Impact of Socioeconomic Inequalities on the Spread of COVID-19

Alpay Arı
Izmir Bozyaka Eğitim ve Araştırma Hastanesi
Hülya Özdemir
Izmir Bozyaka Eğitim ve Araştırma Hastanesi
Fatmanur Kabadurmus
Yaşar University
Selma Tosun
Izmir Bozyaka Eğitim ve Araştırma Hastanesi
Durmuş Özdemir (durmus.ozdemir@yasar.edu.tr)
Yaşar University

Research Article

Keywords: COVID-19, economic and social factors, prevalence, Turkey.

Posted Date: May 20th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-500936/v1

Abstract

Background

To examine the role of medical, economic and social inequalities affecting the prevalence of COVID-19 in Turkey.

Methods

This paper clarifies the medical and socio-economic factors affecting the prevalence of COVID-19 by using clinical and survey data in a binary probit model (BPM). Socio-economic factors affect the prevalence of COVID-19 to different degrees. Socio-economic variables are associated with risk of infection and can increase exposure to and mortality from COVID-19.

Results

The factors that increase the probability that a person will get COVID-19 are gender (males have a 9.4% higher probability), income, household work status, interacting with a COVID-19 case (31.4% higher), using public transportation (6.97% higher), and visiting a hospital (35.7% higher probability for individuals who visited a hospital) or a mosque (15.1% higher). The factors that decrease the probability of testing positive are smoking (14.3% lower for smokers), being employed, having a university education compared to no education (24.7% lower), and wearing gloves (15.4% lower).

Conclusion

In the case of Turkey, the estimations of the BPM show that economic and social variables are important factors for determining COVID-19 prevalence. Inequalities in socio-economic variables affect the prevalence to different degrees. Disparities in education and poverty are more important than being employed or being a smoker for the spread of COVID-19.

Background

According to the World Health Organization (WHO), as of March 15, 2021, there had been 120 383 919 confirmed cases of COVID-19 and 2 664 386 deaths reported globally, and a total of 363 691 238 vaccine doses had been administered.[1] The WHO also confirmed that 291 162 confirmed cases and 29 623 deaths occurred for the same period in Turkey. Many countries introduced extensive and restrictive prevention measures and some countries, such as New Zealand and China, successfully controlled transmission with these measures. In Turkey, a number of restriction measures were taken: 1. Schools and universities were closed and education was continued online. 2. Curfews were imposed on individuals under 18 and over 65. 3. Cafes, restaurants, and hotels were closed, but the restaurants maintained their takeaway services. 4. Public services, except for hospitals, were either stopped or continued in a limited way. 5. Collective activities such as weddings, celebrations, and meetings were banned. 6. Markets and public bazaars remained open, but access was limited to a certain number of

people at any time together with compulsory mask wearing, hand sanitizing on entry, temperature measurement, and a limitation on the time allowed in the market. 7. Most factories remained open with adjustments to working hours, and restricted transportation conditions. 8. Restrictions on intercity transportation were imposed. 9. Mass religious activities such as Friday prayers were banned. However, transmission of COVID-19 continued despite all these measures. According to the Turkish Ministry of Health records, by May 2, 2020, there were a total of 58 209 laboratory-confirmed COVID-19 cases across the country.

Like other respiratory viruses, SARS-CoV-2 can be predicted to have a greater effect on individuals with lower income and socio-economic status.[2–4] Overcrowded home conditions and insufficient hygiene may be affecting this situation further.[5]

The COVID-19 pandemic has highlighted the worsening health and socio-economic inequalities in many countries, including Turkey. The impact of the pandemic has fallen uncontrollably on the most vulnerable people. Before the pandemic, inequality had already been reaching dramatic levels, and inequalities in the occupational, gender, educational, poverty, and unemployment levels have worsened with the COVID-19 pandemic. A higher risk of transmission is linked to overcrowded housing and an inability to self-isolate. Besides the medical factors, a number of social and economic parameters affect the spread of COVID-19 within the population. The pandemic has provided harsh lessons about the societal vulnerabilities that arise from inequality.[2–4] Adopting an equity-focused approach to health services should be an essential part of building a better society that is well prepared to overcome the difficulties of a future pandemic.

A wide spectrum of indicators has been postulated to be associated with COVID-19 cases. However, the spread of the virus has been uneven in both prevalence and speed of propagation. Given the role of social factors in the spread of contagious diseases and the known demographic, economic and cultural differences in Turkey, it is important to analyse the contribution of such factors in the spread of COVID-19.

The relationship between COVID-19 and socio-economic indicators has been emphasized as one of the eight primary, urgent research topics in coronavirus studies in the WHO Blueprint published in February 2020[6]. There are several socio-economic issues considered, such as the role of poverty, low income, and poor education. Empirical evidence from these studies suggests how the identification of potential indicators could aid in the formulation of targeted strategies to mitigate future health problems[7–10]. In this study, ten socio-economic indicators were considered in association with COVID-19 cases in Izmir. At the time of the study there were approximately 500 people in İzmir Bozyaka Education and Training Hospital who had recovered from COVID-19. Socio-economic data were collected between May 2020 and July 2020 from the people treated by the clinic for COVID-19. Medical data for the same patients was taken from the electronic database of the Probel Hospital Information Management System (PHIMS) for the same period. Data were analysed using Stata 16 to estimate the generalized linear model (GLM), which was used to obtain the key socio-economic factors influencing COVID-19 prevalence and the speed

of its propagation. Our research also examined the impact of employment status and poverty on the prevalence of COVID-19.

There are two main questions to be addressed in this research: what are the critical socio-economic determinants, and how much does each criterion contribute to the spread of disease?

Methods

Restrictive measures for the prevention of the spread of COVID-19 were implemented between March 15, 2020 and April 30, 2020 throughout Turkey. Our sample was a total of 560 patients who were hospitalized for COVID-19 during that period. Of these, 215 of were cases confirmed by the polymerase chain reaction (PCR) test while the others were clinically suspected cases who had typical clinical symptoms, including radiological lesions and other laboratory abnormalities, and were treated as being COVID-19-positive.

To avoid obvious bias, health care workers and Umrah visitors were excluded due to the known route of transmission. Of the 215 PCR-positive patients, 175 survived and were accessible; these were included in the study as a COVID-19-positive group. An equal number of individuals, who had a negative PCR test, had not been hospitalized, and had not been suspected of having COVID-19, were randomly selected from hospital and PHIMS records as a COVID-19-negative group. The total number of patients who completed the questionnaire about the socio-economic parameters was 350.

The questionnaire included ten demographic questions: age, gender, marital status, education level, income, smoking status, alcohol use, employment status, and whether any employed people shared accommodation with the respondent. Six questions were about transmission activities: contact with people with COVID-19, use of public transport, hospital visits, going to mosque, shopping in a public bazaar or supermarket, and visiting friends and neighbours. Four questions were about personal protective measures: mask, hand hygiene, social distancing, and going out activities. Finally, four questions were about workplace activities (for those respondents who were employed): means of transport, contact with COVID-19 infection at work, workplace preventive measures, and own precautions after work.

In the BPM model (1), shows the probability of catching COVID-19, is the logistic cumulative distribution function, and are the independent variables.[6] The independent variables chosen can be grouped into three categories: demographic and socio-economic factors, factors related to transmission routes, and factors related to precautionary measures.

$$\Pr(COVID_i = 1|X_i) = \Lambda(\alpha_i + \beta_1 x_i) \qquad (1)$$

The first group of factors we chose are common in the infectious disease literature. These are age, gender, education, marital status, income, smoking, alcohol use, and employment status of the patient and others in the same household.[7-10]

Table 1 shows the prevalence of COVID-19 by baseline characteristics of the sample. In the oldest group (65 years and older) and the youngest group (24 years and younger), 67.86% and 47.22% tested positive, respectively. The percentages of males (51%) and females (49%) who tested positive are similar. Most of the cases who tested positive have only compulsory education (118 cases), are unemployed (106 cases), earn minimum wage (111 cases), are married (142 cases), do not use alcohol (157 cases), and do not smoke (131 cases).

Table 1: Prevalence of COVID-19, by patient type

	COVID-19				COVID-19		
	Negative	**Positive**			**Negative**	**Positive**	
AGE			Total	EDUCATION			Total
0-24	19	17	36	No education	8	7	15
	52.78	47.22	100		53.33	46.67	100
25-34	30	40	70	Compulsory educ.	72	118	190
	42.86	57.14	100		37.89	62.11	100
35-44	56	43	99	High school	47	32	79
	56.57	43.43	100		59.49	40.51	100
45-54	34	36	70	University	48	17	65
	48.57	51.43	100		73.85	26.15	100
55-64	27	20	47	Total	175	174	349
	57.45	42.55	100		50.14	49.86	100
65+	9	19	28	EMPLOYMENT			
	32.14	67.86	100	Unemployed	82	106	188
Total	175	175	350		43.62	56.38	100
	50.00	50.00	100	Employed	93	69	162
GENDER					57.41	42.59	100
Female	85	81	166	Total	175	175	350
	51.20	48.80	100		50.00	50.00	100
Male	90	94	184	ALCOHOL			
	48.91	51.09	100	No	133	157	290
Total	175	175	350		45.86	54.14	100
	50.00	50.00	100	Yes	41	18	59
MARITAL STATUS					69.49	30.51	100
Single	61	33	94	Total	174	175	349
	64.89	35.11	100		49.86	50.14	100
Married	114	142	256	SMOKE			
	44.53	55.47	100	No	80	131	211

Total	175	175	350		37.91	62.09	100
INCOME				Yes	94	44	138
No income	25	11	36		68.12	31.88	100
	69.44	30.56	100	Total	174	175	349
<min wage	13	22	35		50.00	50.00	100
	37.14	62.86	100	HOUSE SHARE WITH WORKER			
min wage	67	111	178	No	113	85	198
	37.64	62.36	100		57.07	42.93	100
≥2x min wage	52	24	76	Yes	62	85	147
	68.42	31.58	100		42.18	57.82	100
≥3x min wage	16	7	23	Total	175	170	345
	69.57	30.43	100		50.72	49.28	100
Total	173	175	348				
	49.71	50.29	100				

The second group of factors captures the common transmission routes such as close/direct contact with a COVID-19 case, visiting friends and/or family, going to the hospital, going to a mosque, shopping (at a local market or shopping centre), and using public transport.

Table 2 demonstrates the major channels of transmission. In our sample, 95 people who tested positive were in close contact with a COVID-19 case. Risk of infection also goes up in public places. Most of the positive cases visited a hospital (136 cases) and went shopping (110 cases). Of the 144 people who used public transport, 81 tested positive (56%). Of the 24 people who visited a mosque, 21 tested positive (88%). Of people who visited family and/or friends, 71% tested positive for COVID-19[1].

Table 2: Prevalence of COVID-19, by transmission route

	COVID-19				COVID-19		
	Negative	Positive			Negative	Positive	
Contact Covid-19			Total	Hospital			Total
No	153	77	230	No	70	34	104
	66.52	33.48	100		67.31	32.69	100
Yes	21	95	116	Yes	105	136	241
	18.10	81.90	100		43.57	56.43	100
Total	174	172	346	Total	175	170	345
	50.29	49.71	100		50.72	49.28	100
Public transport				MOSQUE			
No	111	89	200	No	171	151	322
	55.50	44.50	100		53.11	46.89	100
Yes	63	81	144	Yes	3	21	24
	43.75	56.25	100		12.50	87.50	100
Total	174	170	344	Total	174	172	346
	50.58	49.42	100		50.29	49.71	100
SHOPPING				VISIT			
No	52	63	115	No	154	122	276
	45.22	54.78	100		55.80	44.20	100
Yes	123	110	233	Yes	21	51	72
	52.79	47.21	100		29.17	70.83	100
Total	175	173	348	Total	175	173	348
	50.29	49.71	100		50.29	49.71	100

[1]Although not reported here, none of the people in the sample performed Umrah, and only two people visited relatives who performed Umrah.

The third group of factors control for the risk of exposure and spread of COVID-19 and are related to precautionary behaviours such as going outdoors, wearing gloves and masks, using sanitizers, and

maintaining a safe distance (social distance).

Table 3 reports whether the people in the sample took protective measures to reduce the risk of getting COVID-19. Most people reported that they kept social distance while outdoors (332 out of 341), wore masks (338 out of 342), and used sanitizers (324 out of 340).

Table 3: Prevalence of COVID-19, by precautionary behaviour

	COVID-19				COVID-19		
	Negative	Positive			Negative	Positive	
WENT OUT	0	1	Total	MASK	0	1	Total
No	10	10	20	No	3	1	4
	50.00	50.00	100		75.00	25.00	100
Yes	165	159	324	Yes	172	166	338
	50.93	49.07	100		50.89	49.11	100
Total	175	169	344	Total	175	167	342
	50.87	49.13	100		51.17	48.83	100
					COVID		
GLOVES	0	1	Total	SANITIZER	0	1	Total
No	83	134	217	No	13	3	16
	38.25	61.75	100		81.25	18.75	100
Yes	92	32	124	Yes	161	163	324
	74.19	25.81	100		49.69	50.31	100
Total	175	166	341	Total	174	166	340
	51.32	48.68	100		51.18	48.82	100
SOCIAL DISTANCE							
No	8	1	9				
	88.89	11.11	100				
Yes	167	165	332				
	50.30	49.70	100				
Total	175	166	341				
	51.32	48.68	100				

Results

We used Stata 14.2 to estimate the logit model. Table 4 reports our results. The first column shows the coefficients of the logit model, the second column shows average marginal effects (AMEs), and the third column shows the odds ratios.

Table 4
Results

VARIABLES	Coefficients	Average Marginal Effects	Odds ratio (OR)	95% Confidence Interval (OR)
	(1)	(2)	(3)	
Age	-0.0051	-0.000555	0.9949	0.9665–1.0241
	(0.0148)	(0.00160)	(0.0147)	
Gender (Male)	0.8816**	0.0940**	2.4148**	1.0499–5.5541
	(0.4250)	(0.0435)	(1.0262)	
Marital status (Married)	-0.3317	-0.0353	0.7177	0.2953–1.7441
	(0.4531)	(0.0472)	(0.3251)	
Alcohol (Yes)	-0.0819	-0.00889	0.9214	0.3244–2.6171
	(0.5326)	(0.0580)	(0.4908)	
Smoke (Yes)	-1.2251***	-0.143***	0.2937***	0.1257–0.6862
	(0.4329)	(0.0505)	(0.1272)	
Employment (Employed)	-1.1336**	-0.122**	0.3219**	0.1269–0.8166
	(0.4750)	(0.0494)	(0.1529)	
Education (Compulsory)	-0.1993	-0.0225	0.8193	0.1284–5.2277
	(0.9455)	(0.107)	(0.7747)	
Education (High school)	-1.0304	-0.117	0.3569	0.0476–2.6755
	(1.0278)	(0.116)	(0.3668)	
Education (University)	-2.2474**	-0.247**	0.1057**	0.0131–0.8548
	(1.0666)	(0.116)	(0.1127)	
Income (< min wage)	0.3410	0.0379	1.4064	0.3053–6.4791
	(0.7794)	(0.0868)	(1.0961)	
Income (min wage)	1.2162*	0.138*	3.3745*	0.9591–11.8733
	(0.6419)	(0.0713)	(2.1660)	
Income (≥ 2x min wage)	0.3772	0.0420	1.4582	0.3283–6.4772

Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

VARIABLES	Coefficients	Average Marginal Effects	Odds ratio (OR)	95% Confidence Interval (OR)
	(0.7608)	(0.0841)	(1.1094)	
Income (≥ 3x min wage)	1.2832	0.145	3.6081	0.4817–27.0247
	(1.0274)	(0.115)	(3.7068)	
House Share with worker (Yes)	1.5468***	0.168***	4.6965***	2.0784–10.6126
	(0.4159)	(0.0415)	(1.9535)	
Contact Covid-19 (Yes)	2.8996***	0.314***	18.1674***	7.1520-46.1487
	(0.4756)	(0.0393)	(8.6412)	
Public transport (Yes)	0.6436*	0.0697*	1.9032*	0.9009–4.0209
	(0.3816)	(0.0407)	(0.7263)	
Shopping (Yes)	-2.5187***	-0.273***	0.0806***	0.0273–0.2381
	(0.5529)	(0.0520)	(0.0445)	
Hospital (Yes)	3.2980***	0.357***	27.0577***	7.8792–92.9181
	(0.6295)	(0.0566)	(17.0321)	
Mosque (Yes)	1.3967*	0.151*	4.0417*	0.8426–19.3876
	(0.8000)	(0.0851)	(3.2334)	
Visit (Yes)	0.6144	0.0665	1.8485	0.7705–4.4344
	(0.4465)	(0.0477)	(0.8253)	
Went out (Yes)	0.1675	0.0181	1.1823	0.2630–5.3159
	(0.7670)	(0.0830)	(0.9068)	
Mask (Yes)	-11.2352	-1.216	0.0000	0.0000 - .
	(903.8269)	(97.86)	(0.0119)	
Social distance (Yes)	11.5758	1.253	106,485.5587	0.0000 - .
	(903.8247)	(97.86)	(9.6244e + 07)	
Gloves (Yes)	-1.4181***	-0.154***	0.2422***	0.1117–0.5253
	(0.3950)	(0.0396)	(0.0957)	

Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

VARIABLES	Coefficients	Average Marginal Effects	Odds ratio (OR)	95% Confidence Interval (OR)
Sanitizer (Yes)	2.2164**	0.240**	9.1744**	1.1575–72.7141
	(1.0562)	(0.112)	(9.6900)	
Constant	-3.8897*		0.0205*	0.0003–1.5037
	(2.1927)		(0.0448)	
Observations	325	325	325	
Pseudo R-squared	0.507		0.507	
Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1				

With the AMEs, a marginal effect is computed for each case, and then all the computed effects are averaged. Therefore, AMEs express the average effect of an independent variable x_i on $P(y=1)$. For categorical independent variables, marginal effects show how $P(y=1)$ changes as the categorical variable changes from 0 to 1, after controlling for the other variables in the model.[11]

AMEs in column (2) reveal that the factors that increase the probability that a person will get COVID-19 are gender, income, household work status, interacting with a COVID-19 case, using public transportation, and visiting a hospital or a mosque. The factors that decrease the probability of testing positive are smoking (14.3% lower for smokers), being employed, having a university education compared to no education (24.7% lower), and wearing gloves (15.4% lower).

We find that male individuals have a 9.4% higher probability of getting COVID-19, which is in agreement with other studies that show that being male is a high-risk factor.[12,13]

Three major transmission modes contribute to viral transmission of the COVID-19 disease. These are airborne transmission, contact (with contaminated surfaces), and droplets. Crowded and poorly ventilated places are amongst the most important exposure environments.[14] Looking at transmission, visiting a hospital seems to have the highest risk factor (35.7% higher probability for individuals who visited a hospital), followed by contacting a COVID-19 case (31.4% higher), visiting a mosque (15.1% higher), and using public transportation (6.97% higher). Shopping seems to be negatively associated with COVID-19 infection, but we believe this is due to a limitation of the data. Table 2 shows that, of the 233 people who went shopping, 53% tested negative.

Looking at the impacts of precautionary behaviour, we find that wearing gloves is an effective physical intervention against disease transmission. A surprising result is seen for using sanitizers, but in our sample 324 people out of 340 reported to use sanitizers (Table 3). Therefore, it is not possible to estimate the true impact of this preventive measure in our analysis.

Smoking and alcohol use are common health risk factors. We do not find any evidence of a negative impact of alcohol use. Smoking is generally considered detrimental to the immune system, making the patients more vulnerable to infectious diseases. However, the literature on the role of smoking on COVID-19 does not reach a consensus. In a systematic review of five studies based on Chinese patients, it was concluded that smokers show more severe symptoms.[15] However, another review study found that smoking is not associated with severity of the disease in China.[16] Another study found that smokers have a lower risk of confirmed COVID-19 compared to non-smokers, based on data from French patients.[17] The authors argue that there could be a rebound effect for smokers as nicotine receptors are released due to nicotine withdrawal at the time of hospitalization, which explains why other studies find a negative association between smoking and COVID-19 severity[18]. Our results also support the findings in this study.

Socio-economic variables are also associated with risk of infection and can increase exposure to and mortality from COVID-19. People with low socio-economic status are more likely to live in poor housing conditions and are more likely to work in unstable jobs and have less access to healthcare services.[19] In addition, during the pandemic, some sectors allowed work from home, but this is mostly possible for high-income individuals. Lower-income individuals are more likely to work in occupations that are less amenable to remote working, and they face more health risks and a greater risk of exposure to COVID-19.[5,20] In our sample, lower-income individuals (whose income is equal to the minimum wage) have a 13.8% higher probability of contracting the disease compared to those who have no income. In addition, the probability increases by 16.8% if someone in the household works.

However, our results also suggest that employed people have a lower probability of infection. There could be a number of explanations for this. First, sample characteristics is an important factor. In our sample, 162 individuals out of 350 were working full-time and were defined as ‘employed’. Of these, less than half (43%) tested positive. Unemployed people include those who do not have a job (20 individuals), students (11 individuals), homemakers (90 individuals), retired (47 individuals), and people who were laid-off after the pandemic (20 individuals). Of the homemakers and people laid-off, 60% tested positive and 60% of retirees tested positive.

Second, it is possible that employed people behave more cautiously against the risk of infection. The survey also included questions regarding workplace precautions. The response rate to these questions was not high. Table 5 shows that most of the individuals who responded to work-related questions tested negative. Only 5 of them reported that their workplace did not follow the recommended precautions to protect the health and safety of workers. In our sample, 59 respondents used public transportation to commute to work and 59% of these tested negative. There were not many COVID-19 cases at the workplaces (42 reported “yes”). Lastly, 150 individuals out of 153 said that they took appropriate precautions against infection after they left their workplace.

Table 5
Prevalence of COVID-19, by workplace precautions

	COVID-19				COVID-19		
	Negative	Positive			Negative	Positive	
Workplace precautions			Total	COVID-19 case at work			Total
No	5	0	5				
	100	0.00	100	No	77	40	117
Limited	7	8	15		65.81	34.19	100
	46.67	53.33	100	Yes	19	23	42
Yes	85	59	144		45.24	54.76	100
	59.03	40.97	100	Total	96	63	159
Total	97	67	164		60.38	39.62	100
	59.15	40.85	100	Own precautions			
Transport to work				No	0	3	3
Shuttle	16	12	28		0.00	100.00	100
	57.14	42.86	100	Yes	96	54	150
Public transport	35	24	59		64.00	36.00	100
	59.32	40.68	100	Total	96	57	153
Personal car	43	20	63		62.75	37.25	100
	68.25	31.75	100				
Walking	1	3	4				
	25.00	75.00	100				
Total	95	59	154				
	61.69	38.31	100				

Discussion

Disparities in socio-economic factors affect the prevalence of COVID-19 to different degrees. Socio-economic variables are associated with risk of infection and can increase exposure to, and mortality from, COVID-19. The factors that increase the probability that a person will get COVID-19 are gender,

income, household work status, interacting with a COVID-19 case, using public transportation, and visiting a hospital or a mosque. The factors that decrease the probability of testing positive are smoking, being employed, having a university education compared to no education, and wearing gloves. It has been suggested that there could be a rebound effect for smokers as nicotine receptors are released due to nicotine withdrawal at the time of hospitalization, which explains why our study and some other studies find a negative association between smoking and COVID-19 severity.[17]

Conclusion

In the case of Turkey, the estimations of the BPM show that economic and social variables are important factors for determining COVID-19 prevalence. Inequalities in socio-economic variables affect the prevalence to different degrees. Disparities in education and poverty are more important than being employed or being a smoker for the spread of COVID-19.

Declarations

Acknowledgements

The authors acknowledge all the participating patients at the Izmir region of Turkey for their tremendous cooperation. We are thankful to the participants of All izmir workshop in economics in Izmir for their valuable comments.

Funding

Not applicable

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval and consent to participate

The study was approved by Bozyaka Education and Research Hospital Ethical Committee of the University of Health Sciences. All methods were performed in accordance with the relevant guidelines and regulations. Written informed consent was obtained from all of the participants during the survey

Consent for publication

Not applicable

Availability of data and material

The dataset used and analysed during the current study are available from the corresponding author on reasonable request.

Code availability

Not applicable

Authors' contributions DÖ, AA and ST designed the study, HÖÖ and FNKK analysed the data. All authors read and approved the manuscript.

References

(1) World Health Organization. WHO coronavirus (COVID-19) dashboard. Available at: https://covid19.who.int/ Accessed March 18, 2021.

(2) The Lancet Public Health. COVID-19—break the cycle of inequality.

Lancet Public Health. 2021;6:e82. https://doi.org/10.1016/S2468-2667(21)00011-6.

(3) Marmot M, Allen J, Goldblatt P, Herd E, Morrison J. Build back fairer: the COVID-19 Marmot review. Institute of Health Equity. Published December 2020.Available at: http://www.instituteofhealthequity.org/resources-reports/build-back-fairer-the-covid-19-marmot-review/build-back-fairer-the-covid-19-marmot-review-executive-summary.pdf Accessed March 18, 2021.

(4) Johnson P, Joyce R, Platt L. The IFS Deaton review of inequalities: a New Year's message. Institute for Fiscal Studies. Published January 2021.

DOI: 10.1920/BN.IFS.2021.BN0315, ISBN: 978-1-80103-020-https://www.ifs.org.uk/publications/15241. Accessed March 31, 2021

(5) Blundell R, Costa Dias M, Joyce R, Xu X. COVID-19 and inequalities. *Fisc Stud*. 2020;41(2): 291-319.

(6) A coordinated Global Research Roadmap (WHO). Available at: https://www.who.int/blueprint/priority-diseases/key-action/Roadmap-version-FINAL-for-WEB.pdf?ua=1 / Accessed March 30, 2021.

(7) Tosun S, Aygün O, Özdemir HÖ, Korkmaz E, Özdemir D. The impact of economic and social factors on the prevalence of hepatitis B in Turkey. *BMC Public Health*. 2018;18:649. https://doi.org/10.1186/s12889-018-5575-6

(8) Özdemir D, Özdemir H Ö. Health care cost of socioeconomic inequalities: a pioneering population-wide study. *Am J Public Health*. 2019;109(6):835-836.

(9) Özdemir HÖ, Tosun S, Kabadurmuş FNK, Özdemir D. The impact of socioeconomic factors on the healthcare costs of people living with HIV in Turkey. *BMC Public Health*. 2020;20:368. https://doi.org/10.1186/s12889-020-08469-z

(10) Özdemir HÖ, Tosun S, Ö zdemir D, Korkmaz E. (2020). The determinants of employability of people living with HIV/AIDS in Turkey. *Am J Ind Med*. 2020;63(1):92-98. https://doi.org/10.1002/ajim.23056

(6) Greene WH. *Econometric Analysis*. 7th ed, Saddle River, NJ, Pearson; 2012.

(11) Williams, R. Using the margins command to estimate and interpret adjusted predictions and marginal effects. *The Stata Journal*. 2012;12(2):308-331.

(12) Lippi G, Mattiuzzi C, Sanchis-Gomar F, Henry BM. Clinical and demographic characteristics of patients dying from COVID-19 in Italy versus China. *J Med Virol*. 2020;92(10):1759-1760

(13) Li S, Feng B, Liao W, Pan W. (2020). Internet use, risk awareness, and demographic characteristics associated with engagement in preventive behaviors and testing: cross-sectional survey on COVID-19 in the United States. *J Med Internet Res*. 2020;22(6):e19782. https://doi.org/10.2196/19782

(14) Morawska L, Tang JW, Bahnfleth W. et al. How can airborne transmission of COVID-19 indoors be minimised?. *Environ Int*. 2020;142:105832. https://doi.org/10.1016/j.envint.2020.105832

(15) Vardavas CI, Nikitara K. COVID-19 and smoking: a systematic review of the evidence. *Tob Induc Dis*. 2020;18:20. https://doi.org/10.18332/tid/119324

(16) Lippi G, Henry BM. Active smoking is not associated with severity of coronavirus disease 2019 (COVID-19). *European J Intern Med*. 2020;75:107-108. https://doi.org/10.1016/j.ejim.2020.03.014

(17) Miyara M, Tubach F, Pourcher V. et al. Low rate of daily active tobacco smoking in patients with symptomatic COVID-19. *Qeios.* May 9, 2020; https://doi.org/10.32388/WPP19W.4

(18) Wenzl, T., Smoking and COVID-19 - A review of studies suggesting a protective effect of smoking against COVID-19, EUR 30373 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-22062-6 (online), doi:10.2760/564217 (online), JRC121837.

(19) Patel JA, Nielsen FBH, Badiani AA, et al. Poverty, inequality and COVID-19: the forgotten vulnerable. *Public Health*. 2020;183:110-111. https://doi.org/10.1016/j.puhe.2020.05.006

(20) Weill JA, Stigler M, Deschenes O, Springborn MR. Social distancing responses to COVID-19 emergency declarations strongly differentiated by income. *Proc Natl Acad Sci U S A*. 2020;117(33):19658-19660.