Araştırma Makalesi / Original Research Article *https://doi.org/10.35232/estudamhsd.1028929*

THE RELATIONSHIP BETWEEN THE COVID-19 VACCINATION RATE AND SOCIAL DETERMINANTS OF HEALTH IN TURKEY: A CORRELATION STUDY

Türkiye'de COVID-19 aşılama hızı ile sağlığın sosyal belirleyicileri arasındaki ilişki: Bir korelasyon çalışması

Güliz AYDEMİR ACAR[1]

Abstract

The aim of the research was to evaluate the correlation between the COVID-19 vaccination rate and education, population, health, and income indicators at the provincial level. The study was a descriptive type of research. The first dose COVID-19 vaccination rate was took from the Turkish Ministry of Health COVID-19 Table. Population, economic, education and health indicators of the provinces were obtained from the 2019 Health Statistics Yearbook of the Turkish Ministry of Health and the official website of the Turkish Statistical Institute (TUIK). SPSS v.18 program was used for data analysis. Variables associated with the COVID-19 vaccination rate were evaluated by Spearman correlation analysis. $p<0.05$ was considered significant. There was a very strong positive correlation between the vaccination rate and the 65-year-old population ratio ($r_s=0.710$, $p<0.001$), and a very strong negative correlation between the mean household size ($r_s=-0.848$, $p<0.001$). There was a strong positive correlation ($r_s=0.522$, $p<0.001$) between the rate of university graduates and the vaccination rate, and a strong negative correlation ($r_s=-0.651$, $p<0.001$) between the rate of illiteracy and the vaccination rate. A strong or very strong relationship was found between vaccination rate and all economic indicators except average earnings, and unemployment rate. There was a strong positive correlation between the number of visits to the physician per capita, one of the health indicators, and the vaccination rate ($r_s=0.639$, $p<0.001$). There are inequalities between provinces in terms of COVID-19 vaccination rate. Inequalities in vaccination rates are associated with social determinants of health.

Keywords: Correlation study, health status indicators, COVID-19 vaccines, vaccination, social factors.

Özet

Araştırmanın amacı, il düzeyinde COVID-19 aşılama hızı ile eğitim, nüfus, sağlık, gelir göstergeleri arasındaki korelasyonu değerlendirmekti. Araştırma tanımlayıcı tip epidemiyolojik araştırmaydı. 81 ilin 18 yaş üstü birinci doz COVID-19 aşılama hızı verisi Türkiye Sağlık Bakanlığı COVID-19 Tablosu'ndan alındı. İllerin nüfus, ekonomi, eğitim ve sağlık durumuna ilişkin göstergeler Türkiye Sağlık Bakanlığı'nın 2019 yılı Sağlık İstatistikleri Yıllığı ve Türkiye İstatistik Kurumu'nun (TÜİK) resmi internet sitesinden elde edildi. Veri analizi için SPSS v.18 programı kullanıldı. COVID-19 aşılama hızı ile ilişkili değişkenler Spearman Korelasyon analizi ile değerlendirildi. $p<0,05$ ise anlamlı kabul edildi. Aşılama hızı ile 65 yaş nüfus oranı arasında pozitif yönde çok güçlü ilişki, ($r_s=0,710$, $p<0,001$), ortalama hane halkı büyüklüğü ile negatif yönde çok güçlü ilişki vardı ($r_s=-0,848$, $p<0,001$). Üniversite mezunu oranı ile aşılama hızı arasında pozitif yönde güçlü bir ilişki ($r_s=0,522$, $p<0,001$) okuma yazma bilmeyen oranı ile aşılama hızı arasında negatif yönde güçlü ilişki ($r_s=-0,651$, $p<0,001$) bulundu. Ortalama kazanç ve işsizlik oranı hariç, aşılama hızı ile bütün ekonomik göstergeler arasında güçlü veya çok güçlü ilişki bulundu. Sağlık göstergelerinden kişi başı hekime başvuru sayısı ile aşılama hızı arasında pozitif yönde güçlü ilişki vardı ($r_s=0,639$, $p<0,001$). COVID-19 aşılama hızı bakımından iller arasında eşitsizlikler mevcuttu. Aşılama hızındaki eşitsizlikler sağlığın sosyal belirleyicileri ile ilişkiliydi.

Anahtar kelimeler: Korelasyon çalışması, sağlık durumu göstergeleri, COVID-19 aşıları, aşılama, sosyal faktörler.

1- Niğde Provincial Heatth Directorate, Niğde, Turkey

Sorumlu Yazar / Corresponding Author: Dr. Güliz AYDEMİR ACAR, MD. (Public Health Specialist)
e-posta / e-mail: glz.1986@outlook.com
Geliş tarihi / Received: 26.11.2021, **Kabul Tarihi / Accepted:** 08.02.2022

ORCID: Güliz AYDEMİR ACAR : 0000-0002-8170-4530

Nasıl Atıf Yaparım / How to Cite: *Aydemir Acar G. The relationship between the COVID-19 vaccination rate and social determinants of health in Turkey: A correlation study. ESTUDAM Public Health Journal. 2022;7(2):269-79.*

Introduction

The infectious disease which started in China in December 2019 has affected all countries of the world, still threatens public health. According to the data of the World Health Organization, the COVID-19 pandemic affected more than 200 million people and caused more than 4 million deaths as of August 13, 2021 (1). The pandemic is not only an important cause of mortality and morbidity, but also harms countries economically and socially. While restrictions on reducing human mobility have been effective to mitigate the pandemic, these do not appear to be consistently applicable. The most important strategy to combate against this infectious disease, which does not have an effective drug treatment yet, is vaccination. If herd immunity is established as soon as possible, spread of the disease, the rate of hospitalization and death rates will reduce.

The COVID-19 vaccine has been gradually administered to age groups and professionals who are likely to have severe disease and be affected by the disease since January 2021 in Turkey (2). Currently, all individuals aged 12 years and older can be vaccinated. At the beginning of the pandemic, the basic reproduction number of the COVID-19 virus was accepted as "3", and it was reported that at least 67% of the population should be vaccinated to control social transmission (3, 4). Since January 2021, new variants of the virus have begun to emerge. The data have showed that the delta variant (B.1.617.2), which has become the dominant strain in our country, is twice as contagious as the other strains, causes more serious disease in unvaccinated people, and increases the rates of hospitalization and death (5). According to studies, the basic reproduction number of the delta variant varies between "3.2" and "8" (mean "5.08). This means that at least 80% of the population is immune with a vaccine with 100% effectiveness in order to ensure herd immunity. Considering the decrease in vaccine effectiveness due to delata variant, it will be necessary to reach a vaccine coverage of over 90% in order to control the pandemic (6, 7).

In addition, the minimum vaccination rate required to break the chain of infection should have a similar distribution on the basis of provinces. However, at this point, the immunization rate in our country is far behind the target, and inequalities at the regional level draw attention. Regional differences in vaccination rate cannot be explained only by the attitudes and preferences of individuals living in that geographical area towards vaccination. There are also a number of structural factors that affect vaccine acceptance (8).

Economic and social factors that shape the health of society and individuals are known as social determinants of health (9). Differences in the distribution of diseases and health outcomes in communities living in different geographical regions are the result of the interaction of a number of social determinants (10). Gender, education, income, housing, employment, access to health services, working environment, environmental conditions can be given as examples of social determinants of health (9). Social determinants of health, separately or together, affect individual health behaviors and cause inequalities in health. Inequalities in health are “differences in health status and life expectancy among people that cannot be definitively explained by any biomedical and behavioral risk factors” (11).

It has been observed that there is not enough research in the literature on the social determinants of COVID-19 vaccine acceptance. For this reason, in this study, the relationship between the COVID-19 vaccination rate and population, education, income and health indicators at the provincial level was tried to be revealed. Beliefs and attitudes towards vaccination at the individual level are beyond the scope of this study.

The purpose of the research is to evaluate the correlation between the proportion of the population over the age of 18 who have received a dose of COVID-19 vaccine and education, population, health and income indicators on a provincial basis.

Material-Method

Study Design and Setting

The research was a descriptive epidemiological type of research. The research was carried out in July-August 2021. The universe of the study consisted of all provinces in Turkey (N=81). Sampling was not made and all provinces were included in the study. The dependent variable of the study was the percentage of people who have received at least the 1st dose of vaccine in the target population (population 18 years of age and older). The independent variables of the research are the demographic, economic, education and health indicators of the provinces. In Table 1, the source and year of indicators were taken were showed.

Table 1: Year and source of demographic, education, economic and health indicators of provinces.

Demographic indicators	Education indicators	Economic indicators	Health indicators
Proportion of population aged 65 and over (Health Yearbook, 2019)	Proportion of people who are illiterate (TUIK, 2020)	Gross domestic product per capita (TUIK, 2020)	Life expectancy at birth (TUIK, 2015)
Average household size (TUIK, 2020)	University graduate rate (TUIK, 2015)	Unemployment rate (TUIK, 2015)	Percentage of those who are satisfied with their health (TUIK, 2015)
Population density (TUIK, 2020)		Percentage of households that cannot meet their basic needs (TUIK, 2015)	Number of family medicine units (Health Yearbook, 2019)
Proportion of foreign population (TUIK, 2020)		Average daily earning (TL) (TUIK, 2015)	Population per family physician unit (Health Yearbook, 2019)
Ratio of rural population (TUIK, 2020)		Percentage of households with upper-middle income (TUIK, 2015)	Percentage of satisfaction with health services (TUIK, 2015)
		Number of rooms per person (TUİK, 2015)	Percentage of satisfaction with social life (TUIK, 2015)
			Number of visits to the physician per person (Health Yearbook, 2019)
			Total number of physicians per hundred thousand people (Health Yearbook, 2019)
			Total number of nurses and midwives per hundred thousand people (Health Yearbook, 2019)

Data Collection

The data of 81 provinces were obtained from the Turkish Ministry of Health COVID-19 Table, the 2019 Health Statistics Yearbook of the Turkish Ministry of Health and the official website of the Turkish Statistical Institute (TUIK). The percentage of people who have received at least the 1st dose of vaccine s was taken from the COVID-19 table dated July 4, 2021 published by the Ministry of Health. Official permission was obtained from the COVID-19 Scientific Research Evaluation Commission of the Ministry of Health for the research. Ethics committee approval was not obtained as the research was not conducted directly on the human and all publicly available data were used.

Data Analyses

SPSS versiyon 18.0 program was used for data analysis. The conformity of the data to the normal distribution was evaluated by Kolmogorov Smirnov and Shapiro-Wilk tests. Since the normal distribution conditions were not met, Spearman Correlation analysis was used to evaluate the variables associated with the COVID-19 vaccine rate. Correlation coefficient (rs) was weak if r_s=0.00-0.24, moderate if r_s=0.25-0.49, strong if r_s=0.50-0.74, very strong if r_s=0.75-1.00 (8). $p<0.05$ was considered significant.

Results

As of July 4, 2021, the mean percentage of people who had the first dose of COVID-19 vaccine of provinces was found 56.6±12.1. The region with the highest vaccination percentage was the Aegean region with 66.9±6.5%; the lowest vaccination rate was in the Southeastern Anatolia region with 36.5±8.2%. Table 2 shows the distribution of the percentage of people who received the first dose of COVID-19 vaccine by region. The province with the highest vaccination rate was Muğla with 80%; the province with the lowest vaccination rate was Siirt with 28%. The number of provinces with a vaccination rate of 20-40% was 12, the number of provinces with a vaccination rate of 41-60% was 33, and the number of provinces with a vaccination rate of 61-80% was 36.

Table 2: Distribution of the mean first dose COVID-19 vaccination rate of the provinces in Turkey by regions (July 4, 2021).

REGION	Vaccination rate mean± Standard deviation
Aegean	66.9±6.5
Mediterrenian	58.8±5.3
Marmara	65.9±6.3
Black Sea	61.4±7.1
Central Anatolia	59.6±7.1
Eastern Anatolia	45.8±10.8
Southeastern Anatolia	36.5±8.2
TURKEY	56.6±12.1

A very strong positive correlation was found between the rate of vaccination and the 65-year-old population rate (r_s=0.710, $p<0.001$). A very strong negative correlation was found between vaccination rate and average household size (r_s=-0.848, $p<0.001$). There was a strong positive correlation between the rate of university graduates and the vaccination rate (r_s=0.522, $p<0.001$). There was a strong negative correlation between the rate of illiteracy and the vaccination rate (r_s=-0.651, $p<0.001$).

A strong or very strong relationship was found between the vaccination rate and all economic indicators except the average earnings and unemployment rate. A strong positive correlation was found between the number of visits to the physician per capita, one of the health indicators, and the vaccination rate (rs=0.639, p<0.001). Table 3 shows the correlation between the population, economy, education and health indicators of the provinces and the COVID-19 vaccination rate. In this study, proportion of population aged 65 and over was found to be a strong predictor for vaccination rates of Mediterrenian, Marmara, Black Sea and Eastern Anatolia regions. There was a strong negative correlation between the average household size and the vaccination rate of Aegean, Marmara, Central Anatolia, Eastern Anatolia and Southeastern Anatolia regions. Table 4 shows the correlation between the population, economy and education indicators of the provinces and the COVID-19 vaccination rate by regions. There was a strong positive correlation between life expectancy at birth and COVID-19 vaccination rate in Aegean region. The number of visits to the physician per person was a strong predictor for vaccination rates of Eastern Anatolia and Southeastern Anatolia regions. Table 5 shows the correlation between the health indicators of the provinces and the COVID-19 vaccination rate by regions.

Table 3: Correlation between demographic, economy, education and health indicators of provinces and COVID-19 vaccination rate.

		rho	p
Demographic	Proportion of population aged 65 and over	**0.710**	**<0.001**
	Average household size	**-0.848**	**<0.001**
	Population density	0.153	0.173
	Ratio of rural population	-0.295	**0.036**
	Proportion of foreign population	**0.575**	**<0.001**
Education	Proportion of people who are illiterate	**-0.651**	**<0.001**
	University graduate rate	**0.522**	**<0.001**
Economic	Gross domestic product per capita	**0.695**	**<0.001**
	Unemployment rate	-0.312	**0.005**
	Percentage of households that cannot meet their basic needs	**-0.549**	**<0.001**
	Average daily earning (TL)	0.221	**0.047**
	Percentage of households with upper-middle income	**0.607**	**<0.001**
	Number of rooms per person	**0.757**	**<0.001**
Health	Life expectancy at birth	0.181	0.106
	Percentage of those who are satisfied with their health	0.400	**<0.001**
	Number of family medicine units	0.033	0.771
	Population per family physician unit	-0.009	0.933
	Number of visits to the physician per person	**0.639**	**<0.001**
	Total number of physicians per hundred thousand people	0.383	**<0.001**
	Total number of nurses and midwives per hundred thousand people	0.430	**<0.001**
	Percentage of satisfaction with health services	0.298	**0.007**
	Percentage of satisfaction with social life	0.403	**<0,001**

Table 4: Correlation between demographic, economy, education indicators of provinces and COVID-19 vaccination rate by regions.

	Aegean	Mediterrenian	Marmara	Black Sea	Central Anatolia	Eastern Anatolia	Southeastern Anatolia
Proportion of population aged 65 and over	rho:0.347 p:0.399	rho:0.905 **p:0.002**	rho:0.773 **p:0.005**	rho:0.629 **p:0.005**	rho:0.154 p:0.616	rho:0.811 **p:<0.001**	rho:0.647 p:0.083
Average household size	rho:-0.738 **p:0.037**	rho:-1.000	rho:-0.903 **p:<0.001**	rho:-0.395 p:0.105	rho:-0.841 **p:<0.001**	rho:-0.771 **p:0.001**	rho:-0.810 **p:0.015**
Population density	rho:0.619 p:0.102	rho:-0.595 p:0.120	rho:-0.800 **p:0.003**	rho:0.094 p:0.710	rho:0.313 p:0.297	rho:-0.520 **p:0.047**	rho:0.405 p:0.320
Ratio of rural population	rho:-0.714 **p:0.047**	rho:0.548 p:0.160	rho:0.606 **p:0.048**	rho:0.033 p:0.896	rho:-0.258 p:0.394	rho:0.009 p:0.975	rho:0.024 p:0.955
Proportion of foreign population	rho:-0.200 p:0.747	rho:0.600 p:0.285	rho:-0.548 p:0.160	rho:-0.055 p:0.859	rho:0.261 p:0.467	rho:0.741 **p:0.006**	rho:0.452 p:0.260
Proportion of people who are illiterate	rho:0.214 p:0.610	rho:-0.786 **p:0.021**	rho:-0.770 **p:0.009**	rho:0.056 p:0.830	rho:-0.231 p:0.448	rho:-0.368 p:0.177	rho:-0.286 p:0.493
University graduate rate	rho:0.886 **p:0.003**	rho:0.595 p:0.120	rho:-0.164 p:0.631	rho:-0.297 p:0.232	rho:0.654 **p:0.015**	rho:0.611 **p:0.016**	rho:-0.036 p:0.933
Gross domestic product per capita	rho:0.524 p:0.183	rho:0.643 p:0.086	rho:-0.491 p:0.150	rho:0.010 p:0.968	rho:0.385 p:0.194	rho:0.839 **p:<0.001**	rho:0.429 p:0.289
Unemployment rate	rho:0.738 **p:0.037**	rho:-0.571 p:0.139	rho:-0.573 p:0.066	rho:-0.285 p:0.251	rho:0.451 p:0.122	rho:-0.519 **p:0.048**	rho:-0.619 p:0.102
Percentage of households that cannot meet their basic needs	rho:0.833 **p:0.010**	rho:-0.548 p:0.160	rho:0.091 p:0.790	rho:0.375 p:0.125	rho:-0.473 p:0.102	rho:-0.482 p:0.069	rho:0.119 p:0.779
Average daily earning (TL)	rho:0.024 p:0.955	rho:-0.071 p:0.867	rho:-0.618 **p:0.043**	rho:-0.124 p:0.624	rho:0.593 **p:0.033**	rho:0.371 p:0.173	rho:-0.310 p:0.456
Percentage of households with upper-middle income	rho:0.571 p:0.139	rho:0.286 p:0.493	rho:-0.327 p:0.326	rho:0.113 p:0.656	rho:0.825 **p:0.001**	rho:0.479 p:0.071	rho:-0.238 p:0.570

Table 5: Correlation between health indicators of provinces and COVID-19 vaccination rate by regions.

	Aegean	Mediterrenian	Marmara	Black Sea	Central Anatolia	Eastern Anatolia	Southeastern Anatolia
Life expectancy at birth	rho:0.898 **p:0.002**	rho:0.263 p:0.528	rho:-0.295 p:0.379	rho:0.070 p:0.783	rho:-0.124 p:0.685	rho:0.410 p:0.129	rho:-0.333 p:0.420
Percentage of those who are satisfied with their health	rho:-0.833 **p:0.010**	rho:0.275 p:0.509	rho:-0.331 p:0.320	rho:0.073 p:0.772	rho:-0.104 p:0.734	rho:-0.075 p:0.790	rho:0.167 p:0.693
Number of family medicine units	rho:0.405 p:0.320	rho:-0.357 p:0.385	rho:-0.536 p:0.089	rho:0.072 p:0.777	rho:-0.121 p:0.694	rho:-0.293 p:0.289	rho:-0.095 p:0.823
Population per family physician unit	rho:0.452 p:0.260	rho:-0.524 p:0.183	rho:-0.345 p:0.298	rho:-0.156 p:0.537	rho:0.163 p:0.596	rho:-0.611 **p:0.016**	rho:-0.762 **p:0.028**

Number of visits to the physician per person	rho:0.144 p:0.734	rho:0.084 p:0.844	rho:0.530 p:0.094	rho:0.276 p:0.268	rho:0.163 p:0.596	rho:0.705 **p:0.003**	rho:0.771 **p:0.025**
Total number of physicians per hundred thousand people	rho:-0.412 p:0.310	rho:-0.300 p:0.470	rho:0.171 p:0.616	rho:0.182 p:0.469	rho:-0.299 p:0.321	rho:-0.861 **p:<0.001**	rho:-0.694 p:0.056
Total number of nurses and midwives per hundred thousand people	rho:0.522 p:0.184	rho:-0.784 **p:0.021**	rho:-0.700 **p:0.016**	rho:-0.093 p:0.714	rho:-0.444 p:0.128	rho:-0.631 **p:0.012**	rho:-0.577 p:0.134
Percentage of satisfaction with health services	rho:-0.810 **p:0.015**	rho:0.190 p:0.651	rho:0.182 p:0.593	rho:0.190 p:0.450	rho:-0.121 p:0.694	rho:0.454 p:0.089	rho:0.048 p:0.911
Percentage of satisfaction with social life	rho:-0.874 **p:0.005**	rho:0.333 p:0.420	rho:0.164 p:0.631	rho:0.278 p:0.263	rho:-0.434 p:0.138	rho:0.227 p:0.416	rho:0.810 **p:0.015**

Discussion

According to the research, which was planned to determine the social determinants related to the COVID-19 vaccination rate on the basis of provinces in Turkey, it was seen that the rate of the population over 65 years of age, average household size, education level, income, number of visits to the physician per capita had a strong relationship with the vaccination rate.

According to the research, the vaccination rate of the provinces increased as the population over 65 years of age increased. It has been shown in previous studies that increasing age increases the risk of hospitalization and death due to COVID-19, and the clinic of the disease is more severe in elderly individuals (12, 13). Since the beginning of the pandemic, individuals over the age of 65 have been among the groups most affected by social restrictions. Elderly people who use healthcare services more frequently due to their chronic diseases are more likely to receive vaccination advice from their healthcare professional. For these reasons, a higher risk perception and susceptibility to the disease may have occurred in this age group. The risk of transmission or the aggravation of the course of COVID-19 infection by advanced age and chronic diseases may have been the motivating factors for vaccination in this age group (12). Providing on-site vaccination services by mobile teams for the elderly who need home care has increased the elderly's access to vaccines. The high rate of COVID-19 vaccination in the elderly is a factor that increases the rate of vaccination in provinces with a high population over the age of 65. Age is an important determinant of vaccination in many studies. In the study by Lopez de Andres, seasonal influenza vaccination was more common in individuals older than 75 years (OR 2.4, 95% CI 2.0-2.8) and 70-74 years (OR 1.6, 95% CI 1.3-2.0) compared to the 65-69 age group (14). In the study conducted by Mashado et al, seasonal influenza vaccination was more common in the age group of 70 years and older than in the 60-69 age group (15).

To done study, as the average household size increased, the vaccination rate decreased. There could be two different reasons for this. First, in the provinces where the average household size is large, family elders and adult children may negatively

affect each other's vaccination behaviors due to the predominance of extended family structure. Second, the large average household size indicates a high fertility rate. The rate of young and child population in the total population is high in provinces where the average household size is large. The data have indicated that vaccine indecision and vaccine rejection have been more common in the younger population. Studies have stated that there is an inverse relationship between poverty and average household size, the behavior of having a large number of children (16). Household structure also plays a determining role on income inequality (17). In the study, a strong relationship was found between economic indicators and vaccine acceptance. For these reasons, the increase in the average household size may be a factor that negatively affects the vaccination rate. In the study by Awang Bono et al., the increase in the number of people living in the same house reduces the desire to have the COVID-19 vaccine (OR=0.94, 95% CI 0.92-0.97) (18).

Income is an important determinant of immunization services in terms of the indirect costs required to access the vaccine. Access to vaccination centers can be a problem, especially for people living in rural areas. My low-income individuals often have poor education levels (19). As a matter of fact, according to the research, a relationship was found between all economic indicators of the provinces and vaccination rates. In the study conducted by Freimuth et al., it was stated that those living in high-income households were more confident in the flu vaccine (20).

According to the research, it is seen that there is a strong relationship between the rate of university graduates and the rate of illiterate population and the vaccination rate. Having a high education level can provide easier access to information resources about vaccines. In addition, individuals with high education may be less prone to prejudice and traditional beliefs about vaccination (10). In the study conducted by Awang Bono et al., the willingness to get the COVID-19 vaccine was found to be higher (OR=1.30, 95% CI 1.02-1.68) in university graduates compared to primary and secondary school students (18). In the study by Leng et al., it was found that those with university-level education believe less in conspiracy theories about the COVID-19 vaccine and are more likely to have the vaccine (21). In contrast, in the study by Viswanath et al, level of education was not a predictor of propensity to get the COVID-19 vaccine (22). In a study conducted in Saudi Arabia, no significant relationship was found between the tendency to get the COVID-19 vaccine and the level of education (23).

There is a strong positive relationship between the vaccination rate of the provinces and the number of applications to the physician per capita. Referral to a physician can be a factor that enables individuals to get accurate information about vaccines and reduces their hesitations about vaccines. In the study conducted by Thompson et al., the frequency of vaccination with HPV vaccine was higher in men and women who were last seen by a healthcare professional in less than 6 months (24).

Strengths and limitations of the study

The research has some limitations. Factors affecting vaccine acceptance were evaluated on the basis of publicly available data from the institutions and accessible by the researcher. There may be other factors not considered in the research that affect COVID-19 vaccine acceptance. All data used in the study do not belong to the same year. Since the factors related to the vaccination rate were evaluated on a provincial basis, there may be confusing factors. Despite this, our research contributes to the literature in terms of creating a framework for the social determinants related to the COVID-19 vaccination rate in our country.

Conclusions

As a result, there are inequalities on the basis of provinces in terms of the COVID-19 vaccination rate. Inequalities in vaccination rates are associated with social determinants of health. Social determinants of health should not be ignored while planning vaccination programs. Research results should be evaluated considering the limitations of correlation studies. Large-scale human studies are needed to determine the factors affecting vaccination.

Conflict of Interest

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

This study was not funded by any organization.

References

1. World Health Organization. WHO Coronavirus (COVID-19) Dashboard [Internet]. Geneva; 2021 [cited 2021 Aug 13]. Available from: https://covid19.who.int/
2. Ministry of Health of the Republic of Turkey. Ministry of Health COVID-19 Vaccine İnformation Platform [Internet]. Ankara, Turkey; 2021 [cited 2021 Aug 13] Available from: https://covid19asi.saglik.gov.tr/TR-77706/COVID-19-asisi-ulusal-uygulama stratejisi.html
3. Kwok KO, Lai F, Wei WI, Wong SYS, Tang JWT. Herd immunity - estimating the level required to halt the COVID-19 epidemics in affected countries. J Infect. 2020;80(6):32-3. doi:10.1016/j.jinf.2020.03.027.
4. Fontanet A, Cauchemez S. COVID-19 herd immunity: where are we? Nat Rev Immunol. 2020;20(10):583-4. doi:10.1038/s41577-020-00451-5.
5. Centers for Disease Control and Prevention. COVID-19. Delta variant: What we know about the science [Internet]. Atlanta; 2021 [cited 2021 Nov 25]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/variants/delta-variant.html
6. Liu Y, Rocklöv J. The reproductive number of the Delta variant of SARS-CoV-2 is far higher compared to the ancestral SARS-CoV-2 virus. J Travel Med. 2021;28(7). doi:10.1093/jtm/taab124.
7. McBryde ES, Meehan MT, Caldwell JM, Adekunle AI, Ogunlade ST, Kuddus MA, et al. Modelling direct and herd protection effects of vaccination against the SARS-CoV-2 Delta variant in Australia. Med J Aust. 2021;215(9):427-32. DOI:10.5694/ mja2.51263.
8. Habersaat KB, Jackson C. Understanding vaccine acceptance and demand-and ways to increase them. Bundesgesundheitsblat Gesundheitsforschung Gesundheitsschutz. 2020;63(1):32-9. doi:10.1007/s00103-019-03063-0.
9. Forchuk C, Dickins K, Corring DJ. Social Determinants of Health: Housing and Income. Healthc Q. 2016:27-31. doi:10.12927/hcq.2016.24479.
10. Nagata JM, Hernández-Ramos I, Kurup AS, Albrecht D, Vivas-Torrealba C, Franco-Paredes C. Social determinants of health and seasonal influenza vaccination in adults ≥65 years: a systematic review of qualitative and quantitative data. BMC Public Health. 2013;13:388. doi:10.1186/1471-2458-13-388.
11. Arcaya MC, Arcaya AL, Subramanian SV. Inequalities in health: definitions, concepts, and theories. Glob Health Action. 2015;8(1):27106. doi:10.3402/gha.v8.27106.
12. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020;395(10229):1054-62. doi:10.1016/S0140-6736(20)30566-3.
13. Gallo Marin B, Aghagoli G, Lavine K, Yang L, Siff EJ, Chiang SS, et al. Predictors of COVID-19 severity: a literature review. Rev Med Virol. 2021;31(1):1-10. DOI:10.1002/rmv.2146.
14. Jiménez-García R, Hernández-Barrera V, de Andres AL, Jimenez-Trujillo I, Esteban-Hernández J, Carrasco-Garrido P. Gender influence in influenza vaccine uptake in Spain: time trends analysis (1995-2006). Vaccine. 2010;28(38):6169-75. doi:10.1016/j.vaccine.2010.07.029.
15. Machado A, Santos AJ, Kislaya I, Larrauri A, Nunes B. Understanding influenza vaccination among Portuguese elderly: the social ecological framework. Health Promot Int. 2020;35(6):1427-40.

doi:10.1093/heapro/daaa011.
16. Öztürk L. Türkiye'de illerin yoksulluk nedeni olarak toplam doğurganlık hızları: yatay kesit bir analiz, 1990-2000. Uludağ Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi [Internet]. 2012 [cited 2022 Feb 10];31(1):193-210. Available from: http://www.uludag.edu.tr/ dosyalar /iibfdergi/genel-dokuman/2012_1/ASL09 .pdf
17. Başlevent C. Türkiye'nin değişen hanehalkı yapısı: tek kişilik haneler ne durumda? Yildiz Social Science Review. 2020;6(1):17-31. doi:10.51803/ yssr.703188.
18. Bono SA, Faria de Moura Villela E, Siau CS, Chen WS, Pengpid S, Hasan MT, et al. Factors affecting COVID-19 vaccine acceptance: an international survey among low- and middle-income countries. Vaccines. 2021;9(5):515. doi:10.3390/vaccines9050515.
19. Glatman-Freedman A, Nichols K. The effect of social determinants on immunization programs. Hum Vaccin Immunother. 2012;8(3):293-301. doi:10. 4161/hv.19003.
20. Freimuth VS, Jamison AM, An J, Hancock GR, Quinn SC. Determinants of trust in the flu vaccine for African Americans and Whites. Soc Sci Med. 2017;193:70-9. doi:10.1016/j. socscimed.2017.10.001.
21. Leng A, Maitland E, Wang S, Nicholas S, Liu R, Wang J. Individual preferences for COVID-19 vaccination in China. Vaccine. 2021;39(2):247-54. doi:10.1016/j. vaccine.2020.12.009
22. Viswanath K, Bekalu M, Dhawan D, Pinnamaneni R, Lang J, McLoud R. Individual and social determinants of COVID-19 vaccine uptake. BMC Public Health. 2021;21(1):818. doi:10.1186 /s12889-021-10862-1.
23. Al-Mohaithef M, Padhi BK. Determinants of COVID-19 vaccine acceptance in Saudi Arabia: a web-based national survey. J Multidiscip Healthc. 2020;13:1657-63. doi:10.2147/JMDH. S276771.
24. Thompson EL, Rosen BL, Maness SB. Social determinants of health and human papillomavirus vaccination among young adults, National Health Interview Survey 2016. J Community Health. 2019;44(1):149-58. doi:10.1007/ s10900-018-0565-2.