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Associations between Socio-Demographic Characteristics and Maternal Attitudes towards Childhood Vaccination in Cyprus—A Cross-Sectional Survey

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Abstract: Background: As vaccination acceptance is dynamic, the current COVID-19 pandemic may have changed maternal perceptions towards childhood vaccination and influenced their decision to vaccinate their children. This study aimed to examine the associations between socio-demographic characteristics and maternal attitudes towards childhood vaccination at the beginning of the COVID-19 pandemic in Cyprus. Methods: A web-based cross-sectional study was conducted between April and June 2020 using a self-administered survey. Adult mothers with at least one child under the age of 18 were included in this study. Results: Overall, 703 mothers were included, with the majority of them strongly agreeing or agreeing that all vaccinations included in the National Vaccination Program should be available to children (89.3%), recognizing the usefulness of vaccines (91.4%) and their ability to provide protection (90%), acknowledging that the benefits of vaccination outweigh potential risks (86.6%), and being aware that some vaccines may cause adverse reactions (84.1%). Socio-demographic factors, particularly marital status, single-parent status, and employment status, have a significant impact on maternal attitudes and perceptions regarding childhood vaccination. Conclusions: Public health policies should be designed to overcome structural and healthcare system barriers specifically related to socio-demographic factors, ensuring effective and comprehensive strategies to improve childhood vaccination uptake.

Keywords: vaccination; vaccines; COVID-19; attitudes; mothers; socio-demographic factors; Cyprus

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1. Introduction

Childhood vaccination uptake is a growing public health concern. Especially during the COVID-19 pandemic, existing research has shown a decline in routine childhood vaccination uptake. Specifically, the uptake of vaccines against measles, mumps, rubella, tetanus, diphtheria, pertussis, polio, and pneumococcal disease dropped significantly [1]. Several factors impacted this, including the reduced access to immunization services during the pandemic [2] and parental COVID-19 infection, which caused the delay of childhood vaccination [3].

Parental vaccine hesitancy has been previously known to result in vaccination delay or avoidance, even prior to the COVID-19 pandemic [4–6]. Despite the proven efficacy and safety of vaccines, negative attitudes and concerns among parents can affect childhood vaccination uptake [7–12], with the immunization status of children often being associated with that of their parents [13]. Various factors influence parental decisions to vaccinate their children, including their socio-demographic status, parental perceptions about vaccines, their educational level, and others [8,14–19]. Public health authorities around the world should consider parental vaccine hesitancy as a possible threat to society. In the recent past,

epidemics of vaccine-preventable diseases were observed; therefore it is crucial to study parental health literacy, attitudes, and perceptions about vaccines [20].

Vaccination acceptance is a complex and variable phenomenon worldwide, necessitating country-specific research. Recent research identified Cypriots as less hesitant compared to residents of other countries [21]. However, there are concerns about potential delays in adhering to the childhood vaccination schedule in Cyprus [22]. The lack of compliance with the vaccination schedule may increase the occurrence of vaccine-preventable diseases. Unfortunately, the available literature on parental attitudes and beliefs towards childhood vaccination in Cyprus is limited. Previous research among healthcare professionals in Cyprus has indicated negative attitudes towards childhood COVID-19 vaccination [23]. This highlights the need for further investigation to better understand the specific factors that influence maternal attitudes towards childhood vaccination in Cyprus.

Given that mothers often oversee their children's vaccination schedule, this study aims to explore the associations between socio-demographic characteristics and maternal attitudes towards childhood vaccination at the beginning of the COVID-19 pandemic in Cyprus. Understanding maternal attitudes towards childhood vaccination during this period provides valuable insights into the factors that influence vaccination decision making. By examining how socio-demographic factors shape maternal attitudes, this research will offer valuable insights into the specific barriers and concerns that may affect vaccine acceptance in different groups. Additionally, this research serves as a baseline for future studies, allowing for a comparison of maternal attitudes towards childhood vaccination before and after the COVID-19 pandemic. Ultimately, the findings will contribute to the development of effective public health strategies tailored to specific socio-demographic contexts in Cyprus, with the goal of improving childhood vaccination rates and preventing vaccine-preventable diseases.

2. Materials and Methods

2.1. Study Design, and Sampling

This was a web-based cross-sectional survey conducted from 4 April to 8 June 2020. The study population comprised mothers aged 18 and above, residing in the five government-controlled municipalities of the Republic of Cyprus (Nicosia, Limassol, Larnaca, Paphos, and Ammochostos), and having at least one minor child below the age of 18. Mothers who had only adult children have been excluded. The self-administered questionnaire was created using Google Forms. Participants were recruited through various channels, including instant messaging apps (e.g., WhatsApp, Viper), social media platforms (e.g., Facebook, Instagram), and professional networking sites (e.g., LinkedIn). These recruitment methods were employed to gather a sample that would be representative of all regions in Cyprus. During the data collection period, which coincided with the COVID-19 pandemic and associated quarantine restrictions, a convenience sampling approach was necessary due to the limited sampling options available. Despite the non-probabilistic nature of this sampling method, deliberate efforts were made to include participants from various age groups and socio-economic backgrounds. The goal was to obtain a reasonably representative sample of the adult female Cypriot population, considering the challenges posed by the pandemic and the restrictions in place during the data collection period. Further details regarding the sampling procedure are provided elsewhere [24]. This study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology [25].

2.2. Survey Instrument

The data collection process involved the use of a self-administered questionnaire that was designed to be anonymous. No personally identifiable information was collected from the participants to ensure their privacy and confidentiality. The first section instigated the maternal socio-demographic characteristics and children's characteristics. The age of mothers and children was reported in years. Gender of children was recorded as male or female. City of residency was categorized based on the five government-controlled municipalities

of Cyprus, while residency was reported as residents of urban and rural regions. Marital status was recorded as single, married/in cohabitation, divorced/separated/widowed, and participants' single-parent status was reported by a yes or no question. Educational attainment was categorized as primary education, secondary education, and higher education (undergraduate or postgraduate). Employment status was recorded as unemployed, private employee, state employee, and freelancer. Income status was evaluated using the monthly income categorized as: (i) no income, (ii) low (less or equal to EUR 1500), (iii) moderate (EUR 1501–2500), and (iv) high (more than EUR 2500) income. The second section used 14 Likert-scale questions on a five-point rating scale to assess maternal attitudes and beliefs towards childhood vaccination (1 = absolutely disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, and 5 = absolutely agree). Before the study began, 50 mothers pilot assessed the survey for face validity and comprehensibility. The Cronbach's α-value for internal reliability for the second section was 0.93. A 12-item scale was used to assess participants' general knowledge of vaccination, but these analyses have been published elsewhere [24].

2.3. Statistical Analysis

The Shapiro–Wilk test was used to determine the normality of numeric data based on the skewness of the distribution. Maternal and children's baseline characteristics are presented as median (1st quartile: q_1, 3rd quartile: q_3) for continuous measures with skewed distributions, while categorical data were presented as absolute (n) and relative (%) frequencies.

Pearson's chi-square test was applied to detect any differences between each vaccine's attitude question and the categorical baseline characteristics. Kruskal–Wallis rank tests were employed to identify any differences between each vaccine's attitude question and non-normally continuous characteristics. Multiple logistic regression models were used to examine the association of each attitude item (categorical dependent variables) with the socio-demographic maternal characteristics. All attitude items were modeled as binary variables. To address the issue of multiple comparisons, the Bonferroni correction test was applied. The statistical significance level for all two-sided statistical hypotheses was set at $\alpha = 0.05$. STATA 14.0 statistical software (Stata Corp, College Station, TX, USA) and Microsoft Excel 2013 were used for statistical analysis.

2.4. Ethics

The Cyprus National Bioethics Committee (CNBC) approved the study protocol (EEBK ΕΠ 2020.01.82). The application, together with the required study instrument, was submitted to CNBC and detailed the study objectives and outcomes and the study methodology.

3. Results

3.1. Participants' Characteristics

The web-based study involved the participation of 703 mothers in Cyprus. The median age of the mothers was 35 years old ($q_1 = 32$, $q^3 = 39$). Approximately 51% of the participants resided in Nicosia, the capital of Cyprus; 93.6% were married; 90.8% had completed higher education; and around 42% were classified as having a high average salary (>EUR 2500 per month). Single-parent families accounted for 8.3% of the participants. In total, the study included information on 1218 children, with 51.3% being males. The median number of children in the household was 2, and the median age of the children was 5 years old (q1 = 2, q3 = 9) (Table 1).

Table 1. Socio-demographic characteristics of mothers and their children.

Socio-Demographic Characteristics	Overall (N = 703)
Median age of mothers, [years (IQR)] [a]	35 (32–39)
Gender of children, [N (%)] [b]	
Male	611 (51.3)
Female	580 (48.7)
Median age of children, [years (IQR)] [c]	5 (2–9)
City of residency, [N (%)] [d]	
Nicosia	356 (50.9)
Limassol	184 (26.3)
Larnaca	106 (15.1)
Paphos	31 (4.5)
Ammochostos	23 (3.3)
Region of residency, [N (%)] [e]	
Urban	540 (80.8)
Rural	128 (19.2)
Marital status of mother, [N (%)] [f]	
Single	18 (2.6)
Married/in cohabitation	658 (93.6)
Divorced/separated/widowed	27 (3.8)
Single-parent family, [N (%)] [d]	
Yes	642 (91.7)
No	58 (8.3)
Education level of mother, [N (%)] [e]	
Primary	-
Secondary	65 (9.2)
Higher	639 (90.8)
Employment status of mother, [N (%)] [g]	
Unemployed	74 (10.6)
State employee	172 (24.6)
Private employee	390 (55.9)
Freelance	62 (8.9)
Income status of mother, [N (%)] [h]	
None	23 (3.1)
Low	163 (23.2)
Medium	225 (32.1)
High	292 (41.6)

Abbreviations: IQR, interquartile range; [a] N = 699; [b] N = 1191 (total number of children who were reported by their mothers); [c] N = 1218; [d] N = 700; [e] N = 668; [f] N = 703; [g] N = 698; [h] N = 702.

3.2. Attitudes and Beliefs towards Childhood Vaccination

The majority of mothers strongly agreed or agreed that all vaccinations of the National Vaccination Program (NVP) should be available to children (89.3%), expressed confidence in the safety of vaccines (53.1%), believed that vaccines protect children from serious and potentially fatal diseases (90.1%), held the perception that vaccines always provide protection to children (56.1%), acknowledged that some vaccines may cause adverse reactions (84.1%), recognized that the benefits of vaccination outweigh the potential risks (86.6%), and found vaccines to be useful (91.4%). Conversely, most of the mothers strongly disagreed or disagreed with the notion that a large number of vaccines can have a negative impact on children's immune systems (55.7%), expressed disagreement with the idea that children should be vaccinated as soon as a new vaccine is available (51.9%), and firmly rejected the belief that natural childhood illness is preferable to vaccination (67.4%). Additionally, nearly half of the mothers held a neutral stance on the safety and effectiveness of new vaccines (47.4%), as well as whether some vaccines are manufactured for commercial interests (46.3%) (Supplementary Figure S1).

3.3. Socio-Demographic Characteristics and Attitudes towards Childhood Vaccination

We discovered two statistically significant associations for the attitudes "Large number of vaccines can have a negative impact on children's immune system" (p = 0.03) and "Natural disease is preferable to vaccination" (p < 0.01) (Supplementary Table S1). We also reported that employment and income status were significant socio-demographic indicators for most of the attitudes (Supplementary Table S2). Moreover, we observed statistically significant associations between the age of the mother (p = 0.02) and the age of the children (p = 0.01) with the statement that all vaccinations provided by the NVP should be available to children (Supplementary Table S3). Regarding the association of vaccination attitudes with geographical region and area of residence, we found statistically significant differences between many statements (Supplementary Table S4).

When compared to private employees, freelancers had a lower probability of absolutely agreeing/agreeing that all vaccinations provided by the NVP must be offered to children (Table 2, Model 1). Similarly, compared to private employees, unemployed mothers had a lower probability of absolutely agreeing/agreeing that vaccines protect children from serious and potentially fatal diseases (Table 2, Model 3). We discovered statistically significant associations for age, married/in cohabitation, and no single parent when we modeled the attitude "Some vaccines may cause adverse reactions" with socio-demographic factors as independent variables (Table 2, Model 6). Furthermore, compared to single mothers, no single-parent families were 3.28 times more likely to absolutely disagree/agree that children should be vaccinated as soon as a new vaccine is available (Table 2, Model 10). Finally, we discovered that married, freelance, and unemployed mothers had a lower probability of absolutely agreeing/agreeing to believe in the usefulness of vaccines when compared to single mothers and mothers who work in the private sector, respectively (Table 2, Model 12).

Table 2. Multiple logistic regression models for the association between mothers' attitudes and childhood vaccination.

	Model 1 [OR (95% C.I)]	**Model 2 [OR (95% C.I)]**	**Model 3 [OR (95% C.I)]**	**Model 4 [OR (95% C.I)]**	**Model 5 [OR (95% C.I)]**	**Model 6 [OR (95% C.I)]**	**Model 7 [OR (95% C.I)]**
Age of mothers	0.98 (0.94, 1.03)	1.01 (0.98, 1.04)	1.00 (0.95, 1.05)	1.01 (0.98, 1.04)	1.02 (0.99, 1.05)	**0.96 (0.92, 1.00)**	1.02 (1.00, 1.05)
Marital status of mother							
Single	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Married/in cohabitation	0.23 (0.04, 1.43)	0.48 (0.14. 1.65)	0.08 (0.01, 0.53)	0.27 (0.08, 0.99)	0.46 (0.14. 1.57)	**10.2 (1.33, 78.6)**	1.10 (0.31, 3.91)
Divorced/separated/widowed	0.32 (0.05, 2.01)	0.80 (0.22. 2.87)	0.37 (0.06, 2.46)	0.92 (0.26, 3.27)	1.01 (0.28, 3.69)	0.40 (0.04, 3.91)	1.37 (0.37, 5.03)
Education level of mother							
Secondary	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Higher	1.57 (0.76, 3.27)	0.94 (0.53, 1.68)	1.56 (0.73, 3.33)	1.07 (0.60, 1.89)	1.35 (0.77, 2.38)	0.82 (0.35, 1.88)	1.27 (0.71, 2.29)
Single-parent family							
Yes	Ref	Ref	Ref	Ref	Ref	Ref	Ref
No	0.41 (0.13, 1.34)	0.50 (0.19, 1.37)	0.12 (0.04, 0.36)	0.39 (0.14, 1.12)	0.64 (0.25, 1.65)	**27.11 (1.80, 407.6)**	0.96 (0.37, 2.53)
Employment status of mother							
Private employee	Ref	Ref	Ref	Ref	Ref	Ref	Ref
State employee	0.87 (0.44, 1.72)	1.10 (0.75, 1.61)	0.97 (0.47, 2.02)	0.94 (0.65, 1.37)	0.65 (0.45, 0.95)	0.91 (0.55, 1.49)	0.88 (0.60, 1.28)
Freelance	**0.41 (0.18, 0.90)**	0.75 (0.43, 1.30)	0.53 (0.22, 1.28)	0.65 (0.37, 1.15)	0.75 (0.43, 1.30)	1.12 (0.51, 2.45)	0.84 (0.49, 1.47)
Unemployed	0.36 (0.17, 0.78)	0.60 (0.32, 1.14)	**0.38 (0.17, 0.86)**	0.80 (0.43, 1.48)	0.74 (0.40, 1.35)	1.04 (0.44, 2.48)	0.74 (0.40, 1.39)
Income status of mother							
None	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Low	0.36 (0.09, 1.47)	0.92 (0.31, 2.72)	0.63 (0.18, 2.24)	0.76 (0.27, 2.11)	0.94 (0.34, 2.58)	0.63 (0.16, 2.46)	1.27 (0.42, 3.85)
Medium	0.47 (0.11, 2.01)	1.52 (0.51, 4.52)	1.17 (0.31, 4.42)	0.86 (0.30, 2.44)	0.93 (0.33, 2.60)	0.82 (0.20, 3.36)	1.54 (0.50, 4.72)
High	1.23 (0.27, 5.59)	2.20 (0.73, 6.60)	1.95 (0.49, 7.79)	0.87 (0.30, 2.50)	1.03 (0.36, 2.90)	2.81 (0.61, 12.88)	1.84 (0.60, 5.67)
	Model 8 [OR (95% C.I)]	**Model 9 [OR (95% C.I)]**	**Model 10 [OR (95% C.I)]**	**Model 11 [OR (95% C.I)]**	**Model 12 [OR (95% C.I)]**	**Model 13 [OR (95% C.I)]**	**Model 14 [OR (95% C.I)]**
Age of mothers	1.02 (0.98, 1.07)	0.99 (0.96, 1.02)	0.95 (0.92, 0.98)	1.06 (1.03, 1.10)	0.96 (0.91, 1.01)	0.98 (0.95, 1.01)	1.03 (1.00, 1.06)
Marital status of mother							
Single	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Married/in cohabitation	0.31 (0.07, 1.49)	2.00 (0.56, 7.17)	3.59 (0.99, 13.07)	0.69 (0.15, 3.16)	**0.06 (0.01, 0.65)**	0.57 (0.16, 1.98)	1.32 (0.37, 4.67)
Divorced/separated/widowed	0.64 (0.12, 3.45)	3.03 (0.79, 11.58)	1.75 (0.48, 6.44)	0.66 (0.15, 2.95)	0.22 (0.02, 2.33)	1.22 (0.33, 4.41)	3.00 (0.78, 11.55)
Education level of mother							
Secondary	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Higher	1.12 (0.54, 2.33)	1.27 (0.71, 2.26)	1.32 (0.74, 2.37)	1.60 (0.75, 3.43)	1.82 (0.83, 3.96)	0.95 (0.53, 1.71)	1.25 (0.70, 2.26)

Table 2. *Cont.*

	Model 8 [OR (95% C.I)]	Model 9 [OR (95% C.I)]	Model 10 [OR (95% C.I)]	Model 11 [OR (95% C.I)]	Model 12 [OR (95% C.I)]	Model 13 [OR (95% C.I)]	Model 14 [OR (95% C.I)]
Single-parent family							
Yes	Ref	Ref	Ref	Ref	Ref	Ref	Ref
No	0.38 (0.13, 1.10)	0.78 (0.30, 2.01)	**3.28 (1.10, 9.83)**	1.01 (0.32, 3.21)	0.17 (0.06, 0.55)	0.64 (0.23, 1.76)	0.41 (0.16, 1.08)
Employment status of mother							
Private employee	Ref	Ref	Ref	Ref	Ref	Ref	Ref
State employee	0.68 (0.38, 1.22)	1.09 (0.75, 1.61)	1.32 (0.90, 1.92)	1.28 (0.85, 1.92)	0.76 (0.36, 1.61)	1.12 (0.75, 1.67)	0.89 (0.58, 1.35)
Freelance	0.47 (0.22, 1.01)	0.98 (0.56, 1.72)	2.68 (1.47, 4.87)	0.80 (0.42, 1.53)	**0.38 (0.15, 0.93)**	0.93 (0.51, 1.69)	0.96 (0.52, 1.77)
Unemployed	0.40 (0.19, 0.84)	0.89 (0.48, 1.65)	1.85 (0.98, 3.47)	0.46 (0.19, 1.11)	**0.37 (0.16, 0.87)**	1.18 (0.63, 2.20)	0.56 (0.29, 1.03)
Income status of mother							
None	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Low	0.47 (0.13, 1.68)	1.76 (0.61, 5.09)	1.65 (0.58, 4.69)	0.51 (0.13, 2.00)	0.55 (0.10, 3.02)	1.29 (0.45, 3.68)	1.19 (0.42, 3.33)
Medium	0.53 (0.14, 1.97)	2.08 (0.70, 6.12)	1.71 (0.59, 4.96)	0.63 (0.16, 2.49)	0.52 (0.09, 2.89)	1.09 (0.37, 3.17)	1.58 (0.55, 4.53)
High	1.29 (0.33, 5.01)	3.25 (1.09, 9.66)	1.32 (0.45, 3.86)	0.69 (0.17, 2.75)	0.61 (0.11, 3.46)	0.80 (0.27, 2.36)	2.34 (0.80, 6.80)

Abbreviations: OR, odds ratio; CI, confidence interval; Model 1: attitude "All vaccinations provided by the National Vaccination Program must be offered to our children" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 2: attitude "All vaccines are safe" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 3: attitude "Vaccines protect children from serious and potentially fatal diseases" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 4: attitude "Vaccination in childhood protects for a lifetime" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 5: attitude "Vaccines always provide protection to children" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 6: attitude "Some vaccines may cause adverse reactions" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 7: attitude "Vaccines can cause long-term problems in children" (absolutely disagree/disagree vs. absolutely agree/agree/disagree or neither disagree nor agree); Model 8: attitude "The benefits of vaccination outweigh the potential risks" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 9: attitude "Large number of vaccines can have a negative impact on children's immune system" (absolutely disagree/disagree vs. absolutely agree/agree/disagree or neither disagree nor agree); Model 10: attitude "Children should be vaccinated as soon as a new vaccine is available" (absolutely disagree/disagree vs. absolutely agree/agree/disagree or neither disagree nor agree); Model 11: attitude "I doubt the safety and effectiveness of new vaccines" (absolutely disagree/disagree vs. absolutely agree/agree/disagree or neither disagree nor agree); Model 12: attitude "I believe in the usefulness of vaccines" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 13: attitude "Some vaccines are made for commercial purposes" (absolutely agree/agree vs. absolutely disagree/disagree/disagree or neither disagree nor agree); Model 14: attitude "Natural disease is preferable to vaccination" (absolutely disagree/disagree vs. absolutely agree/agree/disagree or neither disagree nor agree); bold font indicates statistical significance; Bonferroni correction was applied.

4. Discussion

The current investigation represents the first attempt to assess maternal attitudes and beliefs towards childhood vaccination in Cyprus. Our findings revealed an overall positive attitude towards children's access to all vaccinations provided by the NVP (89.3%), belief in vaccine-mediated protection from serious and potentially fatal diseases (90.1%), awareness of possible adverse reactions from some vaccines (84.1%), acknowledgment that the benefits of vaccination outweigh the potential risks (86.6%), and recognition of the usefulness of vaccines (91.4%). Socio-demographic factors, particularly marital status, single-parent status, and employment status were found to have a significant impact on maternal attitudes and perceptions regarding childhood vaccination.

According to the findings of our study, the majority of mothers believed that all vaccinations recommended by the NVP should be given to their children, a finding that is consistent with another study in Greece [26]. Moreover, we found that mothers in Cyprus do not think natural childhood illness is preferable to vaccination, which is in agreement with another study that examined vaccine hesitancy in the United Arab Emirates [27]. On the other hand, our results revealed that mothers disagreed that a large number of vaccines can have a negative impact on children's immune systems, a finding that is in contrast with a study in Saudi Arabia, in which 37% of participants believed that vaccines at the same time have no effects on the immune systems of children [28]. A strong relationship between neutral and negative vaccination attitudes has been associated with vaccination omission in the literature [29–31]. The current study identified neutral attitudes towards vaccination safety and effectiveness, long-term vaccination-related problems, vaccination with new vaccines, and vaccine commercial profiteering. It is possible to hypothesize that parents

with neutral attitudes are more likely to change their perceptions; hence, targeting those could influence vaccination coverage in Cyprus. Neutral parental attitudes may change towards positive or negative attitudes after, so public health authorities should intervene using appropriate interventions to affirm that parental attitudes change to desire direction.

We reported that single mothers were more likely to have unfavorable attitudes towards childhood vaccinations. This finding was similar to a study in the United Arab Emirates that investigated the beliefs and attitudes of parents about childhood vaccination [27], in contrast to a study in Malaysia where single parents were more likely to vaccinate their children [32]. Apart from this, we found that mothers who completed only secondary education had significantly more prevalent unfavorable vaccination attitudes, which is in disagreement with a study in Israel that identified parents with a low educational level as less vaccine hesitant [33]. On the other hand, that finding is in agreement with a study that identified a lower vaccination acceptance among lower-educated mothers [34]. Furthermore, we reported that unfavorable attitudes about childhood vaccination were more prevalent among mothers with low or no income. Similarly, as before, this finding was in contrast with the study that examined the parents' perceptions of childhood immunization in Israel, where higher compliance rates about vaccination were reported among those with an average level of income [33].

While we reported some associations between educational level, income status, and age with mothers' attitudes about childhood vaccination, these findings should be interpreted cautiously due to their lack of statistical significance. Previous studies have shown that a mother's education significantly impacts vaccination status, with those who have completed higher education exhibiting greater vaccination awareness and a higher likelihood of fully vaccinating their children [35–37]. Although our study did not find a statistically significant association between educational level and mothers' attitudes about childhood vaccination, it is worth noting that higher education in mothers was associated with more positive vaccination attitudes [38,39]. Similarly, our study did not reveal a statistically significant association between income status and mothers' attitudes towards childhood vaccination. However, it is important to highlight that our study did not find trends among income status categories regarding mothers' attitudes, which were included in the study. In contrast to our findings, numerous studies have shown that pediatric vaccination coverage is low in middle-income countries, highlighting the significant influence of income status as a determinant of vaccination attitudes, uptake, and knowledge, with mothers who have low or no income often displaying negative attitudes toward vaccination [40–43]. Furthermore, although previous studies have reported that a mother's age affects her attitudes related to childhood vaccination [31,44,45], our study did not find a statistically significant association between the age of the mother and the majority of attitudes included in the study.

This study has some limitations that should be acknowledged. This was a cross-sectional study and was limited by non-random, online sampling that limits our study's representativeness. Furthermore, because the data were gathered through self-reported surveys, there is a risk of misreporting and recall bias. The latter, on the other hand, is less of an issue because it is inherent in all sorts of attitude evaluation studies. In addition, causal inferences cannot be drawn due to the study design. Lastly, beliefs and attitudes were measured after vaccination; hence, some of these may have been influenced by the vaccination experiences.

Several implications arose from the current study that could impact future public health strategies in Cyprus. We noted that mothers possess a heterogeneous population of humans with different attitudes and perceptions towards childhood vaccination. The identified influential factors may help the government authorities understand the determinants of vaccine hesitancy among mothers in Cyprus. It is well established that public health maintenance requires specific interventions to achieve higher vaccination compliance. Targeting groups of mothers based on their socio-demographic and economic characteristics may help them attain those levels. A lack of trust in new vaccines was observed in our study,

raising intriguing questions regarding the nature and extent of vaccine hesitancy. Previous research in Italy, even before the COVID-19 pandemic, identified hesitation towards new vaccines [46], and a study in England revealed parental preference for new vaccines to be given separately [47]. New vaccine trust may be influenced by trust in medical providers and government authorities, while previous experience and disease severity could affect new vaccine acceptance [47,48]. During and after the COVID-19 pandemic, parental attitudes towards new vaccines may have been influenced by heightened uncertainty, resulting in neutral attitudes towards them [26]. In our research, only 7% were positive about the vaccination of their children after the release of new vaccines. Our study's low levels of new vaccine acceptance raise questions about future vaccination uptake, such as the COVID-19 vaccine. It is therefore suggested that a follow-up study concentrating on new vaccination trust among mothers in Cyprus be conducted.

5. Conclusions

Our findings provide valuable insights into the associations between socio-demographic characteristics and maternal attitudes towards childhood vaccination observed during the early stages of the COVID-19 pandemic in Cyprus. This study revealed that many Cypriot mothers hold positive attitudes towards childhood vaccination, and specific socio-demographic factors such as marital status, single-parent status, and employment status were identified as important determinants of maternal attitudes regarding childhood vaccination. These insights can inform public health decision-makers in developing targeted interventions that address specific barriers and concerns, aiming to enhance mothers' knowledge, awareness, and acceptance of vaccinations. Furthermore, public health policies should be designed to overcome structural and healthcare system barriers specifically related to socio-demographic factors, ensuring effective and comprehensive strategies to improve childhood vaccination uptake.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/covid3070076/s1, Figure S1. Maternal responses to questions about vaccination attitudes and beliefs. Table S1. Maternal responses to questions about vaccination attitudes by marital status, educational attainment, and single-parent status. Table S2. Maternal responses to questions about vaccination attitudes by employment and income status. Table S3. Maternal responses to questions about vaccination attitudes by age of mother and their child/children. Table S4. Maternal responses to questions about vaccination attitudes by geographical region and area of residence.

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