Association between teenage mothers and acute infections in children under five in Peru from 2015-2019

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Abstract

Objectives: to assess the association between mothers age and the presence of acute respiratory infections (ARIs) and acute diarrhea (AD) in Peruvian children under five years old.

Methods: secondary analysis of the database of the "Demographic and Family Health Survey" of 2015 and 2019. We analyzed data from children under five and their reproductive-age mothers who live in the same household. Poisson regression models were used to generate adjusted prevalence ratios (aPR) with 95% confidence intervals (95%CI) to assess the association between mothers' age group and the presence of ARIs and AD in their children.

Results: 84,671 mother/child data were analyzed. In the adjusted regression model, being a young mother (aPR= 1.18; 95%CI= 1.11-1.25; p<0.001) or an teenage (aPR= 1.11; 95%CI= 1.01-1.22; p=0.045) were associated with a higher prevalence of ARIs in their children. In addition, being a young mother a teenage (aPR= 1.18; 95%CI= 1.11-1.25; p<0.001) or a teenage (aPR= 1.22; 95%CI= 1.10-1.35; p<0.001) were also associated with a higher prevalence of AD cases in their children.

Conclusions: mothers' age was found to be associated with the prevalence of ARIs and AD in Peruvian children under five, with teenagers and young mothers having the greatest probability of ARIs and AD.

Key words *Respiratory tract infections, Diarrhea, Maternal age, Maternal health, Child health, Peru*

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Introduction

In Peru, acute diarrhea (AD) and acute respiratory infections (ARIs) are two pediatric diseases with the highest frequency in children under five years old.[1] The National Center for Epidemiology, Prevention, and Disease Control reported that in Peru, the cumulative incidence of pneumonia in 2023 was 1.2 episodes every 10,000 children under five years of age,[2] while that of acute diarrhea in 2021 was 184.6 and 124.8 episodes every 10,000 children under one year and one to five years, respectively.[3] The factors associated with these diseases are multiple. For example, a systematic review of demographic and health surveys from 34 sub-Saharan countries conducted between 2009 and 2018 showed that young age, educational level, and socioeconomic level were factors associated with diarrhea.[4] Another systematic review of studies published in East Africa between 2000 and 2019 evidenced that using biomass as a fuel source, cooking in an environment not separated from the living room, the presence of the children during the process of cooking, and non-vaccination were associated with pneumonia.[5]

Teenage pregnancy as a risk factor for children's health is a controversial factor. Some studies conducted in different countries between 2002 and 2012, together, have found that this factor is associated with different adverse outcomes regarding mothers' and children's health.[6] In Peru, the National Institute od Statistics and Informatics (INEI – Spanish acronym) considers mothers under 20 years old to be a high-risk group concerning infant mortality because, in 2019, their rate is higher compared to mothers between 20 and 39 years old (incidence of 17 per a thousand versus 13 per a thousand children).[7] Hence, ideally, it is recommended that the first pregnancy should occur between 20 and 30 years old, as the risk related to complications is the minimum in this age group.[8] However, in 2021, a study showed that this effect might be confounded by variables for which it is not adjusted in most studies, and a decrease in pregnancy among mothers under 18 years would not be an effective strategy to improve child health.[9]

Latin America has one of the highest levels of prevalence of adolescent pregnancy in the world.[10] Peru, in 2015, had a rate of 52.1 births per 1000 women in the age group from 15 to 19 years old, and it is a problem, mainly with pregnancy in minors under 15 years old. A study conducted by Planned Parenthood Global in 2015 in Ecuador, Guatemala, Nicaragua, and Peru reported that pregnancy in women between nine and 14 years has increased in the last 10 years.[11] Considering that the main pediatric diseases are ARIs and AD, it is important to know whether the mother's age, including being a part of the age group of teenage, might be associated with a higher risk of ARIs and AD in the Peruvian children population. Given that, in Peru, these diseases are important causes of morbidity in children, it is necessary to identify what associated characteristics exist. Therefore, this study aims to evaluate whether mothers' age is related to the presence of ARIs and AD in children under five in the Peruvian population.

Methods

We performed a secondary analysis of the database of the Demographic and Family Health Survey (ENDES – Spanish acronym) during the period between 2015 and 2019. ENDES is a cluster sampling survey, stratified and representative at the national level, administered annually by the INEI. The survey has three questionnaires (household, individual, and health) and is administered to update the knowledge of health indicators of the Peruvian population.[12]

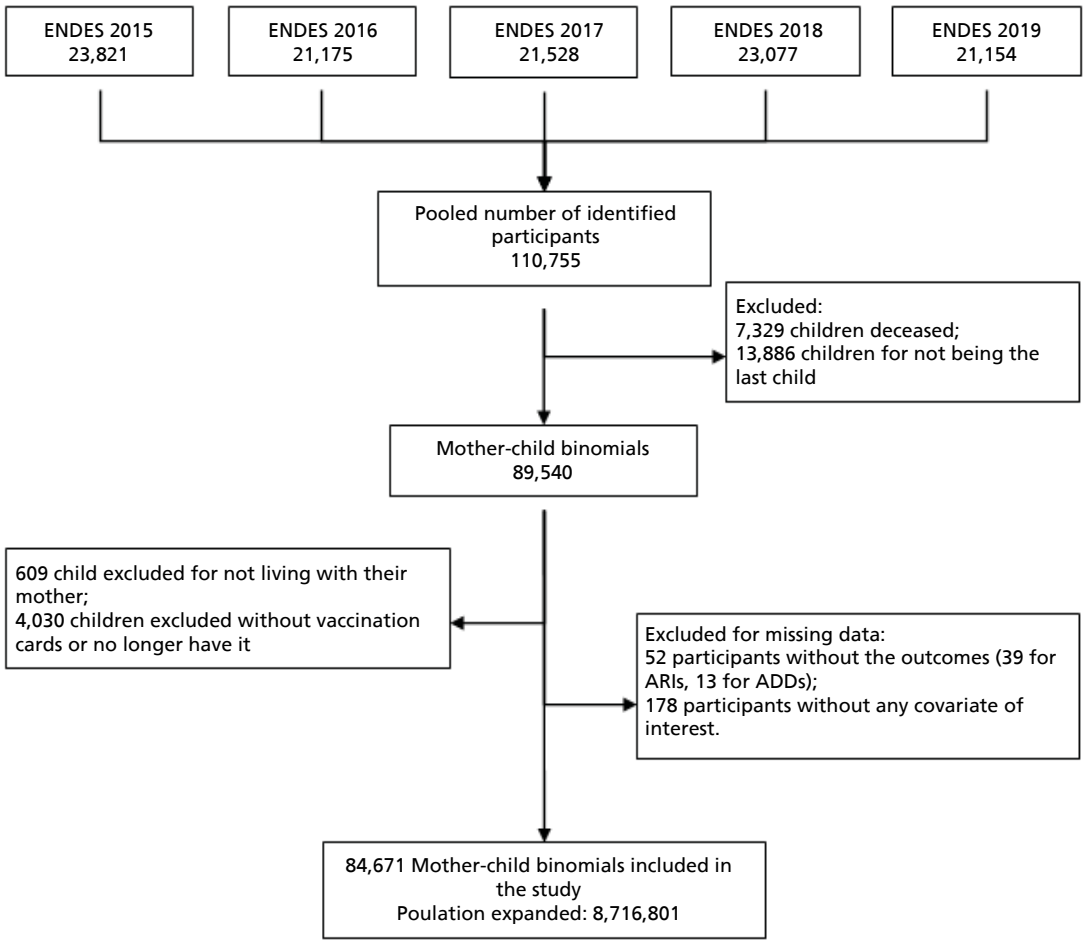
The study population was constituted of women of reproductive age (WRA) from 12 to 49 years old. ENDES used probability, balanced two-stage, stratified and independent sampling at the department level and per urban and rural area. ENDES estimations have annual representativity at the national level that covers urban/rural areas per geographic domain (Lima Metropolitan Area, Coast, Highlands, and Jungle) and for the 24 regions of Peru and the constitutional province of Callao.[12]

As our interest was to evaluate the association between maternal age and the presence of ARI and AD in children under five years of age, we included data on women of reproductive age and their children under five years of age. Each child was matched to his or her mother, so 110,755 mother/child pairs were identified. After excluding 7,329 records of deceased children, the dataset was cleaned by only including information regarding the youngest child if a given mother had two or more children. This led to the exclusion of cases where two (n=12,517), three (n=1,324) or four (n=45) children living with the same mother were not the youngest child. Subsequently, 609 records of children not living with their mothers and 4,030 records lacking information on their children's immunization records were excluded. In addition, 52 records lacking the outcome and 178 records with incomplete information on the variables of interest were eliminated. Finally, we analyzed 84,671 mother/child data (Figure 1).

We considered two outcomes: presence of ARIs, and presence of AD in children. ARIs were defined as the joint presence of cough and shortness of breath, or rapid breathing over the last two weeks prior to the survey according to the indications of the Technical Standard

Figure 1

Flowchart of the selection of participants included in the analysis, Peru ENDES 2015-2019.



ARI= Acute respiratory infections; ADD= Acute diarrheal diseases; ENDES = Demographic and Family Health Survey (ENDES by its acronym in Spanish).

of Ministry of Health of Perú.[13] The questions used were: "In the last 14 days has the child had a cough?" and "Did the child breathe faster than usual, with short, choppy breaths?" On the other hand, AD was defined as the presence of diarrhea in the last two weeks prior to the survey. This variable was constructed based on the question "Has the child had diarrhea in the last two weeks?", and considering the methodology of some previous studies.[14] All questions were answered by the mothers, the response options were yes and no.

The exposure variable was mothers' age group. The age of the mother was collected numerically in years. For the analysis, we classified this variable into three distinct categories: teenage mother, those who are between 12 and 19 years old; young mother, those between 20 and 30 years old; and adult mother, those who are between 31 and 49.

Furthermore, other covariates were included as confounders according to the literature, such as child age (categorized into zero - 23 months old and 24 - 59 months old), child gender (female, male), and vaccination status of the child (incomplete, complete). In addition, regarding mothers, we included educational level (complete elementary education or below, high school, non-university higher education, university education), current marital status (single, live-in-parter only, married, widowed, divorced/separated), violence (no, yes), pregnancy (no, yes), number of children, wealth index (poorest, poorer, middle, richer, richest), health insurance (yes, no), residence area (urban, rural), geographic region of the mother's residence (Lima Metropolitan Area, rest of the coast, highlands, jungle), vaccination status (according to the vaccination schedule by age group of the children, established by the Technical Health Standard (NTS) Nº141-MINSA/2018/DGIESP of the Ministry of Health of Peru,[15] considering the vaccines of children who had their vaccination cards and/or vaccines reported by their mothers), and intimate partner violence (including physical, psychological, and sexual abuse; for the creation of this variable, questions

of the questionnaire were taken into account, which are described in other previously published study.[16]

The ENDES database, corresponding to 2015-2019, was downloaded in a .SAV format file, then exported and analyzed with STATA v16.0 (TX, StataCorp LP). All the sample patterns were analyzed according to the stratum and weighting factor, considering the complex sampling design of ENDES, using the command *svy*.

In the descriptive analysis, the categorical variables were expressed in frequencies and percentages with their respective 95% confidence intervals (95%CI). The numerical variables were shown as means, with their respective 95%CI. To determine if significant differences exist between the independent variables according to the proposed outcomes, we used the chi-squared test with Rao-Scott correction for complex sampling. To determine the differences between numerical variables, we used the Wald test.

We constructed Poisson regression models to know the associations between the mothers' age group and the presence of ARIs and AD in children and to estimate crude prevalence ratios (cPR) and adjusted prevalence ratios (aPR) with their respective 95%CI. A first crude model was performed by bivariate regressions for the variables of interest, while the second models were regressions adjusted by covariates of the study, following a statistical criterion. Those variables that showed a $p<0.05$ in the crude analysis were included as adjustment variables, using the backward selection method. Collinearity was determined through the variance inflation factors, considering a cutoff point greater than 10 (it should be noted that none of the obtained factors was higher than this predefined cutoff point). In addition, we constructed stratified models according to child age to assess differences in the presence of ARIs and AD. A p-value lower than 0.05 was considered statistically significant for all the analysis.

This study analyzed available secondary data, which can be accessed on the website of INEI.[17] The databases can be downloaded and do not have identifiers for the respondents, for which the information of the participants is confidential. All participants gave their informed consent terms when surveyed by the team who administered the survey.

Results

Regarding children, 51.25% were male, and the mean age was 31.98 (31.83-32.13) months old. Only 12.43% had completed their vaccination schedule according to their age. The prevalence of ARIs and AD was 14.76% and 10.91%, respectively. Regarding mothers, the mean age was 30.17 (30.09-30.24). Of them, 46.17% had a secondary level; 59.34% had a domestic partner; 82.70% had health insurance; almost half were poorer (23.03%) or the poorest (20.67%). Only 3.45% were pregnant when they were surveyed. The average number of children per mother was 2.24 (2.22-2.25). In addition, 14.53% of mothers mentioned being victims of intimate partner violence. 75.82% resided in an urban area and 30.67% in Lima Metropolitan (Table 1).

Regarding ARIs, the prevalence of this condition was 17.22%, 16.70%, and 12.90% in children under five of teenage, young, and adult mothers, respectively. Concerning AD, the prevalence in these children was 17.11%, 12.31%, and 9.13% in children under five of teenage, young, and adult mothers, respectively. Bivariate analysis by mothers' age group showed statistically significant differences for all variables, except children's sex and health insurance (Table 2).

Bivariate analysis according to the presence of ARIs in children showed statistically significant differences for all variables except for pregnancy, while the bivariate analysis according to the presence of AD in children showed statistically significant differences for all variables except for pregnancy and health insurance (Table 3).

In the adjusted model, being a young (aPR= 1.18; 95%CI= 1.12-1.24; $p<0.001$) or teenage mother (aPR= 1.11; 95%CI= 1.01-1.22; $p=0.045$) was associated with ARIs in children, in comparison with adult mothers' children. In the stratified analysis according to children's age, in children under 23 months old, the association with ARIs remained in children whose mothers are young (aPR= 1.26; 95%CI= 1.15-1.39; $p<0.001$) or teenage (aPR= 1.26; 95%CI= 1.10-1.45; $p=0.001$), in comparison with adult mothers' children. In children from 24 to 59 months old, the association with ARIs was only found in young mothers' children (aPR= 1.17; 95%CI= 1.10-1.24; $p<0.001$) in comparison with adult mothers' children (Table 4).

In the adjusted model, we found that being a young mother (aPR= 1.18; 95%CI= 1.11-1.25; $p<0.001$) or a teenage one (aPR= 1.22; 95%CI= 1.10-1.35; $p<0.001$) was also associated with higher prevalence of AD cases in their children, in comparison with adult mothers' children. The stratified analysis showed a higher prevalence of AD in children under 23 months old whose mothers are young (aPR= 1.17; 95%CI= 1.08-1.28; $p<0.001$) or teenage (aPR= 1.15; 95%CI=1.02-1.30; $p=0.007$), in comparison with adult mothers' children. Similarly, in children from 24 to 59 months old, we found a higher prevalence of AD cases in young mothers' children (aPR= 1.20; 95%CI= 1.10-1.30; $p<0.001$) and teenage mothers' children (aPR= 1.65; 95%CI= 1.39-1.98; $p<0.001$), in comparison with adult mothers' children (Table 4).

Table 1

General characteristics of mothers and children from Perú included in the analysis, ENDES 2015-2019 (n=84,671; N=8,716,801).

Characteristics	Absolute frequency	Weighted proportion*	
	n	%	95%CI
Child variables			
Child's age (months)			
Mean (95%CI)		31.98	31.83-32.13
0 – 24	28741	33.70	33.28-34.11
24 – 59	55930	66.30	65.89-66.72
Sex			
Female	41295	48.75	48.30-49.21
Male	43376	51.25	50.79-51.70
Vaccination			
Incomplete	72820	87.57	87.26-87.88
Complete	11851	12.43	12.12-12.74
Acute respiratory infections			
No	72519	85.24	84.88-85.59
Yes	12152	14.76	14.41-15.12
Acute diarrheal diseases			
No	74790	89.09	88.79-89.38
Yes	9881	10.91	10.62-11.21
Mother's variables			
Mother's age (years)			
Mean (95%CI)		30.17	30.09-30.24
12 – 19	4643	5.12	4.92-5.33
20 – 30	37576	43.13	42.64-43.62
31 – 49	42452	51.75	51.22-52.28
Education level			
Complete elementary education or below	17053	19.06	18.47-19.67
High school	39622	46.17	45.54-46.81
Non-university higher education	15655	19.21	18.76-19.66
University education	12341	15.56	15.00-16.14
Current marital status			
Single	4690	5.39	5.18-5.60
Live-in-partner only	51367	59.34	58.75-59.93
Married	20140	25.32	24.77-25.88
Widow	83	0.10	0.08-0.13
Divorced/Separated	8391	9.85	9.57-10.14
Violence			
No	71958	85.47	85.12-85.81
Yes	12713	14.53	14.19-14.88
Pregnancy			
No	81767	96.55	96.38-96.70
Yes	2904	3.45	3.30-3.62
Number of children			
Mean (95%-CI)		2.24	2.22-2.25
Wealth index			
Very poor	20592	20.67	19.94-21.41
Poor	22621	23.03	22.34-23.74
Medium	17842	20.97	20.42-21.53
High	13759	18.69	18.13-19.27
Very high	9857	16.64	15.86-17.45
Health insurance			
No	13520	17.30	16.90-17.71
Yes	71151	82.70	82.28-83.10
Area of residence			
Urban	61167	75.82	74.99-76.62
Rural	23504	24.18	23.38-25.01
Geographic region of residency			
Metropolitan Lima	10683	30.67	29.15-32.24
Other areas of Coast region	26451	26.60	25.40-27.84
Highlands	27274	26.70	25.51-27.92
Jungle	20263	16.02	15.11-16.97

95%CI = 95% confidence intervals; *Weights and the design effect of the complex survey sampling were included; ENDES = Demographic and Family Health Survey (ENDES by its acronym in Spanish).

Table 2

Characteristics of the mother and the child according to the age group to which the mother belongs in Peru, ENDES 2015-2019.

Characteristics	Teenage mother (12 – 19 years) n=4,643			Young mother (20 – 30 years) n=37,576			Adult mother (31 – 49 years) n=42,452			*p**
	n	%	95%CI	n	%	95%CI	n	%	95%CI	
Child variables										
Child's age (months)										<0.001
0 – 24	3259	70.47	68.68-72.20	13016	35.03	34.40-35.67	12466	28.95	28.38-29.52	
24 – 59	1384	29.53	27.80-31.32	24560	64.97	64.33-65.60	29986	71.05	70.48-71.62	
Sex										0.968
Female	2276	48.98	47.16-50.80	18200	48.72	48.05-49.39	20819	48.76	48.10-49.42	
Male	2367	51.02	49.20-52.84	19376	51.28	50.61-51.95	21633	51.24	50.58-51.90	
Vaccination										<0.001
Incomplete	3610	79.37	77.88-80.79	32260	86.99	86.53-87.43	36950	88.87	88.47-89.27	
Complete	1033	20.63	19.21-22.12	5316	13.01	12.57-13.46	5502	11.13	10.73-11.53	
Acute respiratory infections										<0.001
No	3869	82.78	81.36-84.11	31562	83.30	82.77-83.82	37088	87.10	86.63-87.56	
Yes	774	17.22	15.89-18.64	6014	16.70	16.18-17.23	5364	12.90	12.44-13.37	
Acute diarrheal diseases										<0.001
No	3782	82.89	81.50-84.19	32738	87.69	87.24-88.12	38270	90.87	90.50-91.22	
Yes	861	17.11	15.81-18.50	4838	12.31	11.88-12.76	4182	9.13	8.78-9.50	
Mother´s variables										
Education level										<0.001
Complete elementary education or below	802	18.74	17.22-20.37	5725	15.03	14.38-15.70	10526	22.46	21.70-23.24	
High school	3545	75.33	73.59-76.99	19890	52.14	51.35-52.93	16187	38.32	37.49-39.15	
Non-university higher education	162	3.22	2.60-3.98	6907	19.15	18.56-19.75	8586	20.84	20.23-21.46	
University education	134	2.71	2.08-3.53	5054	13.69	13.11-14.29	7153	18.39	17.59-19.21	
Current marital status										<0.001
Single	922	19.92	18.41-21.50	2564	6.71	6.38-7.06	1204	2.84	2.63-3.07	
Live-in-partner only Live-in-partner only	3076	65.67	63.85-67.45	25257	66.25	65.54-66.95	23034	52.96	52.17-53.74	
Married	157	3.93	3.17-4.87	5696	16.08	15.51-16.66	14287	35.14	34.36-35.92	
Widow	0	0.00	—	10	0.02	0.01-0.05	73	0.18	0.13-0.24	
Divorced/Separated	488	10.47	9.33-11.73	4049	10.94	10.51-11.38	3854	8.89	8.51-9.28	

Violence										<0.001
No	4016	86.93	85.63-88.13	31708	84.85	84.35-85.34	36234	85.83	85.37-86.28	
Yes	627	13.07	11.87-14.37	5868	15.15	14.66-15.65	6218	14.17	13.71-14.63	
Pregnancy										<0.001
No	4459	95.76	94.94-96.45	35979	95.75	95.48-96.00	41329	97.29	97.07-97.49	
Yes	184	4.24	3.55-5.06	1597	4.25	4.00-4.52	1123	2.71	2.51-2.93	
Number of children										<0.001
Mean (95% CI)		1.10	1.09-1.12		1.67	1.66-1.69		2.82	2.80-2.85	
Wealth index										<0.001
Very poor	1928	38.08	36.02-40.18	9793	22.79	21.94-23.66	8871	17.17	16.46-17.90	
Poor	1356	27.73	26.06-29.46	11056	26.09	25.25-26.95	10209	20.01	19.27-20.77	
Medium	780	17.31	15.82-18.91	8034	21.83	21.14-22.53	9028	20.62	19.96-21.30	
High	405	11.33	10.01-12.81	5552	17.54	16.84-18.26	7802	20.38	19.70-21.08	
Very high	174	5.55	4.56-6.73	3141	11.75	11.08-12.47	6542	21.82	20.74-22.93	
Health insurance										0.159
No	656	16.59	15.09-18.20	6137	17.68	17.11-18.27	6727	17.05	16.52-17.60	
Yes	3987	83.41	81.80-84.91	31439	82.32	81.73-82.89	35725	82.95	82.40-83.48	
Area of residence										<0.001
Urban	2643	59.48	57.33-61.60	26443	73.33	72.35-74.28	32081	79.50	78.68-80.30	
Rural	2000	40.52	38.40-42.67	11133	26.67	25.72-27.65	10371	20.50	19.70-21.32	
Geographic region of residency										<0.001
Metropolitan Lima	357	18.82	16.61-21.26	4274	27.31	25.77-28.91	6052	34.65	32.94-36.40	
Other areas of Coast region	1236	25.54	23.57-27.61	11697	27.65	26.33-29.01	13518	25.83	24.60-27.10	
Highlands	1524	29.10	27.04-31.20	12033	27.34	26.05-28.67	13717	25.92	24.71-27.17	
Jungle	1526	26.53	24.39-28.80	9572	17.69	16.65-18.77	9165	13.60	12.78-14.46	

95%CI= 95% Confidence intervals; Weights and the design effect of the complex survey sampling were included; *Refers to the statistical significance obtained from the comparison of the proportions between the categories of the variables considering the complex sampling of the survey; ENDES = Demographic and Family Health Survey (ENDES by its acronym in Spanish).

Table 3

General characteristics of the mother and child according to the presence of acute respiratory infections or acute diarrheal diseases in children from Peru, ENDES 2015-2019.

Characteristics	Acute respiratory infections							Acute diarrheal diseases						
	Yes (n=12,152)			No (n=72,519)			*p**	Yes (n=9,881)			No (n=74,790)			*p**
	n	%	95%CI	n	%	95%CI		n	%	95%CI	n	%	95%CI	
Child variables														
Child's age (months)							<0.001							<0.001
0 – 24	4567	16.15	15.57-16.76	24174	83.85	83.24-84.43		4983	16.26	15.70-16.84	23758	83.74	83.16-84.30	
24 – 59	7585	14.05	13.64-14.47	48345	85.95	85.53-86.36		4898	8.19	7.90-8.50	51032	91.81	91.50-92.10	
Sex							<0.001							<0.001
Female	5683	14.18	13.73-14.65	35612	85.82	85.35-86.27		4516	9.91	9.55-10.29	36779	90.09	89.71-90.45	
Male	6469	15.31	14.82-15.81	36907	84.69	84.19-85.18		5365	11.86	11.46-12.28	38011	88.14	87.72-88.54	
Vaccination							0.003							0.001
Incomplete	10575	14.93	14.56-15.32	62245	85.07	84.68-85.44		8393	10.75	10.44-11.07	64427	89.25	88.93-89.56	
Complete	1577	13.53	12.73-14.37	10274	86.47	85.63-87.27		1488	12.06	11.30-12.85	10363	87.94	87.15-88.70	
Mother's variables														
Mother's age (years)							<0.001							<0.001
12 – 19	5364	12.90	12.44-13.37	37088	87.10	86.63-87.56		4182	9.13	8.78-9.50	38270	90.87	90.50-91.22	
20 – 30	6014	16.70	16.18-17.23	31562	83.30	82.77-83.82		4838	12.31	11.88-12.76	32738	87.69	87.24-88.12	
31 – 49	774	17.22	15.89-18.64	3869	82.78	81.36-84.11		861	17.11	15.81-18.50	3782	82.89	81.50-84.19	
Education level							<0.001							<0.001
Complete elementary education or below	2513	15.35	14.63-16.10	14540	84.65	83.90-85.37		1918	10.62	10.08-11.20	15135	89.38	88.80-89.92	
High school	5877	15.18	14.68-15.69	33745	84.82	84.31-85.32		4959	11.82	11.41-12.25	34663	88.18	87.75-88.59	
Non-university higher education	2191	14.43	13.65-15.23	13464	85.57	84.76-86.35		1740	10.48	9.85-11.14	13915	89.52	88.86-90.15	
University education	1571	13.21	12.38-14.09	10770	86.79	85.91-87.62		1264	9.10	8.46-9.79	11077	90.90	90.21-91.54	
Current marital status							<0.001							<0.001
Single	736	15.88	14.57-17.28	3954	84.12	82.72-85.43		645	12.55	11.43-13.76	4045	87.45	86.24-88.57	
Live-in-partner only	7494	15.05	14.62-15.50	43873	84.95	84.50-85.38		6201	11.58	11.22-11.95	45166	88.42	88.05-88.78	
Married	2577	12.99	12.35-13.65	17563	87.01	86.35-87.65		1915	8.56	8.08-9.07	18225	91.44	90.93-91.92	
Widow	16	19.26	10.92-31.72	67	80.74	68.28-89.08		76	5.77	2.58-12.40	76	94.23	87.60-97.42	
Divorced/Separated	1329	16.87	15.76-18.05	7062	83.13	81.95-84.24		1113	12.09	11.24-13.00	7278	87.91	87.00-88.76	
Violence							<0.001							<0.001
No	9744	13.85	13.49-14.22	62214	86.15	85.78-86.51		7960	10.33	10.03-10.64	63998	89.67	89.36-89.97	
Yes	2408	20.11	19.19-21.05	10305	79.89	78.94-80.81		1921	14.32	13.53-15.14	10792	85.68	84.86-86.47	

Pregnancy							0.670							0.127
No	11730	14.75	14.39-15.11	70037	85.25	84.89-85.61		9569	10.95	10.66-11.25	72198	89.05	88.75-89.34	
Yes	422	15.13	13.46-16.97	2482	84.87	83.03-86.54		312	9.84	8.58-11.25	2592	90.16	88.74-91.42	
Number of children							<0.001							<0.001
Mean (95%-CI)		2.12	2.09-2.15		2.26	2.24-2.27			2.12	2.08-2.15	2.25		2.24-2.27	
Wealth index							<0.001							<0.001
Very poor	3144	16.19	15.48-16.93	17448	83.81	83.07-84.52		2570	12.16	11.58-12.77	18022	87.84	87.23-88.42	
Poor	3436	15.52	14.88-16.17	19185	84.48	83.83-85.12		3050	13.01	12.44-13.61	19571	86.99	86.39-87.56	
Medium	2535	14.99	14.24-15.77	15307	85.01	84.23-85.76		2016	10.78	10.19-11.40	15826	89.22	88.60-89.81	
High	1844	14.35	13.53-15.21	11915	85.65	84.79-86.47		1445	10.08	9.44-10.76	12314	89.92	89.24-90.56	
Very high	1193	12.10	11.25-13.00	8664	87.90	87.00-88.75		800	7.56	6.90-8.26	9057	92.44	91.74-93.10	
Health insurance							0.036							0.072
No	1826	14.00	13.23-14.79	11694	86.00	85.21-86.77		1477	10.34	9.68-11.04	12043	89.66	88.95-90.32	
Yes	10326	14.92	14.54-15.31	69825	85.08	84.69-85.46		8404	11.03	10.72-11.35	62747	88.97	88.65-89.28	
Area of residence							0.010							<0.001
Urban	8688	14.50	14.10-14.92	52479	85.50	85.08-85.90		7057	10.65	10.32-11.00	54110	89.35	89.00-89.68	
Rural	3464	15.57	14.87-16.29	20040	84.43	83.71-85.13		2824	11.73	11.19-12.30	20680	88.27	87.70-88.81	
Geographic region of residency							0.002							<0.001
Metropolitan Lima	1622	14.85	14.06-15.68	9061	85.15	84.31-85.94		957	8.46	7.86-9.09	9726	91.54	90.91-92.14	
Other areas of Coast region	3623	14.60	13.97-15.25	22828	85.40	84.75-86.03		2690	10.63	10.14-11.14	23761	89.37	88.86-89.86	
Highlands	3824	13.97	13.41-14.55	23450	86.03	85.45-86.59		3352	11.75	11.28-12.23	23922	88.25	87.77-88.72	
Jungle	3083	16.16	15.48-16.85	17180	83.84	83.15-84.52		2882	14.69	14.07-15.33	17381	85.31	84.66-85.93	

95%CI= 95% Confidence intervals; Weights and the design effect of the complex survey sampling were included; *Refers to the statistical significance obtained from the comparison of the proportions between the categories of the variables considering the complex sampling of the survey; ENDES = Demographic and Family Health Survey (ENDES by its acronym in Spanish).

Table 4

Crude and adjusted regression models to evaluate the association between the mother's age and the presence of acute respiratory infections and the presence of acute diarrheal diseases in children from Peru, ENDES 2015-2019.

Exposure		Acute respiratory infections					
		Crude model[a]			Adjusted model		
		PR	95%CI	*p*	PR	95%CI	*p*
Entire sample[b]							
	Adult mother	Ref.	—	—	Ref.	—	—
	Young mother	1.29	1.24-1.35	<0.001	1.18	1.12-1.24	<0.001
	Teenage mother	1.33	1.22-1.46	<0.001	1.11	1.01-1.22	0.045
Stratified by age of child[b]							
0 – 23 months	Adult mother	Ref.	—	—	Ref.	—	—
	Young mother	1.27	1.18-1.38	<0.001	1.26	1.15-1.39	<0.001
	Teenage mother	1.34	1.20-1.49	<0.001	1.26	1.10-1.45	0.001
24 – 59 months	Adult mother	Ref.	—	—	Ref.	—	—
	Young mother	1.29	1.22-1.37	<0.001	1.17	1.10-1.24	<0.001
	Teenage mother	1.10	0.93-1.31	0.268	0.95	0.79-1.13	0.531
		Acute diarrheal diseases					
Entire sample[c]							
	Adult mother	Ref.	—	—	Ref.	—	—
	Young mother	1.35	1.28-1.42	<0.001	1.18	1.11-1.25	<0.001
	Teenage mother	1.87	1.71-2.05	<0.001	1.22	1.10-1.35	<0.001
Stratified by age of child[c]							
0 – 23 months	Adult mother	Ref.	—	—	Ref.	—	—
	Young mother	1.21	1.13-1.30	<0.001	1.17	1.08-1.28	<0.001
	Teenage mother	1.26	1.14-1.40	<0.001	1.15	1.02-1.30	0.028
24 – 59 months	Adult mother	Ref.	—	—	Ref.	—	—
	Young mother	1.36	1.27-1.46	<0.001	1.20	1.10-1.30	<0.001
	Teenage mother	2.06	1.74-2.44	<0.001	1.65	1.39-1.98	<0.001

PR= prevalence ratio; 95%CI= 95% confidence intervals;
[a] A generalized linear model of the Poisson family with a log link was made considering the effect of the design and the weights of the complex sampling of the survey;
[b] Adjusted for the child's sex, age, and vaccination status, and for the mother's level of education, violence, health insurance, wealth index, area of residency, and number of children;
[c] Adjusted for the child's sex, age, and vaccination status, and for the mother's marital status, violence, wealth index, area, geographic region, and number of children.

Discussion

This study aimed to assess the association between mother's age and the presence of ARIs and AD in children under five years old. We found that ARIs cases as well as AD cases showed a greater proportion in children of teenage and young mothers, in comparison with children of adult females. Thus, we could identify a group of children in which these health problems would be more prevalent and would demand the development of strategies oriented to the prevention of these groups of diseases.

In relation to mother's age and the presence of AD in children under five years old, it was found that being a young or adolescent mother is related to a higher proportion of AD in children. Previous studies indicate that low educational level, as well as lack of hygiene, are related to higher prevalence of AD in children under the age of five.[18,19] The study's finding could be explained by the fact that an adolescent mother would probably have fewer years in the educational system than older mothers, which could translate into lower access to knowledge of AD, hygiene measures, and preventing diseases in infancy. In addition, given the current dynamic and fertility rate in Peru, it is more probable that a young mother has fewer children than an adult mother or that the analyzed information corresponds to her only child, which implies a lower experience concerning childcare; this could increase the risk of infections. Given that most of the factors associated with AD development in children under five years old are preventable, strategies should be implemented to limit the development of this disease, focused on groups such as teenage and young mothers.[20] These strategies should promote the increase of knowledge about the prevention and treatment of the disease, as well as hygiene measures for mothers and children, which would be useful for controlling AD.[21]

Concerning ARIs, it was found that the children of mothers in younger age groups (teenage and young people) had a greater probability of presenting this outcome. In the literature, it is described that educational level, specifically a low educational level of parents, is a factor related to the presence of ARIs in children under the age of five, which is present in low- and middle-income countries.[22] As it was described for AD, the lower age of a mother could be related to a lower level of knowledge of preventive measures and hygiene for children under five years old, which is a possible explanation for the reported finding. A higher educational level would not only be related to a lower number of ARIs cases but also to a higher identification of alarm signs in children under five years old with ARIs.[23] Hence, educational strategies to face this problem should focus on increasing the knowledge about this disease in teenage and young mothers. This knowledge should include preventive measures and alarm sign identification since it is relevant in the Peruvian population, as ARIs continues to be one of the main causes of death in Peru's children under five years old.[24,25] In addition, ARIs prevention is important in times of low temperatures, when, historically, higher morbidity and mortality rates are evidenced due to this problem in the Peruvian population under the age of five.[25]

In Peru, there is a decrease in the number of AD episodes in children under five years old attended annually (2014 to 2019: decrease from 600,000 to close to 400,000 cases).[26] Similarly, there is a reduction in the number of ARIs medical attention.[25,27] Despite this, both health problems constitute part of Peru's leading cause of morbidity and mortality in children under five. After 2019, during the COVID-19 pandemic in Peru, there has been a decrease in AD and ARIs cases in children under five years old, which can be attributed to lower exposure to social contact in this population subgroup, at school as well as at home and in public places[28,29] and due to the measurements to control COVID-19 transmission in the general population.[28] Because of this, identifying a children subgroup (those with adolescent or young mothers) with a higher probability of presenting ARIs or AD is crucial to the development of strategies to regulate or decrease the expected increase in cases of ARIs and AD in children under five years after COVID-19 pandemic was controlled.

Regarding the study limitations, given that in this study a secondary database was used (ENDES), some characteristics that can allow a better characterization of the study population could not be considered as covariates for the adjusted analysis used to evaluate the association between the variables of interest since they were not available. In addition, memory bias and social desirability bias could be present because the respondent mothers self-reported information on many characteristics included in the study. Moreover, the study's cross-sectional design does not allow the analysis of causality between the variables of interest. Despite the above, we consider that the use of a database (ENDES), whose methodology is widely used in the world (Demographic Health Survey methodology),[30] which has methodological quality controls whose sample allows the obtaining of representative results of the Peruvian population at the national and regional level, and that is used for the study of different health indicators in Peruvian populations, is an adequate source of information for the studied problem.

In conclusion, mothers' age was found to be associated with the presence of ARIs and AD in children under five. Children under five years old whose mothers are teenagers or youngsters show greater proportions of ARIs and AD compared to adult mothers' children. Thus, being a child of an adolescent or young mother is related to the presence of respiratory and digestive infectious diseases in children under five years old. Hence, strategies to reduce ARIs and AD, including the enhancement of promotion of healthy lifestyles and prevention of infectious diseases, can be developed, prioritizing resources for the children of teenage and young mothers.

Authors' contribution

Benites-Meza JK, Herrera-Añazco P, Carreazo NY, Bendezu-Quispe G, Soriano-Moreno AN, Benites-Zapata VA: conceptualization, formal analysis, interpretation of results, writing-original draft, writing-review & editing. All authors approve the final version of the article and declare no conflict of interest.

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