



FACTORS ASSOCIATED WITH THE NON-COMPLIANCE OF THE CHILD VACCINATION OF DIPHTHERIA, PERTUSSIS AND TETANUS IN PERU, 2019

FACTORES ASOCIADOS AL INCUMPLIMIENTO DE LA VACUNACIÓN INFANTIL DE DIFTERIA, PERTUSSIS Y TÉTANOS EN PERÚ, AÑO 2019

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ABSTRACT

Introduction: Pertussis tetanus and diphtheria, (DPT) are highly contagious diseases in children; worldwide vaccination schemes have been established for the prevention of these pathologies. However, different factors can lead to non-compliance with them. **Objective:** To determine the factors associated with non-compliance with the vaccination schedule against diphtheria, pertussis and tetanus (DPT) in Peru in 2019. **Methods:** Analytical, retrospective study of secondary source based on data from 7 187 mothers between 15 and 49 years old regarding the vaccination schedule of their children older than six months of age obtained in the Demographic and Family Health Survey (ENDES) Peru 2019. The vaccination schedule of children over six months of age and the sociodemographic variables of the mothers were analyzed. A bivariate and multivariate analysis was performed using the chi square test for independence ($p < 0,050$). **Results:** The sample included in the study was 7 187 mothers surveyed regarding the vaccination schedule for their children older than six months of age. The variables associated with the incomplete scheme by multivariate analysis were: low educational level (RPa: 1,19; 95% CI: 1,02-1,40), not having health insurance (RPa: 1,41; 95% CI: 1,23-1,60), wealth index poor (RPa:1,19; CI95%: 1,02-1,40), age of the mother under 20 years (PR:2,63; CI95%:2,06-3,35) and having two or more children (PRa:1,36; CI95%:1,19 -1,57). **Conclusion:** The index factors of wealth, mother's age, low educational level, not having health insurance and having more than two children are associated with non-compliance with the DPT vaccination schedule.

Keywords. Diphtheria-Tetanus-Pertussis Vaccine; Immunization; Public health; Breach. (Source: MeSH - NLM).

RESUMEN

Introducción: La pertussis, el tétanos y la difteria (DPT) son enfermedades altamente contagiosas en edades pediátricas; para la prevención de estas patologías se han establecido esquemas de vacunación a nivel mundial. Sin embargo, distintos factores pueden llevar al incumplimiento de los mismos. **Objetivo:** Determinar los factores asociados al incumplimiento del esquema de vacunación contra (DPT) en Perú en 2019. **Métodos.** Estudio analítico, retrospectivo de fuente secundaria basado en los datos de 7 187 madres entre 15 a 49 años respecto al esquema de vacunación de sus hijos mayores de seis meses de edad obtenidos en la Encuesta Demográfica y de Salud Familiar (ENDES) de Perú de 2019. Se analizó el esquema de vacunación de los hijos mayores de seis meses de edad y las variables sociodemográficas de las madres. Se hizo un análisis bivariado y multivariado por medio de la prueba de chi cuadrado de independencia ($p < 0,050$). **Resultados:** La muestra incluida en el estudio fue de 7 187 madres encuestadas respecto al esquema de vacunación de sus hijos mayores de seis meses de edad. Las variables asociadas al esquema incompleto por análisis multivariado fueron nivel educativo bajo (RPa:1,19; IC95%: 1,02-1,40), no tener seguro de salud (RPa: 1,41; IC95%: 1,23-1,60), índice de riqueza pobre (RPa:1,21; IC95%: 1,05-1,39), edad de la madre menor de 20 años (RP:2,63; IC95%:2,06-3,35) y tener dos o más hijos (RPa:1,36; IC95%:1,19-1,57). **Conclusión:** Los factores índices de riqueza, edad de la madre, nivel educativo bajo, no tener un seguro de salud y tener más de dos hijos están asociados a un incumplimiento en el esquema de vacunación de la DPT.

Palabras clave: Vacuna DPT; Inmunización; Salud Pública; Incumplimiento. (Fuente: DeCS BIREME).

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INTRODUCTION

Pertussis is a highly contagious acute respiratory disease; Every 3 to 5 years, there are outbreaks of this disease⁽¹⁾. In the United States, 15,609 new cases were reported in 2018⁽²⁾. Tetanus, a disease caused by the *Clostridium tetani*, is highly fatal; In 2016, it presented an incidence rate of 0.01 per 100,000 inhabitants in the United States^(3,4).

Likewise, diphtheria is an acute transmissible infectious disease caused by toxigenic strains of *Corynebacterium diphtheriae*. Although the incidence of diphtheria cases/has been decreasing year after year^(4,5) in October 2020, new cases of this disease were reported in Peru after almost twenty years of absence⁽⁶⁾. This regrowth also occurred in Paraguay, Venezuela, the Dominican Republic, and Haiti⁽⁷⁾. Currently, the prevention of these three pathologies occurs with global and national vaccination schemes⁽⁸⁾, contemplating three doses of the DPT vaccine at two, four, and six months of age in children under one year of age⁽⁹⁾.

One of the pillars for the eradication and control of diseases is to ensure adequate vaccine coverage; Compliance with the DPT vaccination schedule must be guaranteed at no less than 85%^(10,11). Unfortunately, this compliance is hampered by different sociodemographic, economic, and environmental factors.

Increasingly non-compliance with vaccination schedules that include more than one dose is observed in countries such as the United States, Canada, the Netherlands, and Mexico⁽¹²⁻¹⁴⁾ where it is described that the number of children who comply with the first dose is between 80 to 89%⁽¹²⁻¹⁵⁾, while for the following doses compliance tends to decrease between 10 to 15%^(12,13), in additional factors such as children born in rural areas, parents with a lower educational level or type of economic condition⁽¹³⁾ that would make this goal of complying with the vaccination schedule difficult year after year.

One of the pillars for eradicating and controlling diseases is to ensure adequate vaccine coverage, where compliance with the DPT vaccination schedule must be guaranteed at no less than 85%^(10,11). Unfortunately, compliance with the vaccination schedule is hampered by sociodemographic, economic, and environmental factors.

In Peru, according to data from the Ministry of Health (MINSA), through a teleconference held on January 11, 2019, it was found that national coverage of DPT was 78.5% in 2014; in 2015, 87.6%; in 2016, 88.6%; in 2017,

82.3% and for the year 2018 this was reduced to 81.2%⁽¹⁶⁾ with an expected coverage goal of 85.5%⁽⁸⁾; while in samples carried out in micro-networks of Lima, as is the case of the district of San Martín de Porres, it is observed that the coverage was 58.6%⁽¹⁷⁾.

The factors that are associated with non-compliance with vaccination have been described in international studies, but very few have focused on determining whether the economic status and the implications of this at the social level are determining factors in complying with an adequate vaccination schedule. Therefore, it is necessary to carry out studies that allow knowing in greater detail the situation of compliance with the DPT vaccination scheme and the factors that are associated with it, as it is an immunization strategy that avoids the complications of three such relevant and deadly diseases^(1,3,5).

Socially, compliance with this health strategy impacts children since they will have better development and growth. However, the most important impact is observed in reducing the infant mortality rate, one of the priorities established by the United Nations (UN) for 2030⁽¹⁰⁾.

Above, the objective of this research was to determine the factors associated with non-compliance with the DPT vaccination schedule in Peru in 2019.

METHODS

Design

An observational, analytical, retrospective secondary source study based on the (ENDES) of the year 2019, carried out by the National Institute of Statistics and Informatics of Peru (INEI). It is a balanced, stratified, self-weighted, and independent two-stage complex probabilistic sampling population survey for the departmental level and by urban/rural area. The database is freely available (<http://inei.inei.gob.pe/microdatos/>).

Population and sample size

Information from the ENDES of 7,187 women between the ages of 15 and 49 who had children were used, including questions on demographic and social characteristics and the immunization status of their children.

Variables and instruments

Dependent or child variable The dependent variables were: first, second, and third dose vaccine against (DPT); The responses that were in the survey were recorded as "vaccinated" as vaccinated with the date on the card,

vaccinated without date on the card, vaccinated reported by the mother. The "unvaccinated" were obtained from the response with the same name. Any answer that used "I don't know" was invalidated. The estimate of coverage was accepted according to information obtained from the vaccination card or the maternal report.

Variables related to the mother

The independent variables were: age of the mother, distributed in ranges of five years, then, for the inferential analysis, it was dichotomized with a cut-off of 20 years based on published bibliography; mother's highest educational level: no education, primary, secondary, higher; wealth index: richest, richest, average, poorest, poorest, for the analysis it was grouped into two categories: "poor and very poor" and "middle and rich"; health insurance; type of place of residence: urban, rural.

Several modules from the ENDES database were used, corresponding to different parts of the survey, such as:

1. RECHo: contains information from the Household Questionnaire, where the variables related to the type of place of residence were taken.
2. REC0111: contains information on basic data on women aged 15 to 49, from the women's questionnaire. From there, the variables related to the mother's age, level of education, wealth index and health insurance were taken; in addition, it presents the weighting factor. Any woman who was the mother of one or more children was included.
3. REC43: contains information regarding the immunization of the children of the mothers surveyed, this module codes each child with respect to his mother; All children born alive over 6 months of age were included.

Procedures

The respective modules were unified in the SPSS program to obtain results. The variables analyzed were the vaccination of children over 6 months of age, as well as the sociodemographic characteristics of the mothers surveyed.

Statistical analysis

Categorical variables were estimated in relative frequencies and percentages. Likewise, compliance with the DPT vaccine schedule (first, second and third booster doses) was estimated at the national level and according to sociodemographic characteristics.

The data collected was organized in a database (SPSS)

according to each variable considered. In the descriptive analysis, the qualitative variables were expressed using absolute frequencies and percentages. The bivariate and multivariate analysis was performed between the sociodemographic characteristics of the mothers and the compliance with the vaccination schedule of their children, with a $p < 0.05$ as statistically significant. The Chi square test of independence was used. As a measure for evaluating the prevalence factors, the prevalence ratio (PR) with a 95% confidence interval was used. The CSPLAN analysis was elaborated in SPSS version 26 for complex samples according to the sample design. In addition, the weighting factor values that were added in the REC111 module were used. This was carried out by creating a new variable where this factor was divided by one million and subsequently applied to the database.

Ethical aspects

The ENDES databases are publicly accessible, and the confidentiality of the participants is respected. This work was approved by the Biomedical Sciences Research Institute (INICIB) and the ethics committee of the Faculty of Human Medicine of the Ricardo Palma University, Committee Code: PG-35-2020.

RESULTS

The population was 7187 mothers with children older than six months of age. Each mother of these children provided relevant sociodemographic information and reported the children's vaccination status. Table 1 shows the general characteristics of the study population. It can be seen that, of a total of 7,187 women surveyed, 83.9% (6 029) were between 20 and 39 years old.

In relation to their education, women "without education" or with "only primary" were 19.7% (1 416). 73.7% (5 299) lived in an urban area and 26.3% (1 888) in a rural area. In addition, 49.7% (3 571) belonged to the poor and poorer economy range. The majority of women had health insurance, represented by a percentage of 76.2% (5 477). However, 23.8% (1 710) did not have insurance. 29.9% (2 150) had only one child, while 71.1% (5 037) had two or more children.



Table 1. Descriptive analysis of the mothers surveyed and the DPT vaccination status of their children according to ENDES 2019.

Variable	Frequency (n=7187)	Percentage
Age		
15-19 years	345	4.8
20-24 years	1 398	19.5
25 -29 years old	1 670	23.2
30-34 years old	1 661	23.1
35-39 years old	1 300	18.1
40-44 years old	684	9.0
45-49 years old	129	1.8
Total	7 187	100.0
Type of education		
No education or only primary	1 416	19.7
Secondary or higher	5 771	80.3
Total	7 187	100.0
Type of place of residence		
rural	1 888	26.3
urban	5 299	73.7
Total	7 187	100.0
Type of economy		
poor	1 795	25.0
Poorest	1 776	24.7
medium	1 408	19.6
rich	1 199	16.7
richest	1 008	14.0
Total	7 187	100.0
Has health insurance		
Does not have insurance	1 710	23.8
Has insurance	5 477	76.2
Total	7 187	100.0
Number of children		
One single child	2 150	29.9
Two or more children	5 037	71.1
Total	7 187	100,0
DPT vaccination status		
Incomplete	1 508	21
Complete	5 679	79
Total	7 187	100.0

Source: Own elaboration.



Regarding the DPT vaccination status of the children of the women surveyed, there were 21% (1508) of children whose vaccination record was incomplete. In Figure 1, it

can be seen that departments such as Puno, Loreto, Madre de Dios, Amazonas, and Lambayeque have the highest incomplete DPT vaccination schedule.

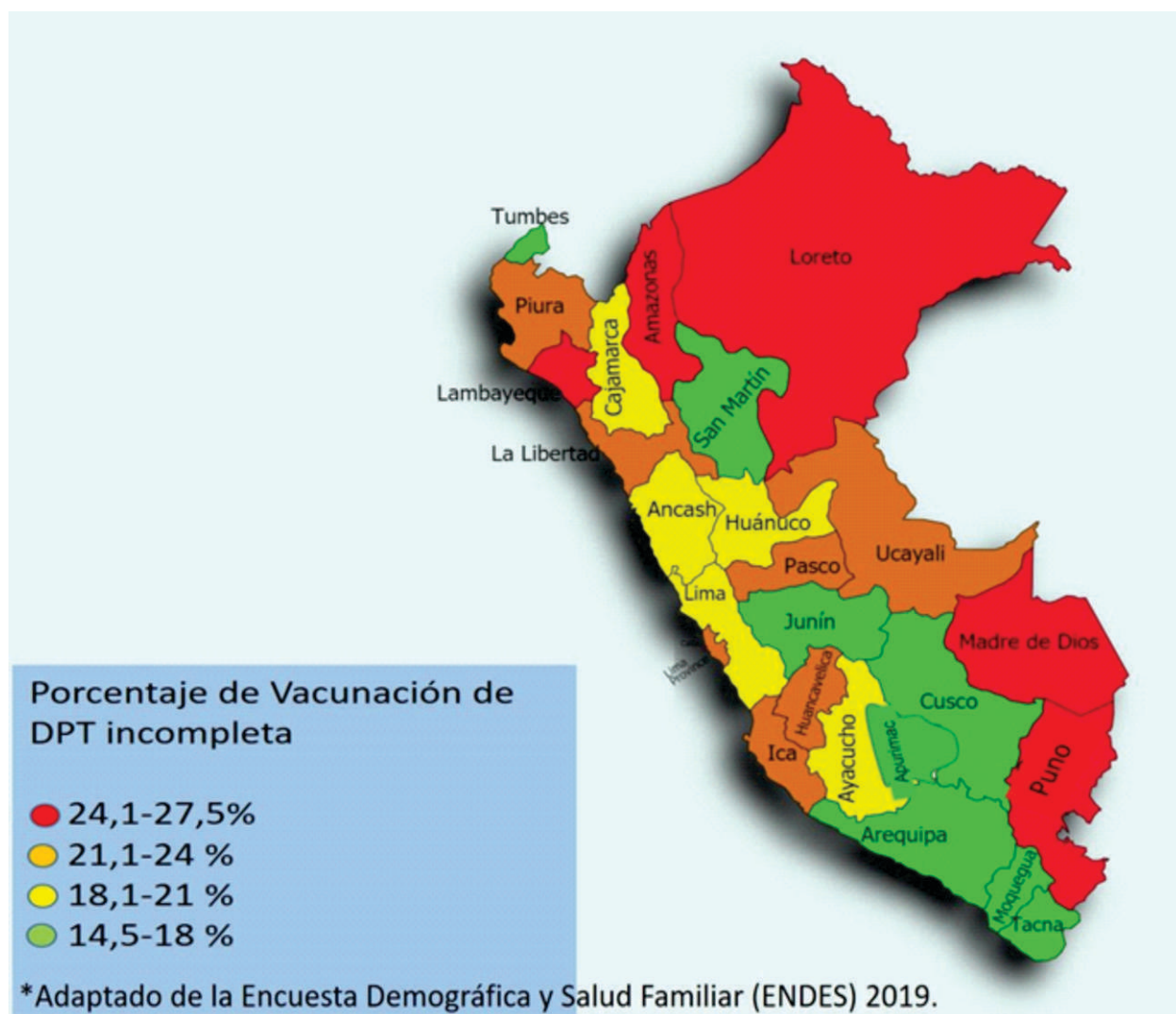


Figure 1. Map of Peru and incomplete DPT vaccination, with respect to each department

Source: self-made. Adapted from ENDES 2019

Table 2 shows the vaccination status for each dose of the applied vaccine in greater detail; it was found that 94.1% (6760) of the mothers had their children vaccinated with the first dose, as confirmed in the vaccination record, while the "unvaccinated" is 5.9% (427).

Regarding the second dose of DPT, the percentage of mothers with vaccinated children is 88.2% (6340), the "unvaccinated" for this dose is 11.8% (847). Finally, the third dose of the DPT vaccine has a percentage of vaccinated 79% (5679), and those "unvaccinated" in 21% (1508).



Table 2. Vaccination status of the children of the mothers surveyed against diphtheria, pertussis and tetanus for each dose, according to ENDES 2019

		First dose of DPT vaccine (n=7187)	Second dose of DPT vaccine (n=7187)	Third dose of DPT vaccine (n=7187)
status	Unvaccinated	5.9 % (427)	11.8 % (847)	21 % (1 508)
Vaccination	Vaccinated	94.1% (6 760)	88.2% (6 340)	79% (5 679)

*DPT: vaccine against diphtheria, pertussis and tetanus.
Source: self made.

The unvaried analysis is shown in Table 3, in relation to an incomplete DPT vaccination of the children and the variable "number of children" reported by the mother (1 507), it was observed that 5.6% (405) had a single child and 15.3% (1 102) had two or more children, resulting significant with a PR=1.16, p=0.04. The analysis of the variable "type of residence" analysis found that those who reside in a rural area and have incomplete vaccination are 5.8% (419). In contrast, mothers living in urban areas cover 15.1% (1 088); in this analysis, the PR=1.10 was insignificant, with p=0.12. The analysis with "type of education" and incomplete vaccination shows us that 4.7% (337) have no education or only attended

primary school, the group that had secondary education or higher, is 16.3% (1171), with a PR= 1.22 and p=0.04.

When analyzing with the variable of "having health insurance" and incomplete vaccination, it was found that 15% (1081) have insurance, while 5.9% (426) do not have insurance; this relationship had a PR= 1.35 with a p<0.01. Regarding the variable "wealth index" and the incomplete vaccination status, the results obtained show that a PR was found: 1.27, 95% CI: 1.14-1.43, p < 0.01 with respect to families "very poor" and "poor." Age was significant with a PR: 1.72, 95% CI: 1.50-2.00, p<0.001.

Table 3. Bivariate analysis for sociodemographic characteristics and proportion of vaccination against DPT, in children older than six months of women enrolled according to ENDES 2019

Variables	Characteristic	Corrected F	p value	PR	LIMIT INF	LIMIT SUP
Number of children	One child	8.43	0.04	1.16	1.05	1.28
Type of place of residence	Rural Urban	2.34	0.12	1.10	0.97	1.25
Type of education	No education or only primary High school or higher	8.44	0.04	1.22	1.06	1.40
Has health	insurance Has no insurance Has insurance	21.16	<0.01	1.35	1.12	1.53
Wealth index	Poor and very poor Middle and rich	17.95	<0.01	1.27	1.14	1.43
Age	<20 years ≥ 20 years	46.4	<0.01	1.72	1.50	2.00

95% CI: confidence interval.
PR: Prevalence ratio.
Source: self made.



The results of the multivariate analysis, in Table 4, show that after controlling the other predictor variables, the incomplete DPT vaccination schedule was associated with the index of poor wealth (RPa:1.21; CI95%:1.05-1.39, p<0.01), not having insurance (Rpa: 1.41; CI95%:

1.23-1.60, p<0.01), without education or only primary school (RPa:1.19; CI95% : 1.02-1.40; p=0.01), age under 20 years (PRa:2.63; 95% CI:2.06-3.35, p<0.01) and having two or more children (RPa: 1.36; 95% CI: 1.19-1.57, p<0.01).

Table 4. Multivariate analysis of the sociodemographic characteristics and the proportion of incomplete DPT vaccination in children older than 6 months of age of women enrolled in the ENDES 2019

VACCINATION STATUS		p	Rpa	95% confidence interval for Exp(B)	
				Limit lower	limit Upper limit
	Variable	Intercept			
	Number of children	Two or more children one child	<0.01	1.36	1.19 1.57
	Wealth index	Poor and very poor Medium and rich	<0.01	1.21	1.05 1.39
VACCINATION STATUS	Place of residence	Rural Urban	0.25	1.00	0.86 1.15
	Have health insurance	no insurance Have insurance	<0.01	1.41	1.23 1.60
	Mother's	age < 20 years >= 20 years	<0.01	2.63	2.06 3.35
	Level of education	No education or only primary Secondary or higher	0.01	1.19	1.02 1.40

Fuente: Elaboración propia
RPa: Razón de prevalencia ajustado

DISCUSSION

This study found that the factors significantly associated with non-compliance with DPT vaccination in Peru in 2019 were: level of education, age, wealth index, not having health insurance, and having two or more children, for bivariate analysis; and the factors, poor or very poor wealth index, not having insurance, no or only primary education, age under 20, and having two or more children by multivariate analysis.

The creation of the WHO/PAHO Immunization Program has been one of the most valued public health strategies and one that contributes to equity. One of the pillars of the success of the programs is to achieve high vaccination coverage. The main indirect indicator of program development is the third dose of DPT vaccine

In this study, it was found that the first dose of the DPT vaccine schedule reached 94.1%. In comparison, the percentage of mothers whose infants did not receive this dose was 5.9%, an appropriate figure according to the UN ^(14,15), since the organization qualifies values above 85% as an expected percentage of vaccination. In the following doses, the proportion of mothers who had their children without vaccination increased, with 11.8% and 21.0%, for the second and third doses, respectively. It is alarming to see that, when analyzing in a general way, the percentage of complete DPT vaccination in infants is only 79%, a figure below the parameters suggested by the relevant health entities. Gilbert et al.⁽¹³⁾ and Scheepers et al.⁽¹⁹⁾ carried out similar studies in which the complete coverage of this type of vaccine reaches values between 84.5% and 98%, which is higher than that found in this study.

⁽¹⁸⁾

Similarly, in the study by Hadjipanayis et al.⁽²⁰⁾ carried out in Cyprus in 2018, it is highlighted that the population of infants not vaccinated against pneumococcus is only 2%; this gives us to understand that there are circumstances such as the wealth index, the type of place where they live, having health insurance or the type of education of the people⁽²¹⁾, whose consequence is that vaccination coverage continues to be low and this represents a major problem with respect to community health.

Regarding the age of the mothers, it was found that being under 20 years old (n=123) was significantly associated with incomplete vaccination of the children (OR: 1.72; 95% CI: 1.50-2.0; p< 0.01), which differs from that reported by Kagone et al.⁽²²⁾, who in a study carried out on 4086 children, found no association with respect to the age of the mother and compliance with the DPT vaccination schedule⁽²²⁾, in the same way there was no association of the age variable with respect to vaccination in the studies by Kusuma et al.⁽²³⁾ and Francis et al.⁽²⁴⁾

The level of education of the mother is a primary factor for compliance and understanding of the importance of a vaccination scheme such as DPT; in this study, the number of mothers "without education or only primary education" represents 19.7%, a similar figure is seen in the study by Kurosky et al.⁽²⁵⁾, where they describe women with a "basic, but not higher" education, at 18.7%. In the bivariate analysis, our study found an association between women with no education or who only had primary education and incomplete DPT vaccination (PR=1.22; 95% CI: 1.06-1.40; p=0.04). . Gilbert et al.⁽¹³⁾ also analyzes in their study the level of education of parents in relation to non-vaccination in infants, obtaining an OR=1.99, CI95%: 1.02-3.91, p=0.000, in countries such as Ethiopia where Yismaw et al.⁽²⁶⁾ with a population of 301 people surveyed found that parents who "do not know how to read or write" their children had an incomplete vaccination schedule in 45% (OR=7.4, p=0.01) suggests that poor educational level is a factor for "non-vaccination".

Within the sociodemographic characteristics of the mother, the place of rural residence and incomplete DPT vaccination was 5.8% (419), the analysis for this association was not significant (PR= 1.1; 95% CI: 0.97-1.25, p>0.05). In his study, Scheepers et al.⁽¹⁹⁾, in his

study, showed association results since he determined that in places with a low and very low urbanization rate to the vaccination status, he obtained an RR=1.02; CI95%: 1.01-1.32; p<0.05. Furthermore, the study by Gilbert et al.⁽¹³⁾, carried out in Canada, showed that in the regions called "Prairies" that constitute the rural and wild area of this country, "non-vaccination" was related to this type of places with an OR= 4.92, p< 0.01. The studies analyzed show us that if there is a relationship with respect to the mother's place to comply with the vaccination schedule, our results did not find this association.

By dichotomizing the wealth index variable. The percentage of mothers with a "poor and very poor" wealth index and the relationship with incomplete DPT vaccination was 11.5%, this relationship obtained a PR: 1.27, CI95%: 1.14-1.43, p<0.01; in other investigations such as Scheepers et al.⁽¹⁹⁾ and Gilbert et al.⁽¹¹⁾ found an association with respect to the family wealth index and non-compliance with the vaccination schedule with OR=2.14, 95% CI: 1.10-4.14, p<0.05, but the description of the "low income" per family differs a lot from the Peruvian reality, since they highlight that these incomes are less than 5,000 dollars per month, while the definition of poverty in Peru shows a monthly income of approximately 500 soles, which is equivalent to 135 US dollars; In studies in our country, the author Chuquin⁽²⁷⁾ analyzed the association between the wealth index and vaccination in children under five years of age, finding a significant association (p<(0.01) between these variables, while Vásquez et al.⁽²⁸⁾ did substantial significant results regarding this association (RPa:0.9, CI95%: 0.64-1.25, p=0.21); Faced with these results, we can see that in similar realities the association is presented in certain studies, and it is also suggested that in countries with greater economic scope this association is visualized in greater detail.

Added to the wealth index, the fact of having or not having health insurance must be analyzed, so when analyzing our data we obtained that the number of mothers without health insurance and who do not have a complete DPT vaccination schedule is 5.9% (476), in the bivariate analysis, a PR= 1.35, p <0.001, was found. The antecedents support this value since in the investigations of Khan et al.⁽²⁹⁾ found a significant association (p=0.03) in the relation between not having health insurance and incomplete vaccination status of

the infant similarly at the South American level, it was found in the results of the study by Hoz et al.⁽³⁰⁾, also a significant association (OR: 1.8; CI 95% CI: 1.2-2.4; $p < 0.001$) with respect to the previously described problem⁽³⁰⁾. This shows that having health insurance allows women and families to overcome the financial burden to take advantage of necessary health care facilities.

Within the variables, the number of children was analyzed with respect to the vaccination status, in this case it was found that mothers who have two or more children and the incomplete vaccination schedule cover 15.3% (1 102) with a PR= 1.16, 95% CI: 1.05-1.28, $p = 0.04$, considering this characteristic as a prevalence factor. A. Hadjipanayis et al.⁽²⁰⁾, in their investigation, found that the rates of non-compliance with the DTP scheme were statistically significant in the second or third child ($p < 0.05$), a similar case manifested by Lernout et al.⁽¹⁴⁾ obtaining HR=1.47, CI95%:1.12-1.8, $p < 0.05$ for the third or fourth child born in relation to the incomplete DPT vaccination schedule⁽¹²⁾. This suggests that children older than six months of age, from families with two or more children, are likely to be noncompliant with the DPT vaccination schedule.

When adjusting the variables related to the incomplete vaccination of the children of the mothers surveyed, in the multivariate analysis, it was obtained that the index of poor wealth (RPa:1.21; CI95%:1.05-1.39, $p < 0.01$), not having insurance (RPa:1.41; 95% CI:1.23-1.60, $p < 0, 01$), without education or only primary education (RPa: 1.19;

95% CI: 1.02-1.40; $p = 0, 01$), age younger than 20 years (RPa: 2.63; 95% CI: 2.06-3.35, $p < 0.01$) and having two or more children (RPa: 1.36; 95% CI: 1 .19-1.57, $p < 0.01$), were statistically significant and resembled the results obtained from the research cited for this article^(11,19,20,22-29).

This research presents the limitations of a retrospective, observational study with secondary bases. However, it is robust because it uses representative data, with probabilistic and stratified sampling, on a national basis. Additionally, the proper use of databases with weighting factors and sufficient statistical power for bivariate and multivariate analysis was applied.

CONCLUSIONS

It is concluded that sociodemographic factors related to the mother, such as having two or more children, poor wealth index, not having health insurance, being under 20 years of age and not having an education or only having completed primary school are associated with their children have a noncompliance in the DPT vaccination schedule.

RECOMMENDATIONS

The development and complexity of immunization programs require strategies and not only that vaccination coverage be high to maintain the protection threshold, but also modernize and be inclusive, emphasizing rural populations, with less education, poor access to health systems and poor economic conditions; since this vaccine helps in cognitive development and educational achievement in children.

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