fetal malnutrition and academic success: Evidence from Muslim immigrants in Denmark. *Economics of Education Review*, 60, 20–35.
- Grossman, M. (1972). On the Concept of Health Capital and the Demand for Health. *Journal of Political Economy*, 80(2), 223–255.
- Guerrero, L. R., and Wallace, S. P. (2021). The Impact of COVID-19 on Diverse Older Adults and Health Equity in the United States. *Frontiers in Public Health*, 9, 661592.
- Gulseren, L., Erol, A., Gulseren, S., Kuey, L., Kilic, B., and Ergor, G. (2006). From antepartum to postpartum: A prospective study on the prevalence of peripartum depression in a semiurban Turkish community. *The Journal of Reproductive Medicine*, 51(12), 955–960.
- Güneş, P. M. (2015). The role of maternal education in child health: Evidence from a compulsory schooling law. *Economics of Education Review*, 47, 1–16.
- Guo, N., Robakis, T., Miller, C., and Butwick, A. (2018). Prevalence of Depression Among Women of Reproductive Age in the United States. *Obstetrics and Gynecology*, 131(4), 671–679.
- Hammer-Helmich, L., Haro, J. M., Jönsson, B., Tanguy Melac, A., Di Nicola, S., Chollet, J., Milea, D., Rive, B., and Saragoussi, D. (2018). Functional impairment in patients with major depressive disorder: The 2-year PERFORM study. *Neuropsychiatric Disease and Treatment*, 14, 239–249.
- Hansen, D., Møller, H., and Olsen, J. (1999). Severe periconceptional life events and the sex ratio in offspring: Follow up study based on five national registers. *BMJ*, 319(7209), 548–549.
- Hashimoto, N., and Hashimoto, H. (2016). The Association Between Maternal Employment and Prevalence of Asthma in Children. *Pediatric Allergy, Immunology, and Pulmonology*, 29(3), 143–148.
- Heckman, J. J. (2007). The economics, technology, and neuroscience of human capability formation. *Proceedings of the National Academy of Sciences*, 104(33), 13250–13255.
- Heneghan, A. M., Silver, E. J., Bauman, L. J., and Stein, R. E. K. (2000). Do Pediatricians Recognize Mothers With Depressive Symptoms? *Pediatrics*, 106(6), 1367–1373.
- Herdiwijaya, D. (2020). On the beginning of the morning twilight based on sky brightness measurements. *Journal of Physics: Conference Series*, 1523(1), 012007.
- Hernández, S. F., Morales, H. R., Cuevas, R. P., and Gallardo, H. G. (1999). The Day Care Center As a Risk Factor for Acute Respiratory Infections. *Archives of Medical Research*, 30(3), 216–223.

Hossain, N., Samuel, M., Mughal, S., and Shafique, K. (2021). Ramadan Fasting: Perception and maternal outcomes during Pregnancy. *Pakistan Journal of Medical Sciences*, 37(5), 1262–1267.

Institute for Health Metrics and Evaluation (IHME). (2019). *GBD Results*. Institute for Health Metrics and Evaluation (IHME) Global Health Data Exchange (GHDx). <https://vizhub.healthdata.org/gbd-results>

Jin, J.-M., Bai, P., and Yang, J.-K. (2020). Gender Differences in Patients With COVID-19: Focus on Severity and Mortality. *Frontiers in Public Health*, 8.

Johnson, S. E., Lawrence, D., Perales, F., Baxter, J., and Zubrick, S. R. (2019). Poverty, Parental Mental Health and Child/Adolescent Mental Disorders: Findings from a National Australian Survey. *Child Indicators Research*, 12(3), 963–988.

Joosop, J., Abu, J., Yu, S. L., Obstetrics, Mbbs, J. J., Mrcog, M., Yu, S. L., Frcog, M., Head, and Obstetrics. (2004). A survey of fasting during pregnancy. *Singapore Med J*.

Karaçam, Z., and Ançel, G. (2009). Depression, anxiety and influencing factors in pregnancy: A study in a Turkish population. *Midwifery*, 25(4), 344–356.

Karimi, S. M. (2018). Pre – Birth Exposure to Ramadan, Height, and the Length of Gestation. *Economic Research Forum Working Papers*, No. 1236.

Karimi, S. M., and Basu, A. (2018). The effect of prenatal exposure to Ramadan on children's height. *Economics & Human Biology*, 30, 69–83.

Karimi, S. M., Little, B. B., and Mokhtari, M. (2021). Short-term fetal nutritional stress and long-term health: Child height. *American Journal of Human Biology*, 33(6), e23531.

Katz, S., Ford, A. B., Moskowitz, R. W., Jackson, B. A., and Jaffe, M. W. (1963). Studies of Illness in the Aged: The Index of ADL: A Standardized Measure of Biological and Psychosocial Function. *JAMA*, 185(12), 914–919.

Kieler, H., Axelsson, O., Nilsson, S., and Waldenström, U. (1995). The length of human pregnancy as calculated by ultrasonographic measurement of the fetal biparietal diameter. *Ultrasound in Obstetrics & Gynecology*, 6(5), 353–357.

Kim, Y. H. (2017). Trajectories of Maternal Depressive Symptoms and Behavioral Problems of Children at Four Years of Age: Evidence from the Panel Study of Korean Children. *Child Indicators Research*, 10(4), 1061–1078.

Kirwan, R., McCullough, D., Butler, T., Perez de Heredia, F., Davies, I. G., and Stewart, C. (2020). Sarcopenia during COVID-19 lockdown restrictions: Long-term health effects of short-term muscle loss. *GeroScience*, 42(6), 1547–1578.

KONDA. (2017). KONDA Barometer, Themes, Ramadan Practices. <https://konda.com.tr/uploads/tr1706-barometre77-ramazan-pratikleri-c2c3887888096986316bc734885abb10883913c1669e654e0cb421aa50c9ec8e.pdf>

- Kostovic, I., and Vasung, L. (2009). Insights From In Vitro Fetal Magnetic Resonance Imaging of Cerebral Development. *Seminars in Perinatology*, 33(4), 220–233.
- Kraemer, S. (2000). The fragile male. *BMJ*, 321(7276), 1609–1612. <https://doi.org/10.1136/bmj.321.7276.1609>
- Kroenke, K., Spitzer, R. L., and Williams, J. B. W. (2001). The PHQ-9. *Journal of General Internal Medicine*, 16(9), 606–613.
- Kroenke, K., Strine, T. W., Spitzer, R. L., Williams, J. B. W., Berry, J. T., and Mokdad, A. H. (2009). The PHQ-8 as a measure of current depression in the general population. *Journal of Affective Disorders*, 114(1–3), 163–173.
- Kværner, K. J., Nafstad, P., and Jaakkola, J. J. K. (2000). Upper Respiratory Morbidity in Preschool Children: A Cross-sectional Study. *Archives of Otolaryngology–Head & Neck Surgery*, 126(10), 1201–1206.
- Laerum, B. N., Svanes, C., Wentzel-Larsen, T., Gulsvik, A., Torén, K., Norrman, E., Gíslason, T., Janson, C., and Omenaas, E. (2007). Young maternal age at delivery is associated with asthma in adult offspring. *Respiratory Medicine*, 101(7), 1431–1438.
- Larson, E. A., Bader-Larsen, K. S., and Magkos, F. (2021). The Effect of COVID-19-related Lockdowns on Diet and Physical Activity in Older Adults: A Systematic Review. *Aging and Disease*, 12(8), 1935–1947.
- Lasunncty. (2018). *English: Vector version of NUTS Map of Turkey.png created using Turkey provinces blank gray.svg.* Own work. https://commons.wikimedia.org/wiki/File:NUTS_Map_of_Turkey.svg
- Lawton, M. P., and Brody, E. M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist*, 9(3, Pt 1), 179–186.
- Lekamwasam, R., and Lekamwasam, S. (2020). Effects of COVID-19 Pandemic on Health and Wellbeing of Older People: A Comprehensive Review. *Annals of Geriatric Medicine and Research*, 24(3), 166–172.
- Lessan, N., and Ali, T. (2019). Energy Metabolism and Intermittent Fasting: The Ramadan Perspective. *Nutrients*, 11(5), Article 5.
- Lou, A., and Hammoud, M. (2016). Muslim patients' expectations and attitudes about Ramadan fasting during pregnancy. *International Journal of Gynecology and Obstetrics*, 132(3), 321–324.
- Lumey, L. H., Stein, A. D., and Susser, E. (2011). Prenatal Famine and Adult Health. *Annual Review of Public Health*, 32(1), 237–262.
- Majid, F., Behrman, J., and Mani, S. (2019). Short-term and long-term distributional consequences of prenatal malnutrition and stress: Using Ramadan as a natural experiment. *Bmj Global Health*, 4(3), 9.

- Majid, M. F. (2015). The persistent effects of in utero nutrition shocks over the life cycle: Evidence from Ramadan fasting. *Journal of Development Economics*, 117, 48–57.
- Makki, A. M. (2002). Impact of Ramadan fasting on birth weight in 4 hospitals in Sana'a city, Yemen. *Impact of Ramadan Fasting on Birth Weight in 4 Hospitals in Sana'a City, Yemen*, 23(11), 1419–1420.
- Malik, A., and Khan, M. (2016). Economic burden of mental illnesses in Pakistan. *Journal of Mental Health Policy and Economics*, 19(3), 155–166.
- Marcos-Pardo, P. J., Abelleira-Lamela, T., González-Gálvez, N., Esparza-Ros, F., Espeso-García, A., and Vaquero-Cristóbal, R. (2022). Impact of COVID-19 lockdown on health parameters and muscle strength of older women: A longitudinal study. *Experimental Gerontology*, 164, 111814.
- Marshall, A. (1890). *Principles of Economics*. Macmillan and Company.
- McQuillen, P. S., Goff, D. A., and Licht, D. J. (2010). Effects of congenital heart disease on brain development. *Progress in Pediatric Cardiology*, 29(2), 79–85.
- Meng, X., and Qian, N. (2009). *The Long Term Consequences of Famine on Survivors: Evidence from a Unique Natural Experiment using China's Great Famine* (Working Paper 14917). National Bureau of Economic Research.
- Metzger, B., Vileisis, R., Ravnika, V., and Freinkel, N. (1982). 'Accelerated Starvation' and the Skipped Breakfast in Late Normal Pregnancy. *The Lancet*, 319(8272), 588–592.
- Milgrom, J., Ericksen, J., McCarthy, R., and Gemmill, A. W. (2006). Stressful impact of depression on early mother–infant relations. *Stress and Health*, 22(4), 229–238.
- Mirghani, H. M., Weerasinghe, S., Al-Awar, S., Abdulla, L., and Ezimokhai, M. (2005). The Effect of Intermittent Maternal Fasting on Computerized Fetal Heart Tracing. *Journal of Perinatology*, 25(2), Article 2.
- Mubeen, S. M., Mansoor, S., Hussain, A., and Qadir, S. (2012). Perceptions and practices of fasting in Ramadan during pregnancy in Pakistan. *Iranian Journal of Nursing and Midwifery Research*, 17(7), 467–471.
- Mueller, A. L., McNamara, M. S., and Sinclair, D. A. (2020). Why does COVID-19 disproportionately affect older people? *Aging (Albany NY)*, 12(10), 9959–9981.
- Mushkin, S. J. (1962). Health as an Investment. *Journal of Political Economy*, 70(5, Part 2), 129–157.
- Neelsen, S., and Stratmann, T. (2011). Effects of prenatal and early life malnutrition: Evidence from the Greek famine. *Journal of Health Economics*, 30(3), 479–488. <https://doi.org/10.1016/j.jhealeco.2011.03.001>

- Nguyen, N. T., Chinn, J., Ferrante, M. D., Kirby, K. A., Hohmann, S. F., and Amin, A. (2021). Male gender is a predictor of higher mortality in hospitalized adults with COVID-19. *PLOS ONE*, 16(7), e0254066.
- Nguyen, P. H., Saha, K. K., Ali, D., Menon, P., Manohar, S., Mai, L. T., Rawat, R., and Ruel, M. T. (2014). Maternal mental health is associated with child undernutrition and illness in Bangladesh, Vietnam and Ethiopia. *Public Health Nutrition*, 17(6), 1318–1327.
- Niu, B., and Zhang, L. (2020). The Burden of Mental Illness and Mental Distress on Family Members. *The Journal of Mental Health Policy and Economics*, 23(1), 3–17.
- Nokso-Koivisto, J., Hovi, T., and Pitkäranta, A. (2006). Viral upper respiratory tract infections in young children with emphasis on acute otitis media. *International Journal of Pediatric Otorhinolaryngology*, 70(8), 1333–1342.
- Owen, N., Sparling, P. B., Healy, G. N., Dunstan, D. W., and Matthews, C. E. (2010). Sedentary Behavior: Emerging Evidence for a New Health Risk. *Mayo Clinic Proceedings*, 85(12), 1138–1141.
- Padela, A. I., Malik, S., Vu, M., Quinn, M., and Peek, M. (2018). Developing religiously-tailored health messages for behavioral change: Introducing the reframe, reprioritize, and reform (“3R”) model. *Social Science & Medicine*, 204, 92–99.
- Patel, V. (2003). Postnatal depression and infant growth and development in low income countries: A cohort study from Goa, India. *Archives of Disease in Childhood*, 88(1), 34–37.
- Pedersen, J. F. (1980). Ultrasound evidence of sexual difference in fetal size in first trimester. *British Medical Journal*, 281(6250), 1253.
- Pelicioni, P. H. S., and Lord, S. R. (2020). COVID-19 will severely impact older people’s lives, and in many more ways than you think! *Brazilian Journal of Physical Therapy*, 24(4), 293–294. <https://doi.org/10.1016/j.bjpt.2020.04.005>
- Petterson, S. M., and Albers, A. B. (2001). Effects of Poverty and Maternal Depression on Early Child Development. *Child Development*, 72(6), 1794–1813.
- Powell-Wiley, T. M., Poirier, P., Burke, L. E., Després, J.-P., Gordon-Larsen, P., Lavie, C. J., Lear, S. A., Ndumele, C. E., Neeland, I. J., Sanders, P., St-Onge, M.-P., and null, null. (2021). Obesity and Cardiovascular Disease: A Scientific Statement From the American Heart Association. *Circulation*, 143(21), e984–e1010.
- Pradella, F., and van Ewijk, R. (2018). As Long as the Breath Lasts: In Utero Exposure to Ramadan and the Occurrence of Wheezing in Adulthood. *American Journal of Epidemiology*, 187(10), 2100–2108.
- Pradhan, A., and Olsson, P.-E. (2020). Sex differences in severity and mortality from COVID-19: Are males more vulnerable? *Biology of Sex Differences*, 11(1), 53.

Propper, C., Rigg, J., and Burgess, S. (2007). Child health: Evidence on the roles of family income and maternal mental health from a UK birth cohort. *Health Economics*, 16(11), 1245–1269.

Quevedo, L. A., Silva, R. A., Godoy, R., Jansen, K., Matos, M. B., Tavares Pinheiro, K. A., and Pinheiro, R. T. (2012). The impact of maternal post-partum depression on the language development of children at 12 months. *Child: Care, Health and Development*, 38(3), 420–424.

Quran, Surah Al-Baqarah 2:184-185. (n.d.). Retrieved 22 October 2022, from <https://quran.com/2?startingVerse=183>

Rahman, A., Bunn, J., Lovel, H., and Creed, F. (2007). Maternal depression increases infant risk of diarrhoeal illness: –A cohort study. *Archives of Disease in Childhood*, 92(1), 24–28.

Rahman, A., Iqbal, Z., Bunn, J., Lovel, H., and Harrington, R. (2004). Impact of Maternal Depression on Infant Nutritional Status and Illness: A Cohort Study. *Archives of General Psychiatry*, 61(9), 946–952.

Rahman, A., Malik, A., Sikander, S., Roberts, C., and Creed, F. (2008). Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: A cluster-randomised controlled trial. *The Lancet*, 372(9642), 902–909.

Ramsey, C. D., Gold, D. R., Litonjua, A. A., Sredl, D. L., Ryan, L., and Celedón, J. C. (2007). Respiratory illnesses in early life and asthma and atopy in childhood. *Journal of Allergy and Clinical Immunology*, 119(1), 150–156.

Rashed, A. H. (1992). The fast of Ramadan. *BMJ: British Medical Journal*, 304(6826), 521–522.

Razykov, I., Ziegelstein, R. C., Whooley, M. A., and Thombs, B. D. (2012). The PHQ-9 versus the PHQ-8 — Is item 9 useful for assessing suicide risk in coronary artery disease patients? Data from the Heart and Soul Study. *Journal of Psychosomatic Research*, 73(3), 163–168.

Republic of Turkey, Ministry of Health. (n.d.). *Infant, Child, Adolescent Monitoring*. General Directorate of Public Health, Department of Child and Adolescent Health. Retrieved 20 November 2023, from <https://hsgm.saglik.gov.tr/tr/sagligin-gelistirilmesiprogramlari/bebek-cocuk-ergen-izlemleri.html>

Robinson, T., and Raisler, J. (2005). D. “Each One Is a Doctor for Herself”: Ramadan Fasting Among Pregnant Muslim Women in the United States. *MENTAL HEALTH*, 15, 5.

Rojas, G., Fritsch, R., Solis, J., Jadresic, E., Castillo, C., González, M., Guajardo, V., Lewis, G., Peters, T. J., and Araya, R. (2007). Treatment of postnatal depression in low-income mothers in primary-care clinics in Santiago, Chile: A randomised controlled trial. *The Lancet*, 370(9599), 1629–1637.

- Romano, J. P., and Wolf, M. (2005a). Exact and Approximate Stepdown Methods for Multiple Hypothesis Testing. *Journal of the American Statistical Association*, 100(469), 94–108.
- Romano, J. P., and Wolf, M. (2005b). Stepwise Multiple Testing as Formalized Data Snooping. *Econometrica*, 73(4), 1237–1282.
- Roseboom, T., de Rooij, S., and Painter, R. (2006). The Dutch famine and its long-term consequences for adult health. *Early Human Development*, 82(8), 485–491.
- Rowe, M. L., Thapa, B. K., LeVine, R., LeVine, S., and Tuladhar, S. K. (2005). How Does Schooling Influence Maternal Health Practices? Evidence from Nepal. *Comparative Education Review*, 49(4), 512–533.
- Rush, D. (2001). Maternal Nutrition and Perinatal Survival. *Nutrition Reviews*, 59(10), 315–326.
- Safari, K., Piro, T. J., and Ahmad, H. M. (2019). Perspectives and pregnancy outcomes of maternal Ramadan fasting in the second trimester of pregnancy. *BMC Pregnancy and Childbirth*, 19(1), 128.
- Sakar, M. N., Gultekin, H., Demir, B., Bakir, V. L., Balsak, D., Vuruskan, E., Acar, H., Yucel, O., and Yayla, M. (2015). Ramadan fasting and pregnancy: Implications for fetal development in summer season. *Journal of Perinatal Medicine*, 43(3), 319–323.
- Scholte, R. S., van den Berg, G. J., and Lindeboom, M. (2015). Long-run effects of gestation during the Dutch Hunger Winter famine on labor market and hospitalization outcomes. *Journal of Health Economics*, 39, 17–30. <https://doi.org/10.1016/j.jhealeco.2014.10.002>
- Schultz, P. T. (2002). Why Governments Should Invest More to Educate Girls. *World Development*, 30(2), 207–225.
- Schultz-Nielsen, M. L., Tekin, E., and Greve, J. (2016). Labor market effects of intrauterine exposure to nutritional deficiency: Evidence from administrative data on Muslim immigrants in Denmark. *Economics & Human Biology*, 21, 196–209.
- Schulz, L. C. (2010). The Dutch Hunger Winter and the developmental origins of health and disease. *Proceedings of the National Academy of Sciences*, 107(39), 16757–16758.
- Searle, A. (1987). The Effects of Postnatal Depression on Mother-Infant Interaction. *Australian Journal of Sex, Marriage and Family*, 8(2), 89–96.
- Seckin, K. D., Yeral, M. I., Karşlı, M. F., and Gultekin, I. B. (2014). Effect of maternal fasting for religious beliefs on fetal sonographic findings and neonatal outcomes. *International Journal of Gynecology & Obstetrics*, 126(2), 123–125.
- Seiermann, A. U., Al-Mufti, H., Waid, J. L., Wendt, A. S., Sobhan, S., and Gabrysch, S. (2021). Women's fasting habits and dietary diversity during Ramadan in rural Bangladesh. *Maternal & Child Nutrition*, 17(3), e13135.

Sharma, G., Volgman, A. S., and Michos, E. D. (2020). Sex Differences in Mortality From COVID-19 Pandemic. *JACC: Case Reports*, 2(9), 1407–1410.

Sherriff, A., Peters, T. J., Henderson, J., Strachan, D., and The Alspac Study Team. (2001). Risk factor associations with wheezing patterns in children followed longitudinally from birth to 3 ½ years. *International Journal of Epidemiology*, 30(6), 1473–1484.

Shin, C., Lee, S.-H., Han, K.-M., Yoon, H.-K., and Han, C. (2019). Comparison of the Usefulness of the PHQ-8 and PHQ-9 for Screening for Major Depressive Disorder: Analysis of Psychiatric Outpatient Data. *Psychiatry Investigation*, 16(4), 300–305.

Simon, A. K., Hollander, G. A., and McMichael, A. (2015). Evolution of the immune system in humans from infancy to old age. *Proceedings of the Royal Society B: Biological Sciences*, 282(1821), 20143085.

Spencer, N. (2005). Maternal education, lone parenthood, material hardship, maternal smoking, and longstanding respiratory problems in childhood: Testing a hierarchical conceptual framework. *Journal of Epidemiology & Community Health*, 59(10), 842–846.

Stein, A., Pearson, R. M., Goodman, S. H., Rapa, E., Rahman, A., McCallum, M., Howard, L. M., and Pariante, C. M. (2014). Effects of perinatal mental disorders on the fetus and child. *The Lancet*, 384(9956), 1800–1819.

Stein, Z., Susser, M., Saenger, G., and Marolla, F. (1972). Nutrition and Mental Performance. *Science*, 178(4062), 708–713.

Stein, Z., Susser, M., Saenger, G., and Marolla, F. (1975). *Famine and human development: The Dutch hunger winter of 1944-1945* (pp. xx, 284). Oxford University Press.

Sur, M., and Rubenstein, J. L. R. (2005). Patterning and Plasticity of the Cerebral Cortex. *Science*, 310(5749), 805–810.

Surkan, P. J., Kennedy, C. E., Hurley, K. M., and Black, M. M. (2011). Maternal depression and early childhood growth in developing countries: Systematic review and meta-analysis. *Bulletin of the World Health Organization*, 89(8), 608–615E.

The Governorship of Istanbul. (2020). *65 Yaş ve Üzeri Vatandaşlarımıza Seyahat İzni*. <http://www.istanbul.gov.tr/65-yas-ve-uzeri-vatandaslarimiza-seyahat-izni>

The Turkish Ministry of Internal Affairs. (2020a). *65 Yaş ve Üstü ile Kronik Rahatsızlığı Olanlara Sokağa Çıkma Yasağı Genelgesi*. <https://www.icisleri.gov.tr/65-yas-ve-ustu-ile-kronik-rahatsizligi-olanlara-sokaga-cikma-yasagi-genelgesi>

The Turkish Ministry of Internal Affairs. (2020b). *65 Yaş ve Üzeri/20 Yaş Altı/Kronik Rahatsızlığı Bulunan Kişilerin Sokağa Çıkma Kısıtlaması İstisnası Genelgesi*. <https://www.icisleri.gov.tr/65-yas-ve-uzeri20-yas-altikronik-rahatsizligi-bulunan-kisilerin-sokaga-cikma-kisitlamasi-istisnasi-genelgesi>

The Turkish Ministry of Internal Affairs. (2020c). *65 Yaş ve Üzeri/20 Yaş Altı/Kronik Rahatsızlığı Bulunan Kişilerin Sokağa Çıkma Kısıtlaması İstisnası Genelgesi*. <https://www.icisleri.gov.tr/65-yas-ve-uzeri20-yas-altikronik-rahatsizligi-bulunan-kisilerin-sokaga-cikma-kisitlamasi-istisnasi-genelgesi>

The Turkish Ministry of Internal Affairs. (2020d). *81 İl Valiliğine 65 Yaş ve Üzeri Vatandaşlarımız İçin Seyahat İzin Belgesi Genelgesi*. <https://www.icisleri.gov.tr/81-il-valiligine-65-yas-ve-uzeri-vatandaslarimiz-icin-seyahat-izin-belgesi-genelgesi>

The Turkish Ministry of Internal Affairs. (2020e). *İstanbul ve Ankara'da 65 Yaş Kısıtlaması Getirildi*. <https://www.icisleri.gov.tr/istanbul-ve-ankarada-65-yas-kisitlamasi-getirildi>

The Turkish Ministry of Internal Affairs. (2020f). *Koronavirüs ile Mücadele Kapsamında—Yeni Kısıtlama ve Tedbirler Genelgesi*. <https://www.icisleri.gov.tr/koronavirus-ile-mucadele-kapsaminda-sokaga-cikma-kisitlamalari---yeni-kisitlama-ve-tedbirler-genelgeleri>

The Turkish Ministry of Internal Affairs. (2020g). *Şehir Giriş/Çıkış Tebirleri ve Yaş Sınırlaması*. <https://www.icisleri.gov.tr/sehir-giriscikis-tebirleri-ve-yas-sinirlamasi>

The Turkish Ministry of Internal Affairs. (2021a). *81 İl Valiliğine Kademeli Normalleşme Tedbirleri Genelgesi Gönderildi*. <https://www.icisleri.gov.tr/81-il-valiligine-kademeli-normallesme-tedbirleri-genelgesi-gonderildi>

The Turkish Ministry of Internal Affairs. (2021b). *81 İl Valiliğine Kısmi Kapanma Genelgesi Gönderildi*. <https://www.icisleri.gov.tr/81-il-valiligine-kismi-kapanma-genelgesi-gonderildi>

Thompson, A. L., Jahnke, J. R., Teran, E., and Bentley, M. E. (2022). Pathways linking maternal mental health and child health in a dual burden context: Evidence from Galapagos, Ecuador. *Social Science & Medicine*, 305, 115043. <https://doi.org/10.1016/j.socscimed.2022.115043>

Tian, X., Gong, J., and Zhai, Z. (2022). Natural disasters and human capital accumulation: Evidence from the 1976 Tangshan earthquake. *Economics of Education Review*, 90, 102304.

Toivonen, L., Karppinen, S., Schuez-Havupalo, L., Teros-Jaakkola, T., Vuononvirta, J., Mertsola, J., He, Q., Waris, M., and Peltola, V. (2016). Burden of Recurrent Respiratory Tract Infections in Children: A Prospective Cohort Study. *The Pediatric Infectious Disease Journal*, 35(12), e362.

Turkish Employment Institution. (2023). *İŞKUR*. Disability Employment. <https://www.iskur.gov.tr/isveren/engelli-istihdami/>

Turkish Ministry of Family and Social Services. (2022). *Statistics Bulletin of the Disabled and Elderly*. https://www.aile.gov.tr/media/98625/eyhgm_istatistik_bulteni_ocak_2022.pdf

Tyrrell, C. J., and Williams, K. N. (2020). The paradox of social distancing: Implications for older adults in the context of COVID-19. *Psychological Trauma: Theory, Research, Practice, and Policy*, 12(S1), S214–S216.

Uçar, A., Arslan, Ş., Manap, H., Gürkan, T., Çalışkan, M., Dayioğlu, A., Efe, H., Yılmaz, M., İbrahimoglu, A., Gültekin, E., Durna, R., Başar, R., Osmanoglu, F., and Ören, S. (2020). Türkiye’de Covid-19 Pandemisinin Monitörizasyonu İçin Interaktif Ve Gerçek Zamanlı Bir Web Uygulaması: TURCOVID19. *Anatolian Clinic the Journal of Medical Sciences*, 25(Special Issue on COVID 19), Article Special Issue on COVID 19.

Uludağ, E., and Göral Türkcü, S. (2022). Ramadan Fasting as a Religious Obligation: A Qualitative Study on Opinions and Experiences of Muslim Pregnant Women about Fasting in Turkey. *Journal of Religion and Health*, 61(4), 2960–2974.

van Ewijk, R. (2011). Long-term health effects on the next generation of Ramadan fasting during pregnancy. *Journal of Health Economics*, 30(6), 1246–1260.

Verachtert, P., De Fraine, B., Onghena, P., and Ghesquière, P. (2010). Season of birth and school success in the early years of primary education. *Oxford Review of Education*, 36(3), 285–306.

Victora, C. G., Adair, L., Fall, C., Hallal, P. C., Martorell, R., Richter, L., and Sachdev, H. S. (2008). Maternal and child undernutrition: Consequences for adult health and human capital. *The Lancet*, 371(9609), 340–357.

Wachs, T. D., Black, M. M., and Engle, P. L. (2009). Maternal Depression: A Global Threat to Children’s Health, Development, and Behavior and to Human Rights. *Child Development Perspectives*, 3(1), 51–59.

Wang, J., Alessie, R., and Angelini, V. (2023). Exposure in utero to adverse events and health late-in-life: Evidence from China. *Health Economics*, 32(3), 541–557.

Webb, R., Abel, K., Pickles, A., and Appleby, L. (2005). Mortality in Offspring of Parents With Psychotic Disorders: A Critical Review and Meta-Analysis. *American Journal of Psychiatry*, 162(6), 1045–1056.

Webb, R. T., Pickles, A. R., King-Hele, S. A., Appleby, L., Mortensen, P. B., and Abel, K. M. (2008). Parental mental illness and fatal birth defects in a national birth cohort. *Psychological Medicine*, 38(10), 1495–1503.

World Health Organization. (2008). *Maternal mental health and child health and development in low and middle income countries: Report of the meeting, Geneva, Switzerland, 30 January - 1 February, 2008*.

<https://apps.who.int/iris/handle/10665/43975>

World Health Organization (WHO). (2017). Depression and other common mental disorders: Global health estimates. *World Health Organization*.

<https://apps.who.int/iris/bitstream/handle/10665/254610/W?sequence=1>

World Health Organization (WHO). (2021). *Depressive disorder (depression)*. Depressive Disorder (Depression). <https://www.who.int/news-room/fact-sheets/detail/depression>

World Health Organization (WHO). (2024). *Coronavirus disease (COVID-19) pandemic*. <https://www.who.int/europe/emergencies/situations/covid-19>

Worldometer. (2024). *COVID - Coronavirus Statistics—Worldometer*. <https://www.worldometers.info/coronavirus/>

Wu, G., Imhoff-Kunsch, B., and Girard, A. W. (2012). Biological Mechanisms for Nutritional Regulation of Maternal Health and Fetal Development. *Paediatric and Perinatal Epidemiology*, 26(s1), 4–26. <https://doi.org/10.1111/j.1365-3016.2012.01291.x>

Wu, Y., Levis, B., Riehm, K. E., Saadat, N., Levis, A. W., Azar, M., Rice, D. B., Boruff, J., Cuijpers, P., Gilbody, S., Ioannidis, J. P. A., Kloda, L. A., McMillan, D., Patten, S. B., Shrier, I., Ziegelstein, R. C., Akena, D. H., Arroll, B., Ayalon, L., ... Thombs, B. D. (2020). Equivalency of the diagnostic accuracy of the PHQ-8 and PHQ-9: A systematic review and individual participant data meta-analysis. *Psychological Medicine*, 50(8), 1368–1380.

Yanez, N. D., Weiss, N. S., Romand, J.-A., and Treggiari, M. M. (2020). COVID-19 mortality risk for older men and women. *BMC Public Health*, 20(1), 1742.

BIOGRAPHY

Gökben AYDILEK is an economist with a strong foundation in research and teaching. Her academic career began as a full scholarship student to obtain a Bachelor's Degree in Economics from TOBB University of Economics and Technology. Then, receiving both a graduate scholarship and TUBITAK scholarship, she pursued her Master's Degree in Economics from Koç University, Istanbul, Turkey. She worked as a research and teaching assistant at the Department of Economics at Koç University during her studies. Following that, she subsequently leveraged her expertise as an economist at CASE in Warsaw, Poland. Since 2016, Gökben has been a research assistant at the Department of Economics at Gebze Technical University, where her main research areas of interest lie primarily in health economics and biostatistics.

PUBLICATIONS AND PRESENTATIONS FROM THE THESIS

Publications

Aydilek G., and Karaoglan D., (2024 - Accepted), “The Effect of Prenatal Exposure to Ramadan on Human Capital: Evidence from Turkey”, *Journal of Population Economics*. (Forthcoming).

Aydilek G., and Karaoglan D., (2024 - Accepted), “Maternal Depression and Physical Health of Under-five Children in Turkey”, *Journal of Mental Health Policy and Economics*. (Forthcoming).

Presentations

Aydilek G., and Karaoglan D., (2024) “Double Lockdown: Unravelling the Impact of Age-targeted COVID-19 Restrictions on Senior Women’s Health – A Difference-in-Differences (DiD) Approach”, *EUHEA 2024*. (Will be presented)

Aydilek G., and Karaoglan D., (2023) “The Far-Reaching Low Spirits: Maternal Depression and Physical Health of Under-five Children in Turkey”, *ICE-TEA2023, 30th Conference on Economics, Turkey*.

Aydilek G., and Karaoglan D., (2023) “The Effect of Prenatal Exposure to Ramadan on Human Capital: Evidence from a Developing Country”, *EUHEA, PhD-Student Supervisor Conference, Italy*.

Aydilek G., and Karaoglan D., (2022) “The Effect of Maternal Education on the Morbidity of Infectious Diseases Among Children”, *ICOMEPE ’22, International Congress of Management, Economy and Policy, Turkey*.

Aydilek G., (2020), “The Effect of Prenatal Exposure to Ramadan on the Educational Outcomes of Individuals: Evidence from Turkey”, *EUHEA*.

APPENDICES

APPENDIX-A: APPENDIX FOR CHAPTER 3

Table A3. 1: Summary statistics for the working-age group (between 33-65 years).

Variables	All			Female			Male		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
<i>Demographics</i>									
Male	0.504	0.500	14599						
Age	46.425	9.087	14599	46.167	9.025	7241	46.678	9.141	7358
Area lived in till age 15:									
Urban	0.322	0.467	12911	0.323	0.468	6755	0.321	0.467	6156
Suburban	0.268	0.443	12911	0.268	0.443	6755	0.268	0.443	6156
Rural	0.389	0.488	12911	0.382	0.486	6755	0.397	0.489	6156
Abroad	0.021	0.143	12911	0.027	0.162	6755	0.014	0.119	6156
Region of residence									
TR1: Istanbul	0.131	0.338	14599	0.131	0.337	7241	0.131	0.338	7358
TR2: Western Marmara	0.090	0.286	14599	0.092	0.289	7241	0.088	0.283	7358
TR3: Aegean	0.175	0.380	14599	0.175	0.380	7241	0.175	0.380	7358
TR4: Eastern Marmara	0.105	0.306	14599	0.105	0.306	7241	0.105	0.306	7358
TR5: Western Anatolia	0.144	0.351	14599	0.147	0.354	7241	0.142	0.349	7358
TR6: Mediterranean	0.102	0.302	14599	0.103	0.304	7241	0.100	0.300	7358
TR7: Central Anatolia	0.061	0.239	14599	0.058	0.234	7241	0.064	0.244	7358
TR8: Western Black Sea	0.057	0.232	14599	0.057	0.233	7241	0.057	0.232	7358
TR9: Eastern Black Sea	0.044	0.205	14599	0.044	0.204	7241	0.044	0.206	7358
TRA: Northeastern A.	0.044	0.205	14599	0.044	0.204	7241	0.044	0.206	7358
TRB: Middle Eastern A.	0.020	0.140	14599	0.020	0.141	7241	0.020	0.139	7358
TRC: Southeastern A.	0.034	0.180	14599	0.031	0.174	7241	0.036	0.186	7358
<i>Educational outcomes</i>									
Illiterate	0.049	0.217	14599	0.087	0.281	7241	0.013	0.112	7358
No education	0.080	0.272	14599	0.134	0.341	7241	0.028	0.164	7358
Years of schooling	8.085	4.828	14599	7.164	4.872	7241	8.992	4.608	7358
Middle school completion	0.467	0.499	14599	0.376	0.484	7241	0.556	0.497	7358
High school completion	0.355	0.479	14599	0.293	0.455	7241	0.416	0.493	7358
College completion	0.176	0.381	14599	0.143	0.350	7241	0.210	0.407	7358
<i>Labour market outcomes</i>									
Labour force participation	0.512	0.500	12911	0.297	0.457	6755	0.747	0.435	6156
Log income	7.580	0.724	6206	7.340	0.899	1631	7.665	0.630	4575
Having regular income	0.630	0.483	6604	0.623	0.485	2004	0.632	0.482	4600
Precarious employment	0.106	0.307	6604	0.098	0.297	2004	0.109	0.312	4600

Data source: 2016 Turkish Family Structure Survey.

Table A3. 2: Summary statistics of outcome variables for the exposed and not-exposed individuals.

Variables	All				Female				Male			
	Not exp.		Exp.		Not exp.		Exp.		Not exp.		Exp.	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
<i>Educational outcomes</i>												
Illiterate	0.087 (0.282)	2802	0.078 (0.269)	14091	0.149 (0.356)	1402	0.135 (0.342)	7044	0.025 (0.156)	1400	0.021 (0.143)	7047
No education	0.132 (0.338)	2802	0.122 (0.327)	14091	0.210 (0.408)	1402	0.193 (0.395)	7044	0.053 (0.224)	1400	0.050 (0.217)	7047
Years of schooling	7.700 (5.103)	2802	7.575 (4.951)	14091	6.517 (5.111)	1402	6.574 (4.966)	7044	8.884 (4.814)	1400	8.576 (4.727)	7047
Middle school completion	0.442 (0.497)	2802	0.428 (0.495)	14091	0.332 (0.471)	1402	0.341 (0.474)	7044	0.553 (0.497)	1400	0.515 (0.500)	7047
High school completion	0.339 (0.474)	2802	0.323 (0.468)	14091	0.265 (0.441)	1402	0.262 (0.440)	7044	0.414 (0.493)	1400	0.384 (0.486)	7047
College completion	0.177 (0.382)	2802	0.160 (0.367)	14091	0.134 (0.341)	1402	0.125 (0.331)	7044	0.221 (0.415)	1400	0.195 (0.396)	7047
<i>Labour Market Outcomes</i>												
Labour force participation	0.497 (0.500)	2123	0.514 (0.500)	10788	0.270 (0.444)	1100	0.302 (0.459)	5655	0.740 (0.439)	1023	0.749 (0.434)	5133
Log income	7.617 (0.735)	1005	7.572 (0.722)	5201	7.390 (0.930)	250	7.330 (0.893)	1381	7.692 (0.640)	755	7.660 (0.627)	3820
Having regular income	0.626 (0.484)	1054	0.630 (0.483)	5550	0.660 (0.475)	297	0.617 (0.486)	1707	0.613 (0.487)	757	0.636 (0.481)	3843
Precarious employment	0.109 (0.312)	1054	0.105 (0.306)	5550	0.091 (0.288)	297	0.099 (0.299)	1707	0.116 (0.321)	757	0.107 (0.310)	3843

Note: Standard errors are in parentheses.

Table A3. 3: Distribution of individuals born over a complete Ramadan cycle of 33 years.

Exposed to Ramadan overlapped with	All		Females		Males	
	N	%	N	%	N	%
January	1162	7.84	558	7.61	604	8.07
February	936	6.32	446	6.08	490	6.55
March	483	3.26	226	3.08	257	3.44
April	689	4.65	322	4.39	367	4.91
May	652	4.40	327	4.46	325	4.34
June	1029	6.95	463	6.31	566	7.57
July	1450	9.79	785	10.70	665	8.89
August	1447	9.77	732	9.98	715	9.56
September	1396	9.42	722	9.84	674	9.01
October	879	5.93	459	6.26	420	5.61
November	1206	8.14	601	8.19	605	8.09
December	1020	6.89	486	6.63	534	7.14
Sample of 33 years	14814		7334		7480	

Data source: 2016 Turkish Family Structure Survey.

Table A3. 4: Age distribution of individuals presented in five-year blocks.

Age distribution	All		Females		Males	
	N	%	N	%	N	%
33-37	3034	17.96	1561	18.48	1473	17.44
38-42	2880	17.05	1452	17.19	1428	16.91
43-47	2463	14.58	1254	14.85	1209	14.31
48-52	2098	12.42	1009	11.95	1089	12.89
53-57	1945	11.51	931	11.02	1014	12
58-62	1473	8.72	692	8.19	781	9.25
63-67	1143	6.77	544	6.44	599	7.09
68-72	793	4.69	408	4.83	385	4.56
73-77	516	3.05	289	3.42	227	2.69
78-82	302	1.79	154	1.82	148	1.75
83-87	182	1.08	111	1.31	71	0.84
88-92	51	0.3	33	0.39	18	0.21
93-97	13	0.08	8	0.09	5	0.06
Sample	16893		8446		8447	

Data source: 2016 Turkish Family Structure Survey.

Table A3. 5: Effects of hours of intrauterine Ramadan exposure on educational outcomes in the pooled sample.

Variables	(1) Illiterate	(2) No formal education	(3) Years of schooling	(4) Middle school completion	(5) High school completion	(6) College completion
<i>Panel A</i>						
Hours exposed	-0.017* (0.009)	-0.015 (0.011)	-0.196 (0.170)	-0.024 (0.017)	-0.023 (0.017)	-0.022 (0.014)
<i>Panel B</i>						
Hours exp. 1 st tr. ^a	-0.014 (0.010)	-0.016 (0.011)	-0.174 (0.180)	-0.021 (0.018)	-0.020 (0.018)	-0.022 (0.015)
Hours exp. 2 nd tr.	-0.022** (0.011)	-0.015 (0.012)	-0.140 (0.192)	-0.021 (0.019)	-0.015 (0.019)	-0.023 (0.016)
Hours exp. 3 rd tr. ^b	-0.015 (0.010)	-0.012 (0.012)	-0.272 (0.191)	-0.030 (0.019)	-0.034* (0.019)	-0.021 (0.016)
Cohort-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14963	14963	14963	14963	14963	14963

Notes: The sample is limited to respondents of the TFS Survey in 2016 who are above 32 years old and not studying; individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the educational outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, mother tongue, and sex.

^a: 1st trimester includes those who were conceived during Ramadan as well.

^b: 3rd trimester includes those who were born during Ramadan as well.

Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table A3. 6: Effects of prenatal exposure to Ramadan on educational outcomes (pooled sample with male interactions).

Variables	(1) Illiterate	(2) No formal education	(3) Years of schooling	(4) Middle school completion	(5) High school completion	(6) College completion
Male	- 0.115*** (0.012)	- 0.149*** (0.014)	2.484*** (0.215)	0.232*** (0.021)	0.162*** (0.021)	0.099*** (0.018)
<i>Panel A</i>						
Exposed	-0.012 (0.012)	-0.011 (0.014)	-0.011 (0.168)	0.001 (0.017)	-0.009 (0.016)	-0.004 (0.012)
Male#Exposed	0.001 (0.013)	0.005 (0.015)	-0.307 (0.232)	-0.041* (0.023)	-0.020 (0.023)	-0.020 (0.019)
<i>Panel B</i>						
1 st trimester ^a	-0.013 (0.014)	-0.019 (0.015)	0.076 (0.182)	0.009 (0.018)	-0.004 (0.018)	-0.004 (0.013)
2 nd trimester	-0.012 (0.015)	-0.005 (0.016)	-0.090 (0.191)	-0.007 (0.019)	-0.009 (0.018)	-0.011 (0.014)
3 rd trimester ^b	-0.010 (0.014)	-0.005 (0.016)	-0.045 (0.194)	-0.000 (0.020)	-0.016 (0.019)	0.002 (0.014)
Male#1 st tri.	0.007 (0.014)	0.018 (0.017)	-0.437* (0.254)	-0.053** (0.026)	-0.024 (0.025)	-0.020 (0.021)
Male#2 nd tri.	-0.008 (0.015)	-0.009 (0.018)	-0.057 (0.267)	-0.018 (0.027)	-0.007 (0.027)	-0.008 (0.022)
Male#3 rd tri.	0.001 (0.015)	0.000 (0.018)	-0.371 (0.270)	-0.046* (0.028)	-0.025 (0.027)	-0.031 (0.022)
Cohort-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area grew-up in	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14963	14963	14963	14963	14963	14963

Notes: Ibid

Table A3. 7: Effects of prenatal exposure to Ramadan on educational outcomes (pooled sample with no interaction variables).

Variables	(1) Illiterate	(2) No formal education	(3) Years of schooling	(4) Middle school completion	(5) High school completion	(6) College completion
<i>Panel A</i>						
Exposed	-0.011 (0.008)	-0.008 (0.009)	-0.172 (0.141)	-0.020 (0.014)	-0.019 (0.014)	-0.015 (0.012)
<i>Panel B</i>						
1 st trimester	-0.010 (0.008)	-0.010 (0.009)	-0.152 (0.150)	-0.018 (0.015)	-0.017 (0.015)	-0.014 (0.012)
2 nd trimester	-0.015* (0.009)	-0.009 (0.010)	-0.125 (0.156)	-0.017 (0.016)	-0.013 (0.016)	-0.016 (0.013)
3 rd trimester	-0.009 (0.009)	-0.005 (0.010)	-0.240 (0.157)	-0.024 (0.016)	-0.029* (0.016)	-0.014 (0.013)
Cohort-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14963	14963	14963	14963	14963	14963

Notes: Ibid

Table A3. 8: Effects of prenatal exposure to Ramadan on sex composition (being a male).

Variables	(I) Hours of exposure	Variables	(II) Exposure dummies
<i>Panel A</i>		<i>Panel A</i>	
Hours exposed	-0.008 (0.019)	Exposed	-0.005 (0.016)
<i>Panel B</i>		<i>Panel B</i>	
Hours exp. 1 st tr.	-0.002 (0.020)	1 st trimester	0.002 (0.017)
Hours exp. 2 nd tr.	-0.036 (0.022)	2 nd trimester	-0.027 (0.018)
Hours exp. 3 rd tr.	0.005 (0.022)	3 rd trimester	0.006 (0.018)
Observations	14963	Observations	14963

Notes: The sample is limited to respondents of the TFS Survey in 2016 who are above 32 years old and not studying; individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Column I shows results for being male by employing the hours of fasting approach and Column II displays results exploiting the exposure dummies while controlling for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, and mother tongue.

Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table A3. 9: Effects of prenatal exposure to Ramadan on labour market outcomes (pooled sample with male interactions).

VARIABLES	(1) Labour force participation	(2) Log income	(3) Having regular income	(4) Precarious employment
Male	0.489*** (0.022)	0.407*** (0.084)	-0.043 (0.037)	0.031 (0.025)
<i>Panel A</i>				
Exposed	0.019 (0.020)	0.068 (0.088)	-0.032 (0.037)	0.008 (0.023)
Male#Exposed	-0.032 (0.024)	-0.042 (0.088)	0.069* (0.041)	-0.025 (0.027)
<i>Panel B</i>				
1 st trimester	0.025 (0.022)	0.072 (0.092)	-0.034 (0.040)	0.019 (0.026)
2 nd trimester	0.008 (0.022)	0.024 (0.102)	-0.036 (0.044)	0.007 (0.029)
3 rd trimester	0.023 (0.023)	0.108 (0.095)	-0.025 (0.042)	-0.009 (0.026)
Male#1 st trimester	-0.030 (0.027)	-0.053 (0.092)	0.038 (0.044)	-0.014 (0.031)
Male#2 nd trimester	-0.030 (0.028)	0.044 (0.102)	0.094* (0.048)	-0.038 (0.033)
Male#3 rd trimester	-0.039 (0.028)	-0.107 (0.096)	0.088* (0.047)	-0.028 (0.031)
Cohort-month fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes
Observations	12911	6206	6604	6604

Notes: The sample is age restricted to individuals between the ages of 33 to 65 since the employment trends among the working-age participants and elderly differ substantially. Individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Panel A and Panel B shows results from separate regressions. Each column presents coefficients from different regressions for the labour market outcomes that control for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, mother tongue, and sex. Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

Table A3. 10: Effects of prenatal exposure to Ramadan on labour market outcomes (pooled sample with no interaction variables).

VARIABLES	(1) Labour market partc.	(2) Log income	(3) Having regular income	(4) Precarious employment
<i>Panel A</i>				
Exposed	0.002 (0.014)	0.034 (0.037)	0.021 (0.024)	-0.012 (0.017)
<i>Panel B</i>				
1 st trimester	0.009 (0.016)	0.030 (0.039)	-0.004 (0.025)	0.008 (0.018)
2 nd trimester	-0.008 (0.016)	0.057 (0.042)	0.035 (0.027)	-0.021 (0.019)
3 rd trimester	0.002 (0.016)	0.024 (0.040)	0.042 (0.027)	-0.031* (0.018)
Cohort-month fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Area grew up in	Yes	Yes	Yes	Yes
Observations	12911	6206	6604	6604

Notes: Ibid.

Table A3. 11: Multiple hypothesis testing (Romano-Wolf) for labour market outcomes among males.

Variables	(I)				(II)			
		Pct hours of exposure			Exposure dummies			
	Coef.	Model p-value	Resample p-value	Romano-Wolf p-value	Coef.	Model p-value	Resample p-value	Romano-Wolf p-value
<i>Labour market participation</i>								
Ramadan exposure	-0.025 (0.023)	0.265	0.241	0.589	-0.019 (0.019)	0.310	0.283	0.668
Ramadan in 1 st tri.	-0.018 (0.024)	0.463	0.457	0.944	-0.012 (0.021)	0.573	0.578	0.983
Ramadan in 2 nd tri.	-0.037 (0.026)	0.154	0.153	0.631	-0.030 (0.022)	0.172	0.171	0.682
Ramadan in 3 rd tri.	-0.026 (0.026)	0.319	0.311	0.869	-0.021 (0.022)	0.336	0.311	0.892
Observation		6156				6156		
<i>Log income</i>								
Ramadan exposure	0.010 (0.044)	0.818	0.829	0.829	0.011 (0.036)	0.758	0.779	0.779
Ramadan in 1 st tri.	0.006 (0.047)	0.904	0.932	1.000	0.008 (0.039)	0.840	0.857	0.993
Ramadan in 2 nd tri.	0.063 (0.050)	0.211	0.194	0.738	0.051 (0.041)	0.217	0.191	0.743
Ramadan in 3 rd tri.	-0.023 (0.049)	0.639	0.659	0.982	-0.014 (0.040)	0.720	0.736	0.990
Observation		4575				4575		

Table A3.11: Multiple hypothesis testing (Romano-Wolf) for labour market outcomes among males (*Continued*).

<i>Having regular income</i>								
Ramadan exposure	0.044 (0.033)	0.192	0.198	0.558	0.032 (0.028)	0.255	0.264	0.668
Ramadan in 1 st tri.	0.000 (0.036)	1.000	1.000	1.000	-0.003 (0.030)	0.913	0.909	0.993
Ramadan in 2 nd tri.	0.077** (0.038)	0.041	0.041	0.308	0.055* (0.031)	0.078	0.076	0.452
Ramadan in 3 rd tri.	0.082** (0.038)	0.031	0.029	0.251	0.061* (0.031)	0.051	0.039	0.351
Observation		4600				4600		
<i>Precarious employment</i>								
Ramadan exposure	-0.025 (0.024)	0.297	0.315	0.589	-0.024 (0.020)	0.241	0.260	0.668
Ramadan in 1 st tri.	0.003 (0.026)	0.898	0.896	1.000	-0.001 (0.022)	0.953	0.963	0.993
Ramadan in 2 nd tri.	-0.043 (0.027)	0.111	0.113	0.546	-0.037* (0.022)	0.099	0.103	0.509
Ramadan in 3 rd tri.	-0.053** (0.026)	0.042	0.056	0.308	-0.045*** (0.022)	0.041	0.060	0.312
Observation		4600				4600		

Notes: The sample is limited to male respondents of the TFS Survey in 2016 who are between 32 and 66 years old, and not studying; individuals who were born on January 1st are excluded. The control group includes those who are identified as certainly not exposed. Group I shows results for the labour market outcomes of males by employing the percentage hours of fasting approach similar to Table 3.4 while Group II displays results exploiting the exposure dummies similar to Table 3.6. For each outcome, the variable Ramadan exposure presented above the dash-line is obtained from separate regressions using Equations (3.1) and (3.3) in Group I and Group II, respectively. The trimester specific variables below the dash-line for each outcome are estimated using Equations (3.2) and (3.4) in in Group I and Group II, respectively. The first column of each Group shows the regression coefficients, followed by model p-values, sample p-values and Romano-Wolf adjusted p-values which account for multiple hypothesis testing correction. Each regression controls for age, age², age³, age⁴, birth cohort, and month-of-birth fixed effects, area lived in till the age of 15 (urban, suburban, rural, or abroad), region fixed effects, and mother tongue. Robust standard errors are shown in parentheses (*** p<0.01, ** p<0.05, * p<0.1).

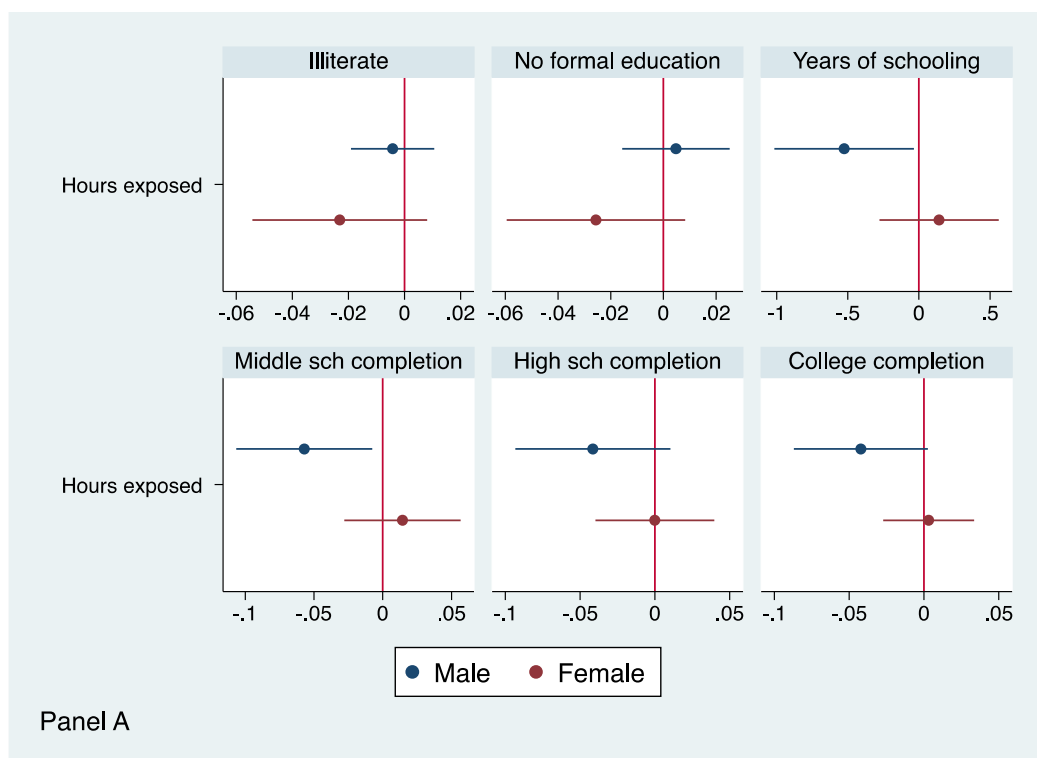


Figure A3. 1: Point estimates of coefficients reported in Panel A of Table 3.2 and their 95% confidence intervals.

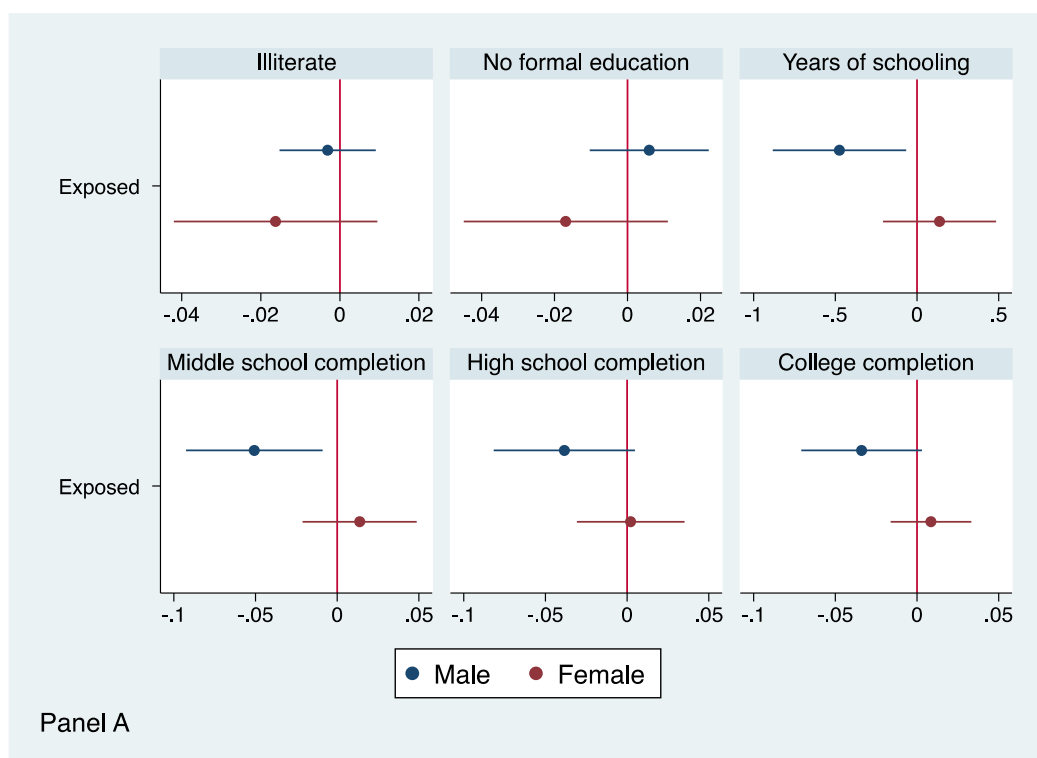


Figure A3. 2: Point estimates of coefficients reported in Panel A of Table 3.6 and their 95% confidence intervals.

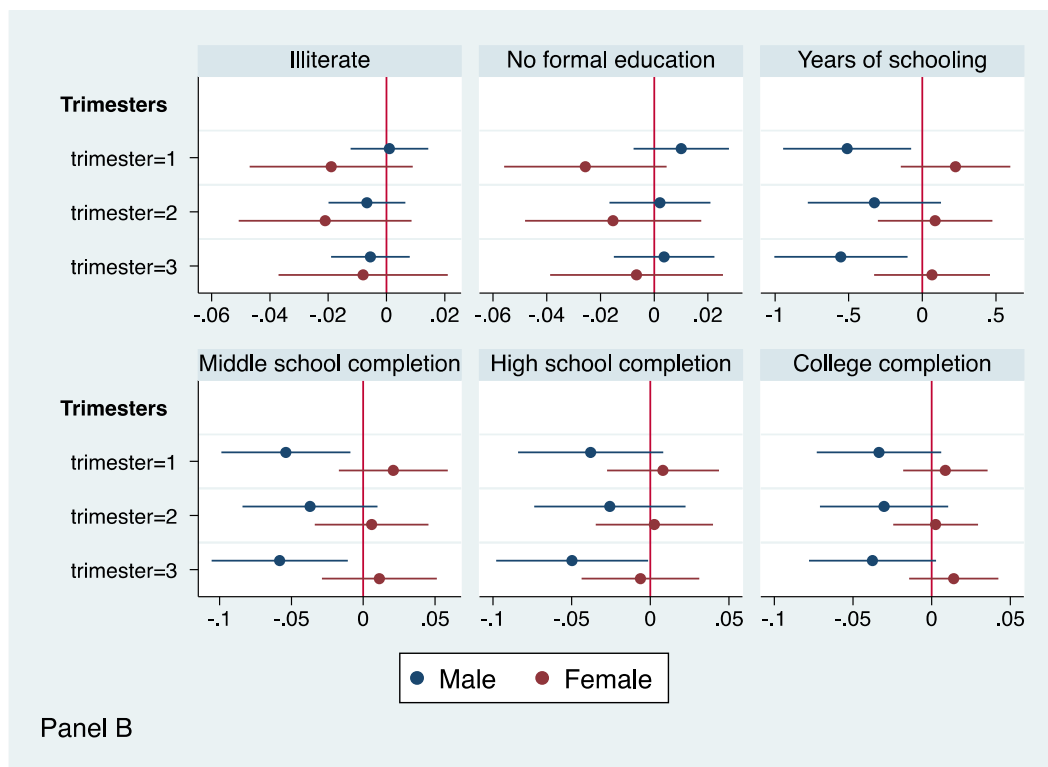


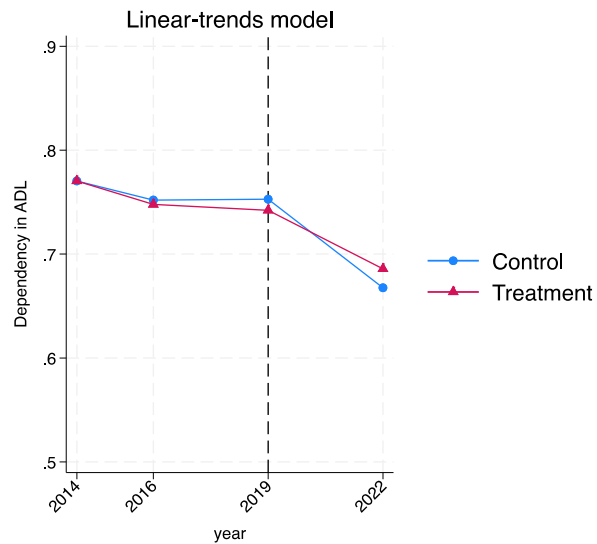
Figure A3. 3: Point estimates of coefficients reported in Panel B of Table 3.6 and their 95% confidence intervals.

APPENDIX-B: APPENDIX FOR CHAPTER 5

Table B5. 1: Descriptive statistics before and after the COVID-19 pandemic for women over 60.

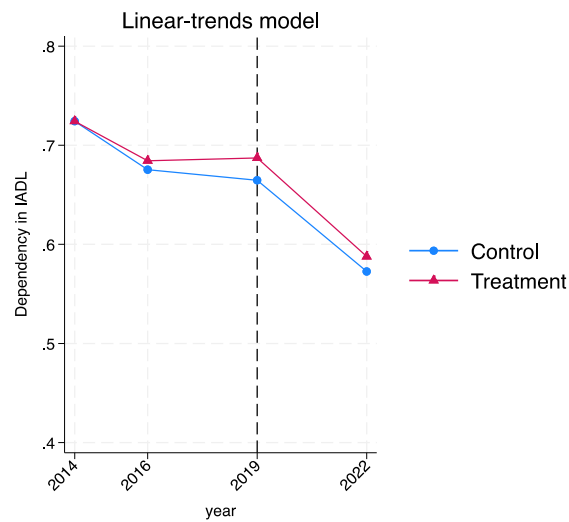
Variables	Unit	ALL		By COVID-19				p-val
		Mean	SD	Pre-Pandemic		Post-Pandemic		
				Mean	SD	Mean	SD	
Demographics								
Age	Years	69.83	7.78	69.96	7.85	69.53	7.60	
Married	1=yes; 0=no	0.56	0.50	0.55	0.50	0.58	0.49	0.015
Household size	Number	2.37	1.51	2.39	1.58	2.32	1.34	0.057
Highest degree completed:								
No education	1=yes; 0=no	0.51	0.50	0.55	0.50	0.43	0.49	
Primary school	1=yes; 0=no	0.36	0.48	0.35	0.48	0.41	0.49	
Middle school	1=yes; 0=no	0.04	0.19	0.03	0.18	0.05	0.21	
High school	1=yes; 0=no	0.05	0.21	0.04	0.19	0.07	0.25	
University or higher	1=yes; 0=no	0.04	0.19	0.03	0.18	0.05	0.21	
Health measures								
Self-assessed health	1=good; 5=poor	3.18	0.83	3.22	0.85	3.07	0.76	<0.001
Chronic health problem	1=yes; 0=no	0.90	0.30	0.91	0.29	0.90	0.30	0.261
Cardiovascular diseases:								
Coronary heart disease	1=yes; 0=no	0.19	0.40	0.20	0.40	0.18	0.39	0.064
High blood pressure	1=yes; 0=no	0.60	0.49	0.61	0.49	0.59	0.49	0.052
Myocardial infarction	1=yes; 0=no	0.07	0.25	0.06	0.24	0.07	0.25	0.336
Metabolic diseases:								
Diabetes	1=yes; 0=no	0.33	0.47	0.32	0.47	0.35	0.48	0.001
Overweight	1=yes; 0=no	0.37	0.48	0.37	0.48	0.39	0.49	0.028
Obesity	1=yes; 0=no	0.38	0.49	0.38	0.49	0.39	0.49	0.507
Musculoskeletal diseases	1=yes; 0=no	0.70	0.46	0.73	0.44	0.61	0.49	<0.001
Dependence in... of daily living								
Basic activities (ADLs)	1=yes; 0=no	0.73	0.44	0.76	0.43	0.66	0.47	<0.001
Instrumental activities (IADLs)	1=yes; 0=no	0.66	0.47	0.70	0.46	0.57	0.50	<0.001
Either activity	1=yes; 0=no	0.81	0.39	0.85	0.36	0.74	0.44	<0.001
Observations		8422		5954		2468		

Data Source: THS 2014-2022



Note: The sample consists of women who are above 60 years old. Individuals who were 65 at the time of the interview are excluded from the analysis since they were not affected from the age-specific curfews implemented previous year.

Figure B5. 1: Parallel trends plot for dependency completing ADLs (1 Yes, 0 No).



Note: Ibid.

Figure B5. 2: Parallel trends plot for dependency in IADLs (1 Yes, 0 No).