


## Article

# Does the COVID-19 Vaccination Rate Change According to the Education and Income: A Study on Vaccination Rates in Cities of Turkey between 2021-September and 2022-February

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**Citation:** Cengiz, B.; Sayılır, M.Ü.; Zengin, N.Y.; Küçük, Ö.N.; Soylu, A.R. Does the COVID-19 Vaccination Rate Change According to the Education and Income: A Study on Vaccination Rates in Cities of Turkey between 2021-September and 2022-February. *Vaccines* **2022**, *10*, 1933. <https://doi.org/10.3390/vaccines10111933>

Academic Editors: Daniel Kwasi Ahorsu and Chung-Ying Lin

Received: 2 September 2022

Accepted: 9 November 2022

Published: 15 November 2022

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**Abstract:** Background: The increase in the coronavirus disease 2019 (COVID-19) vaccination rates in Turkey and in the world plays a key role in reducing the number of deaths and cases from COVID-19. Investigating the underlying causes of COVID-19 vaccine hesitations seems to be a guide in reducing the negative effects of the pandemic. Methods: We analyzed the correlations between double COVID-19 vaccination rates of all cities in Turkey between 1 September 2021 and 1 February 2022 and their per capita income values and their education level percentages. Results: Overall, there was a negative correlation between the vaccination rates of cities and the percentages of illiterate, literate without a diploma, and secondary school graduates for both genders. However, there was a positive correlation between city vaccination rates and the percentages of primary school and college graduates. City income values per capita values were positively correlated with double vaccination rates of cities. Conclusion: Our findings suggest that not only low levels of education, but also interruption of education at some point make a significant contribution to vaccination hesitancy and ultimately to vaccination levels. In order to end the pandemic and reach a sufficient percentage of vaccines, it may be necessary to address some special groups and raise awareness of these groups about vaccination.

**Keywords:** COVID-19; vaccination; vaccine; income; education level; public health

## 1. Introduction

On 11 March 2020, WHO declared that COVID-19, the infectious disease caused by the SARS-CoV-2 virus, could qualify as a pandemic and called on all countries to activate and expand their emergency response mechanisms [1,2]. As of now, while COVID-19 has caused approximately 600 million cases and 7 million deaths in the world, it has also caused approximately 16 million cases and 100 thousand deaths in Turkey [3,4].

The role of the treatments used in this devastating picture created by COVID-19 has been limited [5]. Vaccination is critical in reducing the number of cases and deaths from COVID-19 and plays a key role in ending the pandemic [6]. If we take a look at the vaccine development process against the SARS-CoV-2 virus in the world; the Pfizer BioNTech (BNT162b2, Manhattan, NY, USA) COVID-19 vaccine became the first COVID-19 vaccine to be approved for emergency use by the World Health Organization as of 31 December 2020 [6]. Then, as of 12 January 2022, the emergency use of the Oxford/AstraZeneca (ChAdOx1-S (recombinant) vaccine) COVID-19 vaccine was approved by the World Health Organization [6]. Subsequently, the Janssen/Ad26.COV 2.S vaccine, produced by Johnson & Johnson, was approved on March 12, 2021. As of September 2022, there are 9 vaccines approved against COVID-19 [7]. According to the data announced by the World Health

Organization, as of September 2022, the number of vaccines in clinical development is 171 and 45 of them are in phase 3 [8].

The inactivated COVID-19 vaccine Sinovac-CoronaVac was developed by Sinovac Life Science Company (Beijing, China). To evaluate the efficacy of the Sinovac-CoronaVac vaccine, participants were vaccinated in two doses 14 days apart in a randomized, double-blind, placebo-controlled phase 3 clinical trial among healthy healthcare professionals based in Brazil, conducted from 21 July to 16 December 2020. Efficacy against symptomatic COVID-19 for 14 days after the second vaccine dose was 50.7% (95% Confidence Interval: 36% to 62%) [9]. According to the results of a double-blind, randomized, placebo-controlled phase 3 trial to determine the efficacy and safety of the Sinovac-CoronaVac vaccine carried out in Turkey between 14 September 2020 and 5 January 2021, the effectiveness of the Sinovac-CoronaVac vaccine 14 days or longer after the second dose is 83.5% found [10]. Following these data, the Sinovac-CoronaVac vaccine was given “Emergency Approval” by the Ministry of Health of the Republic of Turkey, and then the COVID-19 vaccination process began on 14 January 2021 [11]. On 19 June 2021, the Ministry of Health announced that 5 million doses of the Sinovac-CoronaVac vaccine had arrived in Turkey [12]. On the other hand, the Sinovac-CoronaVac vaccine had been approved for emergency use by the world health organization on 1 June 2021 [7]. Priority groups were determined in the vaccination process in Turkey. In the first stage, the personnel working in the health institution and all pharmacy workers obtained the right to be vaccinated. Then, this right was granted to the elderly, the disabled, and citizens living and working in places such as protection houses. Afterwards, people over the age of 65 and priority sectors (education sector, food sector, transportation sector, security, ministry of justice, ministry of national defense, prisons, etc.) for the continuation of the service were determined and those working in these sectors were given the right to be vaccinated. Vaccination continued, expanding to lower ages [13]. After the Pfizer-BioNTech vaccine was approved for emergency use by WHO in December 2020, the Pfizer-BioNTech vaccine was offered to the citizens of the Republic of Turkey as the second vaccine alternative, after the Sinovac-CoronaVac vaccine, and the use of the Pfizer-BioNTech vaccine was started on 12 April 2021 [14]. The Pfizer-BioNTech vaccine is an mRNA vaccine against COVID-19 [15]. Between 27 July 2020 and 29 October 2020, in a placebo-controlled, observer-blinded, multinational study of participants aged 16 years and older with no prior evidence of SARS-CoV-2 infection, a 6-month follow-up was performed after two doses of the Pfizer-BioNTech vaccine given 21 days apart and the efficacy of the Pfizer-BioNTech vaccine against COVID-19 was 91% (95% Confidence Interval: 89% to 93%) [16]. While citizens living in the Republic of Turkey could only get the Sinovac-CoronaVac vaccine between 14 January 2021 and 12 April 2021, they were vaccinated with the Sinovac-CoronaVac or Pfizer-BioNTech vaccine as of 12 April 2021, according to their own preferences. On 30 April 2021, the Ministry of Health of the Republic of Turkey gave the emergency use approval for the use of Russia’s Sputnik V vaccine in Turkey after the Sinovac and BioNTech vaccines [17]. Although the first shipment of 400,000 doses of Sputnik V vaccine reached Turkey on 15 June 2021, the Turkish Medical Association announced that the vaccine could not be used because the second doses did not arrive [18]. Although it had been approved for emergency use as of September 2022, the Sputnik V vaccine is not in use in the Republic of Turkey. On 22 December 2021, Turkovac, which was developed in cooperation with Erciyes University and the Ministry of Health, Turkish Health Institutes, was approved for emergency use in Turkey and started to be implemented in the Republic of Turkey as of 30 December 2021 [19]. As a result, as of January 2022, the vaccines used against the SARS-CoV-2 virus in the Republic of Turkey are the Sinovac-CoronaVac, the Pfizer-BioNTech and the Turkovac.

On 25 June 2021, everyone aged 18 and over was given the right to be vaccinated. As of August 2022, approximately 85 percent of the population aged 18 and over who have received at least 2 doses of vaccination is approximately 45 percent of the population aged 18 and over who have received 3 doses of vaccination [20]. Although the vaccination percentage of the Turkish population is higher than the average vaccination percentage of

the world population, the percentage of those who do not have the vaccination is also at a significant level [21].

Although there are many vaccines developed against COVID-19 that act with various mechanisms and there is no shortage of resources, the desired speed in vaccination programs has not been achieved in many countries [21]. Considering the role of time in the formation of SARS-CoV-2 variants, we think that the disruptions in the vaccine programs may have played a role in the emergence of new variants and the prolongation of the pandemic [22]. Taking into account the effect of the vaccine in preventing material and moral damages, it is critical to investigate the underlying causes of vaccine hesitations (not being sure about the vaccine). Researchers from many parts of the world have conducted studies to evaluate the attitudes of societies towards COVID-19 vaccines and to identify the factors that lead to vaccine hesitancy [23–35].

If we take a look at some of the elegant studies conducted in Europe, in a study based in Ireland and the United Kingdom, vaccine hesitancy was evident in 35% and 31% of adult participants, respectively, and the researchers concluded that those who were resistant to the COVID-19 vaccine in both populations were less likely to receive information about the pandemic from authoritative sources [23]. According to another study conducted in France, direct vaccine rejection and vaccine hesitancy were found to be significantly associated with lower education level, inadequate compliance with the vaccines recommended in the past, and not reporting the specified chronic conditions [24]. If we look at some of the comprehensive studies done in the Americas, in one study the intention to get vaccinated was 55% in January 2020 and around 70% in March 2020. When examining the population with high levels of vaccine hesitancy, it was found that young adults, non-Hispanic Black or other race adults, adults of low socioeconomic status, and adults living in the southeastern USA region [25]. In another US-based study involving participants aged 18–45 years, the outcomes of the population receiving the COVID-19 vaccine were associated with male gender, sexual minority status, higher education levels, and previous influenza vaccination [26]. A large-scale national study based in China, located in the Asian continent, examined COVID-19 vaccine hesitancy among the Chinese population. The overall prevalence of COVID-19 vaccine hesitancy in this study was found to be around 8%. It was concluded that women, those with a high level of education, married residents, those with high health status, those who had never smoked, and those with low belief in vaccination conspiracy were more willing to vaccinate than others [27]. In another study conducted to investigate hesitancy and resistance in the COVID-19 vaccine in the Australian continent, it was concluded that 7% of the participants had high hesitancy and 6% were resistant. Women, those living in disadvantaged areas, those with more populist views, and those with higher levels of religiosity have been shown to be more hesitant or resistant, while those with higher household incomes and more reliance on state or territory government or hospitals have been shown to be more likely to be vaccinated [28]. In a study on perspectives on COVID-19 vaccines in Jordan, a country located in the Middle East, a significant correlation was found between male gender, high income, master, doctorate, or undergraduate education level and willingness to have the vaccine [29]. In studies from all over the world examining the underlying causes of COVID-19 vaccine hesitancy, the main differences between the populations who have/intend to get vaccinated and the group who are hesitant about vaccination were their education levels, socioeconomic status, income level, the probability of getting information about the pandemic from authorized sources, and the health status of the participants.

Given that the Turkish government has stated that COVID-19 vaccine will be provided free of charge to the population, we questioned: is there a correlation between cities' education levels, incomes and vaccination percentages? Since we used government data in this study, problems such as small sample size (several thousand), wrong population sampling (several thousand web/Facebook users, etc.) and dividing education levels into a small number of groups did not occur.

## 2. Materials and Methods

From 1 September 2021–1 February 2022, we examined correlations of double COVID-19 vaccination rates (DCVR) (over 18 years old) of all cities (81) in Turkey vs. their per capita income values and their education level percentages. Double COVID-19 vaccination means received two vaccine doses, BioNTech, Pfizer vaccine, or Sinovac COVID-19 vaccine. The COVID-19 vaccination data of more than 60 million Turks recorded by the Ministry of Health has been used in this study. Data on double COVID-19 vaccination rates of cities (between 0% and 100%) were obtained from the Turkish Ministry of Health database and were collected every two weeks between September 2021 and February 2022 [20]. Education data of the last four years [36] (2018 to 2021) were obtained from the Turkish Statistical Institute database. City education levels classified as illiterate, literate without a diploma, primary school (5 years), primary education (6–7 years), secondary school/intermediate graduate (8 years), high school graduate (12 years), college degree (universities and other higher educational institutions), master's degree (including 5 or 6 years faculties) and doctoral degree. Population data at each education level for cities are normalized using the population of that city. The correlation between education data for each year and vaccination rates was calculated by Spearman's rank correlation analysis. Separate analyzes were made for males, females, and for the total population. Per capita city income values (PCCI) of the last three years [37] (2018 to 2020) (USD) are obtained from the Turkish Statistical Institute database. Associations between COVID-19 vaccination rates and PCCI were examined through Spearman's rank correlation analyze.

## 3. Results

As shown in Figure 1, for the education level vs. the DCVR correlations while the correlation values usually do not change with respect to the gender, vaccination rate measurement day and year of education data for each education level, correlations between DVCR, and education levels vary greatly from one education level to the next. As a result of all analyzes, a negative relationship was found between the vaccination rates of the cities and the percentages of illiterate, literate, and secondary school graduates for both genders. However, there was a positive correlation between city vaccination rates and the percentages of primary and university graduates for both genders.

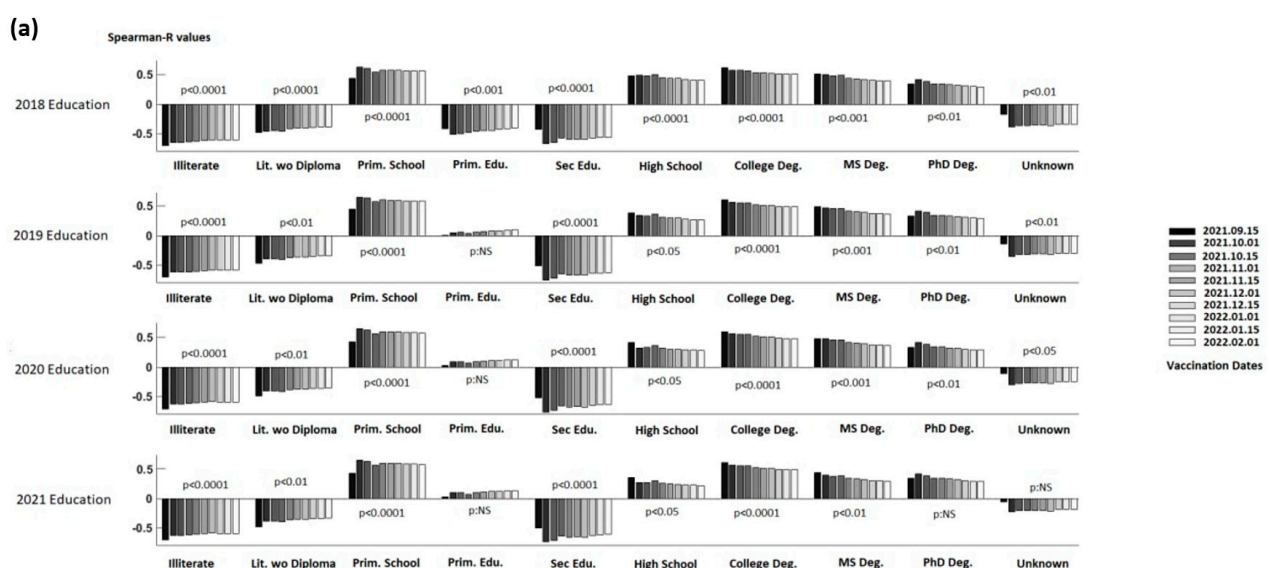
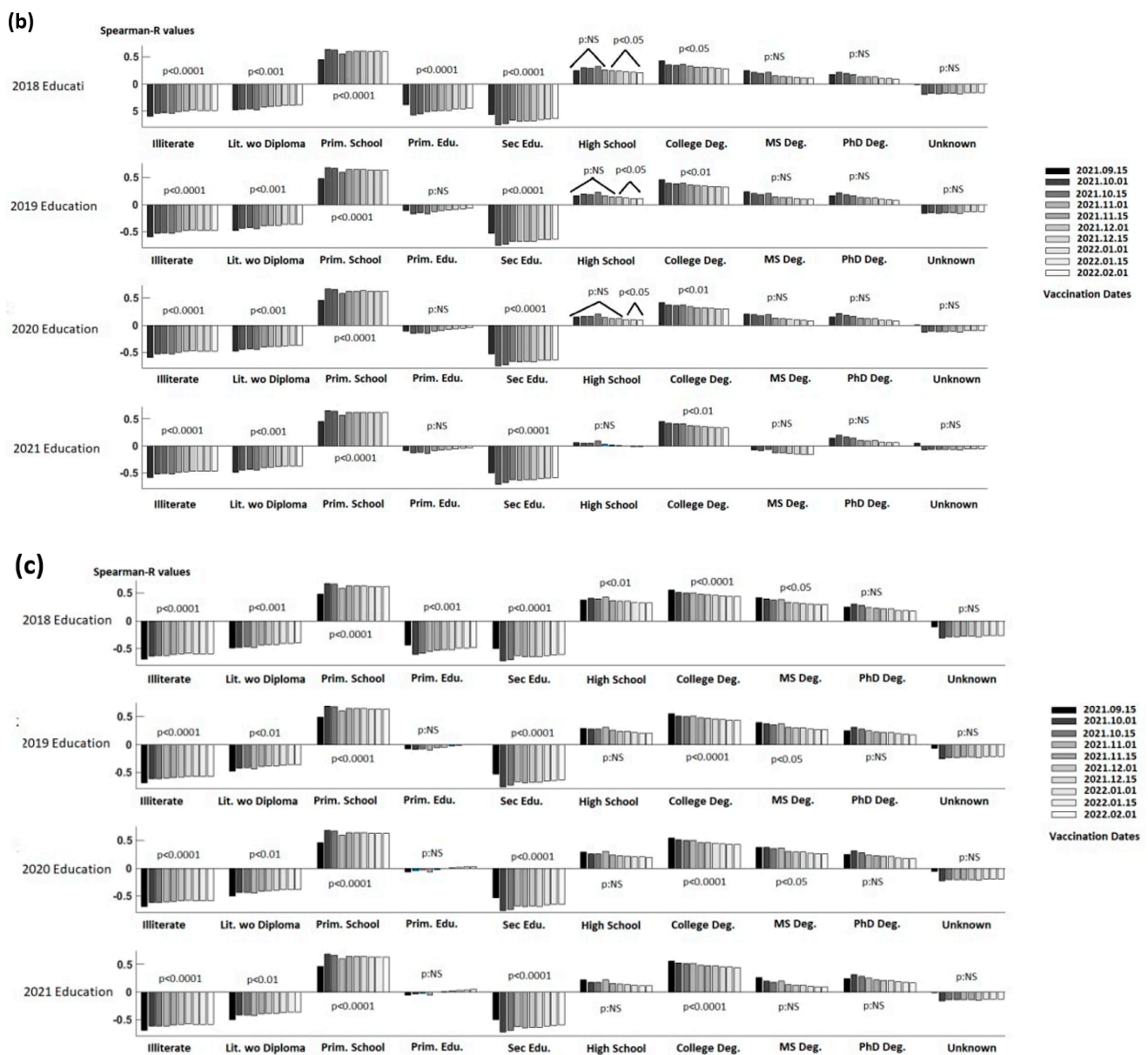
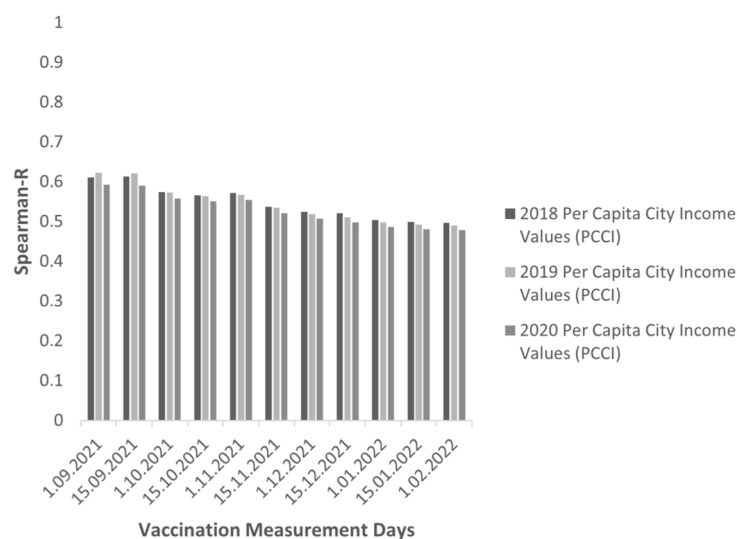


Figure 1. Cont.



**Figure 1.** Spearman-R correlation coefficients (education percentage per city vs. double COVID-19 vaccination percentage in the city) for different educational levels (illiterate, literate without a diploma, primary school, primary education, secondary school/intermediate graduate, high school graduate, college degree, master's degree, doctoral degree, and unknown) and years (2018–2021), between September 2021 and February 2022 COVID-19 vaccination measurement days ((a) Total, (b) Male, (c) Female).

For PCCI and DCVR correlations, as shown in Figure 2, the results found in analyzes with different vaccination rate measurement day and PCCI data calculated in different years were consistent. A positive correlation was found between PCCI and DCVR.



**Figure 2.** Spearman-R correlation coefficients (per capita city income values (2018–2020) vs. double COVID-19 vaccination percentage of cities (between 1 September 2021 and 1 February 2022 COVID-19 vaccination measurement days)) (All p values calculated for the city’s double COVID-19 vaccination percentage against per capita city income values are less than 0.0001).

#### 4. Discussion

Immunization, which is defined as a process that protects a person against a disease through vaccination, is one of the most effective ways to prevent infectious diseases and end pandemics [38]. Thanks to immunization, smallpox has been eradicated worldwide and polio has been eradicated in America [39,40]. The first vaccine produced in the world towards the end of the 1800s is the smallpox vaccine, and vaccine hesitancy/opposition started at the same time [41]. Therefore, vaccine hesitancy and refusal is as old as vaccination itself and is unlikely to disappear. In this context, we believe that the first step towards effective vaccination programs is to identify the causes and contexts that lead to vaccine hesitancy and rejection.

In this study, we tried to provide new information about COVID-19 vaccine levels, vaccine hesitations and underlying causes. Numerous studies have been published examining individuals’ attitudes towards COVID-19 vaccination and the reasons for exhibiting this attitude [23–35]. In a very large part of these studies, a limited number of people were reached online with the effect of the restrictions brought by the pandemic, and their attitudes towards vaccination were questioned through questionnaires [23–35]. We think that one of the reasons why our study has different results from other studies on this subject is that the data of the study is not the data obtained through a survey, but the data of the whole country and therefore it covers more people.

There are a lot of studies that contain data on the relationship between hesitations about vaccination and the educational status of individuals [23–35]. In most of these studies, including studies from Turkey [34], it was concluded that vaccination hesitations increased with the decrease in education level [24–26,29,30,32–34]. On the other hand, in these studies, the educational status of the participants was generally evaluated in 2, 3 or 4 categories [24,25,27–30,32,33,35]. In our study using government data, the educational status of the population over the age of 15 in the cities was evaluated in 9 different categories (illiterate, literate without a diploma, primary school, primary education, secondary school/intermediate graduate, high school graduate, college degree (universities and other higher educational institutions), master’s degree, and doctoral degree). In most of the previous studies, the categories of illiterate, primary school graduate, and secondary school graduate were handled under a single category and we think that the difference in our study is due to the more detailed categorization of educational status. Contrary to other studies, there was no positive correlation between education level and vaccination rates in

our study. While there was a negative correlation between the vaccination rates of the cities and the percentages of illiterate people, literate without a diploma, and those who graduated from secondary school, a positive correlation was found between the percentages of university graduates and the percentages of primary school graduates.

Even though secondary school graduates have had a longer education period than primary school graduates, the difference in their attitudes towards vaccination reveals that there is no positive correlation between the increase in education period and vaccination in this study. This situation makes us think that the interruption of education at some point may be another important determinant in shaping one's views on vaccination, along with the duration of education.

When we look at the relationship between per capita city income values and vaccination rates, which is another factor that we can access from the database of the Turkish Statistical Institute and which we think can guide people's behavior regarding vaccination, we found a positive relationship between PCCI values and vaccination rates. Consistent with our study, in previous studies on this subject, when the income of the participants was questioned, vaccine hesitancy/resistance was higher in those with low income, and those with high income tended to be vaccinated [25,26,28–30,33]. Those with low incomes may be resistant to vaccination or have hesitations about vaccination because they could not access sufficient information about vaccination (vaccination options—vaccine efficacy, post-vaccination complications, etc.).

Only correlations (vaccination rate vs. education level, vaccination rate vs. PCCI) were calculated. As 'correlation is not causation', for more accurate analyses, while collecting vaccination data, other characteristics of the subjects such as detailed education levels should also be questioned and added to the research datasets. In addition, the quality and content of education, conservatism, religiosity, scientific literacy level etc. are potential variables and may have affected the vaccination level of the provinces. Unfortunately, we could not reach these data because the data for the provinces are limited. Another limitation of this study is that it does not include PCCI values for 2021.

## 5. Conclusions

A systematic review of how to approach vaccine hesitancy, based in the United States, concluded that the most effective interventions to reduce vaccine hesitancy are multi-component and dialogue-based interventions [42]. Therefore, we believe that defining the characteristics of the population to be addressed in interventions based on this dialogue in detail will increase the effectiveness of the strategy to be implemented. The current study shows that the education level of the populations has an impact on their attitudes towards the COVID-19 vaccine. Although awareness raising about vaccination is made for the whole society in order to increase the percentage of vaccination, the characteristics of some special groups should be considered and more efforts should be made to raise awareness of these groups.

Sudden jumps from negative to positive (or vice versa) correlation from one education group to another deserves more research. Investigating the effect of education level on COVID-19 vaccination in other countries may have important implications for increasing COVID-19 vaccination rates.

**Author Contributions:** Conceptualization, A.R.S. and B.C.; methodology, A.R.S. and N.Y.Z.; software, A.R.S.; validation, A.R.S.; formal analysis, Ö.N.K.; investigation, B.C., Ö.N.K., N.Y.Z. and M.Ü.S.; resources, B.C., Ö.N.K., N.Y.Z. and M.Ü.S.; data curation, B.C. and Ö.N.K.; writing—original draft preparation, B.C. and N.Y.Z.; writing—review and editing, B.C.; visualization, A.R.S.; supervision, A.R.S.; project administration, A.R.S. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Ethics committee approval was not sought because publicly available government databases were used.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Republic of Turkey Ministry of Health COVID-19 Vaccine Information Platform <https://covid19asi.saglik.gov.tr> (accessed on 1 September 2022) website was accessed between 2021-September and 2022-February at 15-day intervals and city-based vaccination rates were obtained. The education level of the country over the age of 15 is obtained from the database of the Turkish Statistical Institute, <https://data.tuik.gov.tr/Search/Search?text=e%C4%9Fitim&dil=1> (accessed on 1 September 2022)—“statistical tables” tab—“Education level completed by city (15+ years old)” tab (Data for the year 2018, 2019, 2020, 2021). Per capita city income values (PCCI) is obtained from the database of Turkish Statistical Institute, <https://data.tuik.gov.tr/Bulten/Index?p=Il-Bazinda-Gayrisafi-Yurt-Ici-Hasila-2020-37188> (accessed on 1 September 2022)—“GDP per capita by province 2018-2020” tab (Data for the year 2018, 2019, 2020).

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. World Health Organization. Coronavirus Disease (COVID-19)—Overview. Available online: [https://www.who.int/health-topics/coronavirus#tab=tab\\_1](https://www.who.int/health-topics/coronavirus#tab=tab_1) (accessed on 15 September 2021).
2. WHO Director-General’s Opening Remarks at the Media Briefing on COVID-19—11 March 2020. Available online: <https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020> (accessed on 15 September 2021).
3. World Health Organization. Numbers at a Glance. Available online: [https://www.who.int/emergencies/diseases/novel-coronavirus-2019?adgroupsurvey=\{adgroupsurvey\}&gclid=Cj0KCQjw08aYBhDIARIsAA\\_gb0dMdb1bliPkaPx-ogleaqoVr\\_idM0fQ6ZAlg240DoqgPoClurrO2EAaApjMEALw\\_wcB](https://www.who.int/emergencies/diseases/novel-coronavirus-2019?adgroupsurvey=\{adgroupsurvey\}&gclid=Cj0KCQjw08aYBhDIARIsAA_gb0dMdb1bliPkaPx-ogleaqoVr_idM0fQ6ZAlg240DoqgPoClurrO2EAaApjMEALw_wcB) (accessed on 15 August 2022).
4. World Health Organization. Novel Coronavirus (COVID-19) Cases. Available online: <https://github.com/CSSEGISandData/COVID-19> (accessed on 15 August 2022).
5. Centers for Disease Control and Prevention. Benefits of Getting a COVID-19 Vaccine. Available online: <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/vaccine-benefits.html#:~:text=COVID%2D19%20vaccination%20helps%20protect,illness%20or%20post%2DCOVID%20conditions> (accessed on 15 January 2022).
6. Mayo Clinic. COVID-19 Drugs: Are There Any That Work? Available online: <https://www.mayoclinic.org/diseases-conditions/coronavirus/expert-answers/coronavirus-drugs/faq-20485627> (accessed on 7 April 2022).
7. World Health Organization. Coronavirus Disease (COVID-19): Vaccines. Available online: [https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-\(covid-19\)-vaccines?adgroupsurvey=\{adgroupsurvey\}&gclid=CjwKCAjwvNaYBhA3EiwACgndghhyvDvXXVDN0\\_ODg3Qv3s-fk57DSBzEPFS5ZhFLY4FcsIS7ABoCCR0C9rUQAvD\\_BwE](https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/coronavirus-disease-(covid-19)-vaccines?adgroupsurvey=\{adgroupsurvey\}&gclid=CjwKCAjwvNaYBhA3EiwACgndghhyvDvXXVDN0_ODg3Qv3s-fk57DSBzEPFS5ZhFLY4FcsIS7ABoCCR0C9rUQAvD_BwE) (accessed on 2 September 2022).
8. WHO COVID-19 Vaccine Tracker and Landscape. Available online: <https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines> (accessed on 5 September 2022).
9. Palacios, R.; Batista, A.P.; Albuquerque, C.S.N.; Patiño, E.G.; Santos, J.D.P.; Tilli Reis Pessoa Conde, M.; Piorelli, R.D.O.; Pereira Júnior, L.C.; Raboni, S.M.; Ramos, F.; et al. Efficacy and Safety of a COVID-19 Inactivated Vaccine in Healthcare Professionals in Brazil: The PROFISCOV Study. *SSRN Electron. J.* **2021**. [CrossRef]
10. Tanrıover, M.D.; Doğanay, H.L.; Akova, M.; Güner, H.R.; Azap, A.; Akhan, S.; Köse, Ş.; Erdinç, F.Ş.; Akalın, E.H.; Tabak, .F.; et al. Efficacy and Safety of an Inactivated Whole-Virion SARS-CoV-2 Vaccine (CoronaVac): Interim Results of a Double-Blind, Randomised, Placebo-Controlled, Phase 3 Trial in Turkey. *Lancet* **2021**, *398*, 213–222. [CrossRef]
11. Ministry of Health. The First Coronavirus Vaccine Was Given to Minister of Health Fahrettin Koca (In Turkish). Available online: <https://www.saglik.gov.tr/TR,78148/ilk-koronavirus-asisi-saglik-bakani-fahrettin-kocaya-yapildi.html> (accessed on 20 October 2021).
12. Anadolu Agency. Ministry of Health: 5 Million Doses of Sinovac Vaccine Reached Turkey Today (In Turkish). Available online: <https://www.aa.com.tr/tr/koronavirus/saglik-bakanligi-5-milyon-doz-sinovac-asisi-bugun-turkiyeye-ulasti/2279453> (accessed on 6 August 2021).
13. Ministry of Health COVID-19 Vaccine Information Platform (In Turkish). Available online: <https://covid19asi.saglik.gov.tr/TR-77706/covid-19-asisi-ulusal-uygulama-stratejisi.html> (accessed on 18 October 2021).
14. Hurriyet. It Started to Be Used for the First Time Today (In Turkish). Available online: <https://www.hurriyet.com.tr/gundem/pfizer-biontech-asisi-hakkinda-merak-edilenler-41778462> (accessed on 18 September 2021).
15. Centers for Disease Control and Prevention. Overview of COVID-19 Vaccines. Available online: [https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/overview-COVID-19-vaccines.html?CDC\\_AA\\_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fvaccines%2Fdifferent-vaccines%2FPfizer-BioNTech.html](https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/overview-COVID-19-vaccines.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fvaccines%2Fdifferent-vaccines%2FPfizer-BioNTech.html) (accessed on 2 September 2022).
16. Thomas, S.J.; Moreira, E.D., Jr.; Kitchin, N.; Absalon, J.; Gurtman, A.; Lockhart, S.; Perez, J.L.; Pérez Marc, G.; Polack, F.P.; Zerbini, C.; et al. Safety and Efficacy of the BNT162b2 mRNA COVID-19 Vaccine through 6 Months. *N. Engl. J. Med.* **2021**, *385*, 1761–1773. [CrossRef] [PubMed]

17. Anadolu Agency. Turkey OKs Emergency Use of Sputnik-V Vaccine. Available online: <https://www.aa.com.tr/en/latest-on-coronavirus-outbreak/turkey-oks-emergency-use-of-sputnik-v-vaccine/2225824> (accessed on 17 April 2022).
18. Diken Newspaper. Russian Vaccine Turned into Riddle: Ministry Is Still Silent, It Is Not Clear Why It Is Not Used (In Turkish). Available online: <https://www.diken.com.tr/sputnik-v-bilmececi-saglik-bakanligi-hala-sessiz-ttb-acikladi/> (accessed on 26 October 2021).
19. BBC. Turkovac: Emergency Use Approved for Domestic COVID Vaccine. Available online: <https://www.bbc.com/turkce/haberler-dunya-59754868> (accessed on 20 July 2021).
20. Turkish Republic Ministry of Health COVID-19 Vaccine Information Platform (In Turkish). Available online: <https://covid19asi.saglik.gov.tr> (accessed on 1 February 2022).
21. Our World in Data. Coronavirus Pandemic (COVID-19). Available online: <https://ourworldindata.org/coronavirus#coronavirus-country-profiles> (accessed on 25 August 2022).
22. World Health Organization. Tracking SARS-CoV-2 Variants. Available online: <https://www.who.int/activities/tracking-SARS-CoV-2-variants> (accessed on 14 October 2022).
23. Murphy, J.; Vallières, F.; Bentall, R.P.; Shevlin, M.; McBride, O.; Hartman, T.K.; McKay, R.; Bennett, K.; Mason, L.; Gibson-Miller, J.; et al. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nat. Commun.* **2021**, *12*, 29. [CrossRef]
24. Schwarzing, M.; Watson, V.; Arwidson, P.; Alla, F.; Luchini, L. COVID-19 Vaccine Hesitancy in a Representative Working-Age Population in France: A Survey Experiment Based on Vaccine Characteristics. *Lancet Public Health* **2021**, *6*, e210–e221. [CrossRef]
25. Nguyen, K.H.; Nguyen, K.; Corlin, L.; Allen, J.D.; Chung, M. Changes in COVID-19 Vaccination Receipt and Intention to Vaccinate by Socioeconomic Characteristics and Geographic Area, United States, January 6–March 29, 2021. *Ann. Med.* **2021**, *53*, 1419–1428. [CrossRef] [PubMed]
26. Brownstein, N.C.; Reddy, H.; Whiting, J.; Kasting, M.L.; Head, K.J.; Vadaparampil, S.T.; Giuliano, A.R.; Gwede, C.K.; Meade, C.D.; Christy, S.M. COVID-19 Vaccine Behaviors and Intentions among a National Sample of United States Adults Ages 18–45. *Prev. Med.* **2022**, *160*, 107038. [CrossRef] [PubMed]
27. Wu, J.; Li, Q.; Tarimo, C.S.; Wang, M.; Gu, J.; Wei, W.; Ma, M.; Zhao, L.; Mu, Z.; Miao, Y. COVID-19 Vaccine Hesitancy Among Chinese Population: A Large-Scale National Study. *Front. Immunol.* **2021**, *12*, 781161. [CrossRef] [PubMed]
28. Edwards, B.; Biddle, N.; Gray, M.; Sollis, K. COVID-19 Vaccine Hesitancy and Resistance: Correlates in a Nationally Representative Longitudinal Survey of the Australian Population. *PLoS ONE* **2021**, *16*, e0248892. [CrossRef]
29. Abdullah, M.; Shahait, A.D.; Qaisieh, R.; Al-Ramahi, M.; Bader, G.; AbuRajab, M.O.; Haddad, T.A.; Al-Omari, A.Y.; Issa, M.S.B.; Bader, T.; et al. Perspectives on COVID-19 Vaccines and Its Hesitancy Among Jordanian Population. *Cureus* **2022**, *14*, e26337. [CrossRef] [PubMed]
30. Khubchandani, J.; Sharma, S.; Price, J.H.; Wiblishauser, M.J.; Sharma, M.; Webb, F.J. COVID-19 Vaccination Hesitancy in the United States: A Rapid National Assessment. *J. Community Health* **2021**, *46*, 270–277. [CrossRef] [PubMed]
31. Wagner, A.L.; Wileden, L.; Shanks, T.R.; Gool, S.D.; Morenoff, J.D.; Gorin, S.N.S. Mediators of Racial Differences in COVID-19 Vaccine Acceptance and Uptake: A Cohort Study in Detroit, MI. *Vaccines* **2021**, *10*, 36. [CrossRef]
32. Khairat, S.; Zou, B.; Adler-Milstein, J. Factors and Reasons Associated with Low COVID-19 Vaccine Uptake among Highly Hesitant Communities in the US. *Am. J. Infect. Control* **2022**, *50*, 262–267. [CrossRef]
33. Latkin, C.; Dayton, L.; Miller, J.; Yi, G.; Balaban, A.; Boodram, B.; Uzzi, M.; Falade-Nwulia, O. A Longitudinal Study of Vaccine Hesitancy Attitudes and Social Influence as Predictors of COVID-19 Vaccine Uptake in the US. *Hum. Vaccines Immunother.* **2022**, *18*, 2043102. [CrossRef] [PubMed]
34. Sonmezer, M.C.; Sahin, T.K.; Erul, E.; Ceylan, F.S.; Hamurcu, M.Y.; Morova, N.; Al, I.R.; Unal, S. Knowledge, Attitudes, and Perception towards COVID-19 Vaccination among the Adult Population: A Cross-Sectional Study in Turkey. *Vaccines* **2022**, *10*, 278. [CrossRef] [PubMed]
35. Muhajarine, N.; Adeyinka, D.A.; McCutcheon, J.; Green, K.L.; Fahlman, M.; Kallio, N. COVID-19 Vaccine Hesitancy and Refusal and Associated Factors in an Adult Population in Saskatchewan, Canada: Evidence from Predictive Modelling". Editor Anat Gesser-Edelsburg. *PLoS ONE* **2021**, *16*, e0259513. [CrossRef] [PubMed]
36. The Turkish Statistical Institute Database. Available online: <https://data.tuik.gov.tr/Search/Search?text=e%C4%9Fitim&dil=1> (accessed on 1 September 2021).
37. The Turkish Statistical Institute Database. Available online: <https://data.tuik.gov.tr/Bulten/Index?p=Il-Bazinda-Gayrisafi-Yurt-ICI-Hasila-2020-37188> (accessed on 1 September 2021).
38. Randolph, H.E.; Barreiro, L.B. Herd Immunity: Understanding COVID-19. *Immunity* **2020**, *52*, 737–741. [CrossRef] [PubMed]
39. World Health Organization. Smallpox. Available online: [https://www.who.int/health-topics/smallpox#tab=tab\\_1](https://www.who.int/health-topics/smallpox#tab=tab_1) (accessed on 15 September 2021).
40. World Health Organization. Poliomyelitis. Available online: <https://www.who.int/news-room/fact-sheets/detail/poliomyelitis> (accessed on 15 September 2021).
41. Dube, E.; Vivion, M.; MacDonald, N.E. Vaccine hesitancy, vaccine refusal and the anti-vaccine movement: Influence, impact and implications. *Expert Rev. Vaccines* **2015**, *14*, 99–117. [CrossRef] [PubMed]
42. Jarrett, C.; Wilson, R.; O'Leary, M.; Eckersberger, E.; Larson, H.J.; The SAGE Working Group on Vaccine Hesitancy. Strategies for Addressing Vaccine Hesitancy—A Systematic Review. *Vaccine* **2015**, *33*, 4180–4190. [CrossRef] [PubMed]