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Need for Health Promotion Based on Evidence in Cross Sectional School Health Data

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ABSTRACT

With the purpose of evaluating the health condition of children in public primary schools in the province of Cordoba in Argentina, cross sectional data were collected from the School Health Program of the Ministry of Health of Cordoba Province in 2001. To conduct an analysis, a total of 25,701 pupils of the first and the seventh grades from one hundred and fifty primary schools were studied. The data consisted of variables in three groups: i.e., nutrition, vaccination and disease groups. Descriptive statistics revealed a higher prevalence in scoliosis, lower weight, no scar from BCG vaccination and skin transmission diseases in urban and rural areas than in interurban areas, while male genital diseases showed a high prevalence in the three areas. Dental caries had a high prevalence in rural areas. Factor analysis was carried out and six factors were extracted out of 27 variables to cover 64 % of total variance. Regression analyses revealed that nutritional variables such as lower weight and the absence of BCG vaccination were significantly related to scoliosis, and that lower weight significantly affected skin transmission diseases. We considered the necessity of modifying conduct in the school health program from the viewpoints of health promotion and community participation.

Key words: *Health promotion, Risk factors and school health*

Several indicators have been proposed to measure the health conditions of children[5,23,34,38]. One of the health indicators, the infant mortality rate, has shown a remarkable decrease in the last twenty years (1980–2000) in Argentina, from 35 to 17 per 1000 live births, a 50% reduction. The child immunization rate has reached a level as high as 98% and the prevalence rate of child malnutrition was reduced during the period 1993–2000 from 12% to 5%[38]. Nevertheless, according to the Ministry of Health of the Nation[18] and data provided by FAO[10] in 1999, the infant mortality rate in the northern area of Argentina was around 33 per 1000 live births, and the percentage of chronic undernourishment was around 22% in the northwest and the northeast areas. A similar situation can be found in a national study of the anthropometric profile from FAO[10,11] and UNICEF that included a total of 102,716 pupils of six and seven years old, and showed that the average deficiency in height (chronic undernourishment) was 2.8% during the period 1991–1994. In comparison with the rate 6.6% during the period 1995–1996, the average deficiency by chronic undernourishment was more than double.

Data from FAO[9-11] showed a high prevalence of anemia (Hb < 110g/liter), which varied by region: 22% in the central region and 47% in Greater Buenos Aires. Studies among children from two years old in a highly concentrated population short of basic needs revealed a high prevalence of sub-clinical vitamin A deficiency, ranging from 26% to 46%[8]. Previous works[20] which focused on preschool children confirmed a high prevalence of iron deficiency.

As briefly explained above, there is heterogeneity in the health condition of children, although the health status of children averaged at the national level has been improved successfully[11]. The purpose of this paper is to analyze health conditions from the school health program in the province of Cordoba and to contribute to an improvement in child health conditions in Argentina, by making use of the findings obtained in this research.

We briefly explain historical changes in the school health system in Argentina below. In the first decade, after the beginning of the Democratic Era in Argentina in 1984, the Ministry of Health of Cordoba Province created the Division of School Health as the principal strategy of governmental activities in the health sector. The establishment of the Division of School Health contributed to fortify the activities of the local health systems and primary health care in accordance with the principles implemented by the Alma Ata Declaration[39]. In accordance with this goal, the Division of School Health executed a local school health pro-

gram called P.A.I.C.O.R[17] (Cordoba Integral Assistance School Health Program).

Immediately, a basic medical clinical formula was created that included a clinical physical examination, a visual acuteness test and screening for two vaccinations in the child profile: 1) a BCG vaccination profile, and 2) other vaccinations.

Jointly, with the creation of the School Health Program, lunch rooms were located in schools which offered nourishing meals to children who were exposed to some degree of nutritional risk. The School Health Program was applied, dividing the whole into three integral assistance areas: urban, interurban and rural areas, covering both pupils of first and the last (seventh) grades of public primary schools, respectively. The School Health Program operated through a system of automatic derivation, where teams of school health professionals were organized with two physicians per group, having a pool of schools designated during the school calendar year.

In the second decade from 1992, the School Health Program was reorganized in order to reinforce the decentralization process in health and to increase activities that were focused on secondary prevention. After nine years of the operation and registration of the activities carried out, specific and macroscopic signs have been detected that can be defined in order of priority as: 1) the absence of surveillance in the following activities, 2) the lack of reiterative diagnosis of specific diseases easily preventable by health promotion activities, 3) acute pediatric pathologies transformed to a chronic diagnosis, 4) no check on visits to health centers by screened pupils and 5) failure in the triangular communication between the physician, the pupils and the community.

We believe that all the items mentioned above can be researched to provide a real and multi faceted diagnosis of the School Health Program, which detects risk factors, and modifies the operation systems according to the real school situation. There has not been sufficient statistical analysis since 1984 although such analysis is essential for evaluation of the health promotion program. The analysis presented here is intended to contribute to the organization of the entire program, detecting gaps and giving priority to actions related to the three levels of prevention.

DATA AND METHODS

Data

The main data were provided by the Division of School Health of the Ministry of Health of Cordoba Province[17]. Some additional data on vaccination were taken from previous works[3].

The data were cross sectional and collected in 2001 from pupils of the first and seventh grades in one hundred and fifty public primary schools in Cordoba. The normal ages of the pupils of the first and the seventh grades were six and twelve years old, respectively.

The variables in the data consisted of three major groups: nutrition, vaccination and disease groups (Table 1).

The variables in the nutrition group were: normal weight, lower weight, lower height, lower weight-lower height and obesity. Normal weight is defined as the proportion of pupils who are of a weight between the 5 percentile and the 95 percentile, lower weight as the proportion of pupils who are of a weight located under the 5 percentile, lower height as the proportion of the pupils who are of a height under the 5 percentile, lower weight-lower height as the proportion of pupils who have both variables (weight and height) under the 5 percentile, and obesity as the proportion of pupils who are of a weight higher than the 95 percentile, respectively. In all nutrition variables the values used in the classification were taken from National percentile tables by age and

Table 1. List of the variables used in the analysis and their abbreviations

Variable	Abbreviation
1. Nutrition Group	
Normal weight	EUTRO
Lower weight	LOWW
Lower height	LOWH
Lower weight and lower height	LOWWH
Obesity	OBE
Pupils that eats in lunch school room	EAT
2. Vaccination Group	
2a. BCG Group (*)	
No scar	NOSCAR
One scar	ONESC
Two scars	TWOSC
2b. Other Group	
No Sabin	SSAB
No Double	SDOB
No Triple	STRIP
No Measles Vaccination	SANTIS
Full Vaccination	VACFULL
Without National vaccination book	SBOOKC
3. Diseases Group	
Scoliosis	COLPA
Flat foot	FOOP
Cryptorchidism	CRIPT
Phimosis	FIMO
Balano Preputial Adhesion	ADHPREP
Myopia	DIAV
Cardiac murmur	SOULFF
Dental caries	DENTPA
Pediculosis	PEDIC
Scabiosis	ESCA
Piodermatitis	PIODER
Mycosis	MICO

(*) The sum of these three variables is not 100% due to incomplete collection of data.

by sex[26]. The variable representing the proportion of pupils who eat in school lunch-rooms was included in this group.

Two types of vaccines were studied in the variables of the vaccination group: 1) BCG vaccine and 2) specific vaccines according to the national schedule for vaccination calendar[25] such as sabin (immunization against poliomyelitis), double immunizations (immunization against tetanus and diphtheria), triple immunization (DPT, immunization against tetanus, diphtheria and whooping cough) and measles immunization.

With respect to BCG vaccine, the data were collected by two methods: 1) by access to the national vaccination book of each pupil and 2) by observing the BCG scar on the skin of pupils. The variables involved were: no scar (regarded as no vaccination with BCG), one scar (regarded as vaccinated with one dose of the BCG vaccine), and two scars (regarded as vaccinated with two doses of BCG). The data from BCG vaccination obtained according to the second method mentioned provided greater accuracy of data.

In the other variables in the vaccination group, the data were extracted only by access to the national vaccination book held by each pupil, while the proportion of pupils not vaccinated against double, triple, sabin and measles was calculated according to the national pediatric vaccination calendar[25]. In this case, the variables taken were no sabin, no double, no triple, and no measles immunization. The variables of full vaccination were extracted considering the completed vaccine schedule, and the variable without national vaccination book was defined as the proportion of pupils without a national vaccination book.

Data provided by pediatric examinations were used as variables of the disease groups. They included the following diseases: 1) scoliosis, 2) flat foot, 3) cryptorchidism, 4) phimosis, 5) balano preputial adhesion, 6) acute visual decrease, 7) cardiac murmur, 8) dental caries, 9) pediculosis, 10) scabiosis, 11) pyodermatitis, and 12) mycosis. The selection of the diseases mentioned above, as well as the criteria for their diagnosis, were based on the protocol of two school health programs in Chile[13] and Spain[30]. The data were collected from the specific health checks at schools by physicians. In the case of scoliosis, for example, diagnosis was based on back, lateral and frontal views, and by the physicians detecting asymmetry of backs and /or one-sided prominence of shoulders or shoulder blades[35]. Any child with an identified spinal deformity was referred for further evaluation to the health centers.

Methods of analysis

Prevalence rates were calculated for each variable, using the total number of pupils in each school. Descriptive statistics were illustrated with the purpose of showing the prevalence of the diseases by region. Moreover, factor analysis was carried out to seek common factors in order to summarize all the variables incorporated in this research. Regression studies were carried out using the disease groups as dependent variables, and the nutrition, vaccination and disease groups as independent variables. All the statistical analysis performed was carried out with a statistical analysis software package, Systat 7.0 for Windows.

RESULTS

Descriptive statistics

Descriptive statistics were illustrated by grade and by region with the purpose of showing the profile of specific diseases and of making a diagnosis of school health conditions according to prevalence rates (Table 2). According to the average prevalence rates, specific diseases were selected and presented in order to show: 1) the important association between lower weight, scoliosis and no scar from BCG vaccination illustrated by the high prevalence in rural and urban areas in contrast with the low prevalence in interurban areas (Fig.1); 2) skin transmission diseases, such as pediculosis, scabiosis, pyodermatitis and mycosis illustrated by region jointly with lower weight, showed a high prevalence of pediculosis, scabiosis, pyodermatitis, mycosis and lower weight in rural areas, in contrast with a high prevalence only in particular diseases in urban and interurban areas (Fig.2); 3) the higher prevalence of dental caries in rural areas than in urban and interurban areas (Fig.2), and 4) a regional pattern of male genital diseases different from the one observed in Fig. 2 (Fig. 3).

In Table 2 we see extraordinary sex ratios: the numbers of male pupils are much larger than those of female pupils. The percentage of male pupils is about 70% on average. This can be partly explained by the gender discrimination whereby parents expect a higher education for boys than for girls.

Factor Analysis and Essential Structure of the Variables

In order to find common factors and summarize all the variables of the nutrition, vaccination and disease groups, factor analysis was carried out with 27 variables.

Six factors in which the eigen values were larger than unity could explain the following percentages of total variation: 23.8%, 10.4%, 10.7%, 7.6% 6.56% and 5.2%. Cumulatively, 64% of total variance was explained (Table 3).

The meaning of the factors can be understood according to the charge of the original variables included (see the charge for each variable underlined in Table 4). In the first factor, the variables

Table 2. Number of cases of variables by region by grade in pupils of the first and the seventh grades in public primary schools, Cordoba, Argentina, 2001.

Region	Urban				Interurban				Rural			
Grades	1 Grade		7 Grade		1 Grade		7 Grade		1 Grade		7 Grade	
Variables	Cases	(%)	Cases	(%)	Cases	(%)	Cases	(%)	Cases	(%)	Cases	(%)
a) Nutrition Group												
Normal weight	3546	52.2	2636	37.0	1443	93.2	830	55.5	1991	43.7	680	16.1
Lower weight	2975	43.8	3789	53.1	30	1.9	530	35.4	1815	39.9	2114	50.3
Lower height	66	0.9	97	1.3	25	1.6	55	3.6	137	3.0	159	3.7
Lower weight and lower height	73	1.0	78	1.0	12	0.7	20	1.3	5	0.1	1220	29.0
Obesity	135	1.9	258	3.6	27	1.7	13	0.8	48	1.0	12	0.2
b) Vaccination Group												
b.1.) BCG Vaccination												
No scar from BCG vaccination	2394	35.2	3211	45.0	113	7.2	209	13.9	2192	48.2	1939	46.1
One scar from BCG vaccination	1548	22.8	1974	27.7	455	29.3	312	20.8	1159	25.4	1244	29.6
Two scars from BCG vaccination	981	14.4	857	12.0	901	58.2	711	47.5	1058	23.2	948	22.5
b.2.) Other vaccines												
No double	4220	62.1	2652	37.2	1362	87.9	1078	72.1	4045	88.9	3741	89.0
No triple	3235	47.6	2533	35.5	1187	76.6	993	66.4	3985	87.6	3589	85.4
No sabin	2990	44.0	2428	34.0	1234	79.7	984	65.8	3785	83.2	3520	83.8
No measles	2729	40.1	2284	32.0	1176	75.9	842	56.3	3653	80.3	3362	80.0
c) Diseases Group												
Pediculosis	859	12.6	1690	23.7	315	20.3	189	12.6	2245	49.3	2198	52.3
Scabiosis	76	1.1	24	0.3	29	1.8	13	0.8	1283	28.2	1336	31.8
Pyodermatitis	350	5.1	18	0.2	4	0.2	7	0.4	796	17.5	883	21.0
Mycosis	57	0.8	45	0.6	16	1.0	13	0.8	876	19.2	771	18.3
Scoliosis	2788	41.6	3599	50.2	139	8.9	199	13.3	2200	48.3	2900	69.0
Flat foot	472	6.9	351	4.9	192	12.4	114	7.6	716	15.7	725	17.2
Myopia	388	5.7	473	6.6	127	8.2	169	11.3	2079	45.7	2804	66.7
Cardiac murmur	160	2.3	89	1.2	11	0.7	28	1.8	417	9.1	335	7.9
Cryptorchidism†	3345	73.9	2681	67.2	1161	92.8	939	89.4	3128	78.3	2800	89.9
Phimosis†	2172	47.9	956	21.1	300	24.0	252	24.0	1915	47.9	1089	34.9
Balano preputial adhesion†	2353	51.9	3030	75.9	928	74.2	798	76.0	2075	51.9	2023	65.0
Dental caries	1567	23.8	1004	14.0	472	30.4	275	18.3	2682	58.9	2565	61.0
d) Other variables												
Without National Vaccination Book	363	5.3	1102	15.4	407	26.2	398	26.6	1316	28.9	3481	82.9
Pupils who eat lunch in school rooms	2063	30.3	1369	19.2	788	50.9	592	39.5	4520	99.4	4099	97.6
Total of pupils by region by grade	6789	100.0	7123	100.0	1548	100.0	1495	100.0	4547	100.0	4199	100.0
†Total of male pupils by region by grade	4526	100.0	3988	100.0	1250	100.0	1050	100.0	3991	100.0	3112	100.0a

†Male genital diseases. Percentage among males.

of large score selected were: pediculosis, scabiosis, pyodermatitis, mycosis, myopia, normal weight, two scars from BCG vaccination, obesity, lower weight, no scar from BCG vaccination and scoliosis. Specific association by the Pearson correlation coefficient was found, identifying values with a high correlation in some of the variables selected in the first factor, such as: lower weight and scoliosis (0.810 in the first grade, and 0.731 in the seventh grade), lower weight and pediculosis, (0.597 in the first grade, and 0.688 in the seventh grade), lower weight and scabiosis (0.689 in the first grade, and 0.734 in the seventh grade), lower weight and no scar from BCG vaccination (0.822 in the first grade and 0.658 in the seventh grade) and finally no scar from BCG vaccination and scoliosis (0.782 in first the grade, and 0.736 in the seventh grade). The second factor had a high score in variables defined by the absence of specific vaccines i.e., double, triple, sabin, and measles, showing the importance of the vaccination. In the third factor the high scores were observed in pediatric skin diseases such as pyodermatitis and mycosis, and other diseases such as cardiac murmur and flat foot, where activities in health promotion are essentials in successful treatment. The fourth factor was characterized by variables such as full vaccination, pupils who eat lunch in school rooms, and male genital diseases (e.g., cryptorchidism and balano preputial adhesion). In the fifth factor the variables selected were the absence of a national vaccination book in pupils, in addition to incomplete vaccination of BCG (one dose), and finally in the sixth factor chronic nutritional variables such as lower weight-lower height and lower height were identified showing a common pathological association to natural undernourishment history. In conclusion, in spite of the fact that the

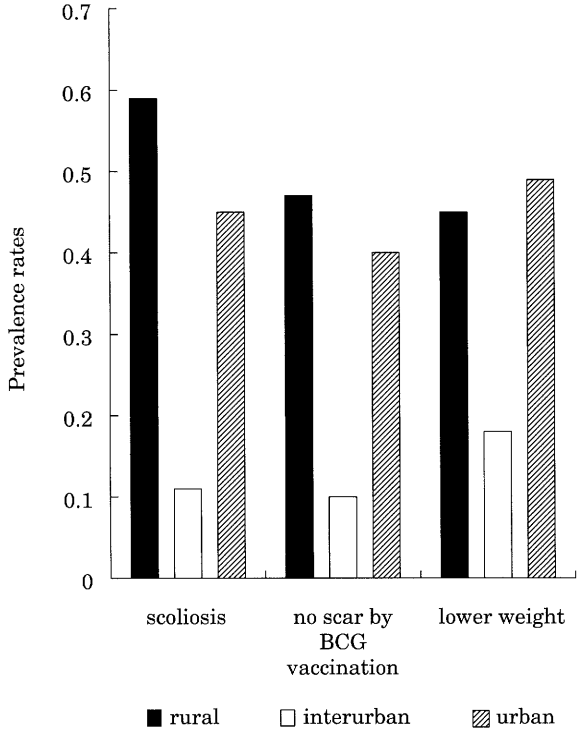

Fig. 1. Prevalence rates of scoliosis, no BCG vaccination and lower weight in pupils of the first and the seventh grades in public primary schools in Cordoba, Argentina, 2001.

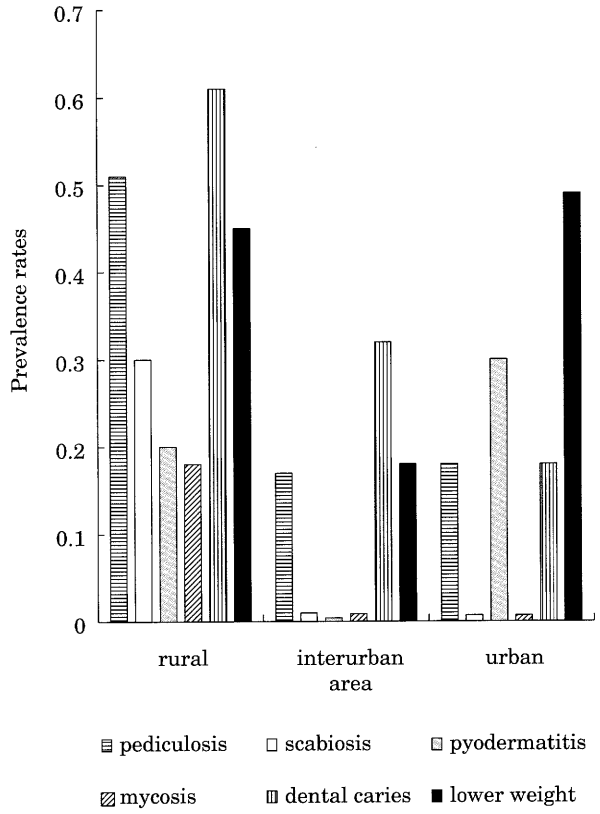

Fig. 2. Prevalence rates of skin transmission diseases, dental caries and lower weight in pupils of the first and the seventh grades in public primary schools in Cordoba, Argentina, 2001.

factors extracted were different ones, observed variables associated with each factor can be explained by the common situation that health promotion activities were insufficient in the different prevention levels. Factor one can be called a major association factor where the variables selected had high Pearson correlation coefficients. Factor two can be identified as a vaccination factor. Factor three and factor four are represented by variables of chronic pediatric diseases of the skin and cardiac system (factor three) and male genital pediatric diseases (factor four), all of which it is important to prevent in the early stages. Factor five the absence of one dose of BCG vaccine in addition to the absence of a national vaccination book record, can be understood as two associated health promotion activities at, and the last factor can be called a nutritional factor, and is associated with two kinds of nutritional variables (Table 4).

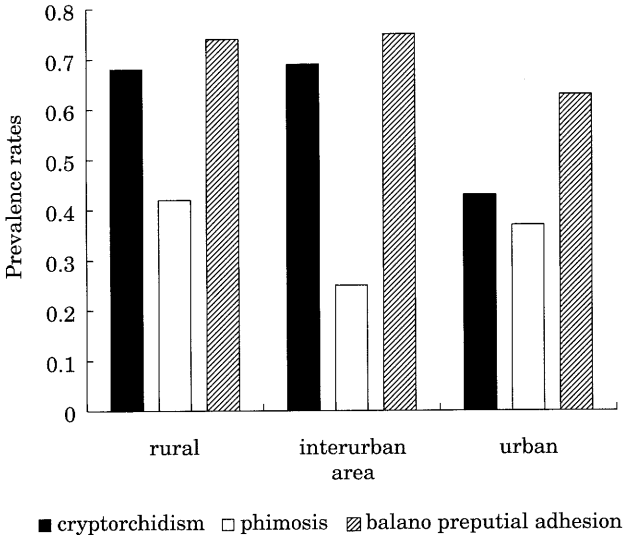

Fig. 3. Prevalence rates of male genital diseases in pupils of the first and the seventh grades in public primary schools in Cordoba, Argentina, 2001.

Regression study

Regression analyses using forward stepwise selection were carried out with the purpose of revealing the risk factor of the specific diseases. In these analyses we selected the disease group as dependent variables, and nutrition, vaccination and disease groups as independent variables. Analyses where lower weight and scoliosis were dependent variables were also executed.

According to the parameters mentioned in the methodology section, the following seven diseases were selected as having high R^2 values (≥ 0.50): lower weight ($R^2 = 0.729$), scoliosis (0.705), scabio-

Table 3. Eigen values and percentage of total variance explained

Factor	Eigen Values	Percentage of Total Variance explained	Accumulative percentage of Total Variance explained
1	6.450	23.889	23.889
2	2.821	10.447	34.336
3	2.892	10.710	45.046
4	2.068	7.661	52.707
5	1.771	6.560	59.267
6	1.355	5.018	64.285
7	0.937	3.469	67.754
8	0.869	3.218	70.972
9	0.772	2.861	73.833
10	0.754	2.791	76.467
11	0.711	2.634	79.101
12	0.644	2.386	81.487
13	0.557	2.062	83.549
14	0.513	1.899	85.448
15	0.489	1.812	87.26
16	—	—	—
17	—	—	—

Table 4. Factors obtained by factor analysis

	After Axis Rotation					
Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
LOWW	0.862	0.019	0.218	–0.057	0.163	–0.011
COLPA	0.821	0.049	0.164	–0.026	0.117	0.124
NOSCAR	0.884	0.059	0.032	–0.049	0.02	0.058
ESC	0.693	0.232	0.404	–0.004	0.056	0.155
DIAV	0.699	0.073	0.314	0.055	0.043	0.175
PEDIC	0.723	–0.032	0.209	0.085	–0.249	0.038
PIODERM	0.482	0.215	0.655	0.070	–0.009	0.077
MICO	0.472	0.205	0.593	0.019	–0.013	0.21
EUTRO	–0.802	–0.030	–0.069	0.131	–0.316	–0.118
TWOSC	–0.791	–0.134	0.054	0.134	0.241	–0.026
OBE	–0.623	–0.204	–0.029	0.106	–0.209	0.057
SSAB	0.094	0.847	0.065	–0.009	0.002	0.019
STRIP	0.158	0.822	0.070	0.024	–0.018	–0.015
SDOB	0.048	0.792	–0.068	0.017	0.032	–0.043
SANTIS	0.123	0.686	0.162	–0.114	0.007	0.163
FOOP	0.227	0.049	0.695	–0.003	–0.182	–0.216
SOULFF	0.222	0.027	0.606	0.034	0.083	0.355
VACFULL	0.008	–0.126	0.231	0.775	0.147	–0.188
ADHPR	–0.186	0.055	–0.214	0.725	0.109	0.221
EATCO	0.171	–0.143	0.211	0.633	–0.342	–0.125
CRIPT	–0.225	0.121	–0.512	0.571	–0.033	–0.064
SBOOKC	–0.042	0.002	–0.030	–0.032	–0.698	0.034
ONESC	–0.182	–0.012	0.177	–0.027	–0.806	0.043
FIMO	–0.326	0.240	–0.384	0.312	0.035	0.358
LOWH	–0.012	0.048	0.038	0.057	–0.164	0.652
LOWWH	0.206	–0.002	0.263	–0.140	0.066	0.619
DENTPA	0.472	–0.023	0.421	0.132	–0.314	0.115

sis (0.695), pyodermatitis (0.619), mycosis (0.582), pediculosis (0.555) and myopia (0.554).

Analysis of lower weight and scoliosis as dependent variables

It is reasonable that lower weight and scoliosis showed a strong relationship with each other. It is remarkable that no scar from BCG vaccination was a significant independent variable in both diseases (Table 5). The regression coefficient and standardized regression coefficient showed the highest values for lower weight, lower weight and lower height and no scar from BCG vaccination with respect to the rest of the analyzed diseases. A disease such as scabiosis was a significant variable in both diseases (scoliosis and lower weight as

dependent variables), while pediculosis had a significant relation with lower weight.

Analysis of skin diseases and other diseases as dependent variables

Acute skin diseases, such as pediculosis, showed a direct relation to vaccination variables and to the lower weight variable (Table 5). Chronic skin diseases had a special association with other chronic diseases such as pyodermatitis, mycosis and cardiac murmur (Table 5). Myopia as a dependent variable had a complicated association with BCG vaccination (one and two scars from BCG vaccination). Nevertheless, scoliosis and dental caries had the largest regression and standardized regression coefficients.

Among the variables concerning the regression analyses, lower weight and scoliosis seemed to have special importance. Four skin diseases were selected for the final regression study, one as an acute skin disease (pediculosis) and the rest as chronic skin diseases (pyodermatitis, scabiosis and

Table 5. Regression analyses of disease group by nutrition, vaccination and disease groups

Dependent Variables	Independent Variables	Regression Coefficient	Standardized Regression Coefficient
Lower weight (R^2 = 0.729)			
	Scoliosis (COLPA)	0.264	0.295**
	No scar from BCG vaccination (NOSCAR)	0.212	0.205**
	Scabiosis (ESC)	0.263	0.215**
	Pediculosis (PEDIC)	0.184	0.176**
Scoliosis (R^2 = 0.705)			
	Scabiosis (ESC)	0.147	0.107*
	Lower weight (LOWW)	0.397	0.354**
	Lower weight and lower height (LOWWH)	0.422	0.090*
	No scar from BCG vaccination (NOSCAR)	0.372	0.321**
	Myopia (DIAV)	0.153	0.137**
Scabiosis (R^2 = 0.695)			
	Pediculosis (PEDIC)	0.108	0.126*
	Pyodermatitis (PIODER)	0.267	0.204**
	Mycosis (MICO)	0.278	0.221**
	Lower weight (LOWW)	0.230	0.282**
	Scoliosis (COLPA)	0.117	0.160*
	No double (SDOB)	0.225	0.138**
Pyodermatitis (R^2 = 0.619)			
	No measles immunization (SANTIS)	0.073	0.084*
	Flat foot (FOOP)	0.233	0.204**
	Mycosis	0.321	0.334**
	Cardiac murmur (SOULFF)	0.217	0.101*
	Scabiosis (ESC)	0.184	0.241**
	Lower weight (LOWW)	0.087	0.139*
Mycosis (R^2 = 0.582)			
	Pyodermatitis (PIODER)	0.415	0.398**
	Cardiac murmur (SOULFF)	0.320	0.143*
	Scabiosis (ESC)	0.227	0.286*
	Lower weight (LOWW)	0.352	0.129*
Pediculosis (R^2 = 0.555)			
	Scabiosis (ESC)	0.239	0.205**
	Lower weight (LOWW)	0.290	0.304**
	Dental caries (DENTPA)	0.174	0.183**
	No scar from BCG vaccination (NOSCAR)	0.217	0.220**
	One scar from BCG vaccination (ONESC)	0.223	0.164**
	No measles immunization (SANTIS) –0.133	–0.100*	
Myopia (R^2 = 0.554)			
	Dental caries (DENTPA)	0.347	0.348**
	Two scars from BCG vaccination (TWOSC)	–0.222	–0.234**
	One scar from BCG vaccination (ONESC)	–0.287	–0.202**
	Scoliosis (COLPA)	0.306	0.343**

(*) $p \leq 0.05$
(**) $p \leq 0.01$

mycosis). All had a significant and uniform relation with lower weight as an independent variable (when lower weight increases then skin diseases uniformly increase). Pyodermatitis, pediculosis and scabiosis showed a uniform association with vaccination groups, and finally myopia had a complicated relation to the BCG vaccination group and a uniform relation to scoliosis. It is reasonable to assume as a final conclusion in this model that there are two principal diseases that have a high prevalence association, scoliosis and lower weight, both associated with the absence of BCG vaccination. Lower weight as a risk factor can be understand in two different ways: 1) as a risk factor for scabiosis, pyodermatitis, mycosis, and pediculosis due to the lower immunological status of a child that has lower weight, and 2) as a secondary sign due to scoliosis. In both cases we detected the presence of a vicious circle in the analyses of scoliosis, lower weight, pyodermatitis, pediculosis, scabiosis, mycosis and myopia having vaccination variables as a risk factor.

DISCUSSION

We first review several important points obtained in our analyses and consider their background. After giving a brief account of the methodological limitations of our analyses of cross sectional data, we critically review the present school health program and suggest some ideas for its improvement.

In descriptive statistics several important points have been revealed as results of our analyses. 1) A strong correlation between lower weight, lower weight-lower height and scoliosis. It is natural to consider that scoliosis can be caused by malnutrition. This could be explained through the natural history of the disease in reference to the developmental stage of malnutrition (lower weight as acute malnutrition, and lower height and lower weight-lower height as chronic malnutrition) with bone complications following afterwards[4,7,29,31-33]. 2) These undesirable correlations are also related to the absence of vaccination as indicated by no scar from BCG vaccination. Previous works[1] have shown that a low prevalence rate of infant tuberculosis was observed in areas with a high vaccination rate. In addition to this direct effect of BCG, there may be an indirect effect. A high prevalence rate of BCG vaccination may contribute to the improvement of more general health conditions. 3) Morbidity prevalence rates in the interurban area were much lower than other areas for many diseases excepting for male genital diseases. 4) Male genital disorder had a higher prevalence in the first and the seventh grades. There is a possibility that preventive effort may be absent or, even if present, not effective.

An important viewpoint concerning the decrease of vaccination coverage is the economic crisis suffered from 1999. According to reports produced by the World Bank[37] at the end of 2001, there was a delay in vaccine supply to the provinces equivalent to the stock needed for an entire quarter during the same year and also in 2000 the supply of vaccine was erratic with 30% of the total infant population not having access to at least one of the vaccines provided by A.I.P. (Amplified Immunization Program). The national government is the coordinator for submitting the vaccination doses to each province. The economic crisis may have another aspect at the personal level. At the national level, the incidence of poverty defined by the National Institute of Statistics and Census[19] was around 52% in urban areas and 73% in rural areas. The definition is based on the satisfaction of basic needs such as water supply, education for children and employment, etc. In Cordoba province official estimates[27,36] revealed that 43.5% of households and 55.2% of citizens were below the poverty line. People who live in poverty have greater difficulty in accessing the vaccination service provided at health centers even though the service is free of charge.

Remarkable points were also revealed concerning the interurban area: 1) A lower prevalence of scoliosis, lower weight, skin diseases and no scar from BCG vaccination than in urban and rural areas. This situation is attributable to the influence of new health care centers that have been established by the prefectures. 2) A high prevalence of male genital diseases. This may be associated with a special religious community called Jehovah's Witnesses who live in the interurban area. They constitute 37.5%~40% of the total interurban population. Jehovah's Witnesses cannot accept medical care that may include a blood transfusion. Because of this religion taboo, specific genital diseases such as cryptorchidism (chronic stage), balano preputial adhesion and other diseases that may require surgery and blood transfusion as treatment must are inevitably.

Another important point is dental caries. The low percentage in urban areas can be explained by the higher distribution of dental clinics in urban areas than in interurban and rural areas.

The results from factor analysis summarized all the variables incorporated in this research and six factors were extracted, each named according to the interpretation of the variables with large scores. In the regression analysis of scoliosis, we observed that lower weight and no scar from BCG vaccination had strong association. Other diseases selected according to R^2, such as scabiosis, pediculosis and pyodermatitis, were associated uniformly with lower weight. It is likely that lower weight is a condition conducive to skin diseases. Variables from the vaccination group, such as no double, one scar, and no scar from BCG vaccination, were also uniformly associated with specific skin diseases

such as scabiosis and pediculosis. In conclusion, we found that nutritional conditions such as lower weight and lower weight-lower height were uniformly associated with scoliosis. Moreover, other skin diseases (pediculosis, scabiosis, pyodermatitis, and mycosis) were also uniformly associated with lower weight. The absence of specific vaccines mentioned above could be a secondary factor in the prevalence of these skin diseases closing this circular association of special diseases extracted according to high R^2 values. Malnutrition is a risk factor conducive to specific diseases (scabiosis, pediculosis, measles and tuberculosis, etc) affecting the immunological profile in the child health condition.

We consider lower weight as a risk factor because lower weight is a social variable in Latin countries, influenced by the absence of food supply among children. In the regression study, lower weight is uniformly associated with skin transmission diseases more specifically, with pediculosis, scabiosis and mycosis which are typically associated with poverty. The circular association with lower weight shows the importance of nutritional status in children and the influence in the immunological profile of the prevalence of these diseases.

At the moment there is no available data from the school health program of provinces other than Cordoba, except for specific works on infant turberculosis and iron deficiency among children[1,20]. It is difficult to draw precise conclusions only from analyses of cross sectional data because this method allows several possible interpretations of data. When a higher prevalence is observed in the cross sectional data among seventh grade pupils than in first grade pupils, this may be caused by the aging process of pupils. On the other hand, is equally probable that it is caused by the cohort effect: the pupils of the seventh grade already had a high prevalence rate when they were in the first grade seven years before. In our research, we carefully considered which case was more likely for each specific problem. This was done by focusing on the type of variable. If the variable was typified as a social variable (for example, the nutrition group) it is reasonable to understand that the prevalence rate was large seven years before. In contrast, if the variable was identified as a biological variable (scoliosis, chyptorchidism or myopia, etc), the explanation will be in concordance with the absent of treatment, or a deficiency in the health promotion activities carried out.

In addition the accuracy of data must be focused upon to avoid a misleading interpretation. We observed a disparity in the total percentage of cases with respect to the total number of pupils to be checked. This situation is attributable to numerous factors including: 1) absence from school (infant prostitution, child worker, etc), 2) type of work area (physicians who work in the urban area may not have collected the data in the time required), 3) type of relationship with school authorities in relation to the help received from teachers, directors etc as collaborators in data collection.

Some of the several important points we found can be attributed to the insufficiency or failure of the present school health program, as follows: 1) The school health program was created mainly by the Ministry of Health of Cordoba without the participation of community health centers at the prefectural level. This separation and lack of coordination has had an effect on the health attention normally given by schools, with the consequence that diseases which are highly preventable and easy to reduce are transformed in the long term into chronic diseases (e.g., genital male diseases, scoliosis, in the seventh grade, etc). Previous works[14-16] show the importance of integrating of the health care centers that are dependent on the prefecture to primary health care programs and community participation in schools based on the health centers. 2) The fact that a higher prevalence of the absence of two scars from BCG vaccination is observed in the seventh grade than in the first grade is synonymous with missed opportunities for vaccination. Specific research has revealed that 52% of missed opportunities for vaccination are caused by professionals[12], due mainly to the lack of coordination between health centers and the provincial office. 3) The presence of male genital disorders in children of the seventh grade, identified as highly preventable diseases by means of health promotion, provides a target for improvement by the integration of community participation in this area.

Surveillance of school health does not cover pupils from the second grade to the sixth grade. Moreover, some diseases that can be easily prevented and treated at the early stage develop to the chronic stage. These failures are due to the insufficiency of health promotion and community participation in health care. Numerous programs in school health care are based only on screening and physical examination[24,28].

Thus it is concluded that an urgent change in the policy of the school health program is necessary, focusing on two topics: 1) urgent policy intervention, 2) health surveillance. It is important to promote these in order to make health centers more efficient.

New strategies should be devised with the participation of the community focusing on specific objectives such as increasing the health promotion activities of professional physicians toward the school community[6,21,22]. It is also necessary to produce a substantial change in the information systems and data analysis of this program[2], by

involving other departments such as health statistics, unifying criteria in the analysis of collected data and supervising the activities carried out in each area.

From the findings obtained by data analysis, we expect this research will contribute to reorganizing the school health program, focusing on the gaps in the methodology to be carried out according to the diagnosis and providing a concrete health condition diagnosis of the pupils of the province of Cordoba. The results obtained by this research will be also useful for future interventions in health care programs by other departments such as Epidemiology, Immunization and Maternal and Infancy, working jointly toward common goals.

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REFERENCES

1. **Baspineiro, B., Monroy Palacios, O., Quiroga, E., Pagano, H. and Yaique, M.A.** 1998. Epidemiological behavior of the infant tuberculosis in Jujuy province. Archivos Argentino de Pediatria. **96:** 89–94.
2. **Batista, R. and Salabarria, L.** 1995. La vigilancia en salud a nivel de atencion primaria. Revista Cubana de Medicina Integral. **2:** 1.
3. **Beltran, N.** 2001. Epidemiological profile of vaccination state of pupils in primary schools of the Cordoba province. 1995–2001. Revista de la Facultad de Ciencias Medicas.U.N.C. **56:** 12–23.
4. **Buenos Aires National University. Faculty of Medicine.** "Situacion de Salud de la mujer, el niño y el adolescente. Salud del niño en edad escolar". Programa Materno Infantil de la Provincia de Buenos Aires-Argentina- Home Page. (online), available from <http://www.fmed.uba.ar/mspba/linessit.htm#ses>, (last accessed 2003–11–10).
5. **Busso, N.F.** 2001. Los nuevos desafios de la mortalidad Infantil. Archivos Argentinos de Pediatria. **99:** 144–149.
6. **Corteguera, R.** 2000. Strategies for decrease the infant Mortality in Cuba 1959–1999.Revista Cubana de Pediatria. **72:** 147–164.
7. **Durstchi, A.** 1999. "Deficiency Diseases and Good Nutrition. Determining Deficiency Diseases Caused by Malnutrition". Determining Deficiency Diseases Because of Malnutrition. (online), available from <http://waltonfeed.com/self/health/vit-min/summary.html>, (last accessed 2003–12–03).
8. **Escobal, N., Lejaraga, H., Reybaud, M., Picasso, P., Lotero, J., Pita de Portela, M.L. and Rio De Gomez del Rio, M.E.** 1999. Deficiency of Vitamin A in infant population of high social risk in Argentina. Archivos Argentino de Pediatria. **97:** 291–299.
9. **FAO. Food and Agriculture Organization of the United Nations.** 1999. Perfiles Nutritionales por paises. Argentina. **23:** 26.
10. **FAO. Food and Agriculture Organization of the United Nations.** 1999. "Economic and Social Department: Food and Nutrition: Nutrition country profiles". UN Food and Agriculture Organization. (online), available from <ftp://ftp.fao.org/es/esn/nutrition/ncp/ARGmap.pdf>, (last accessed 2003–12–03).
11. **FAO. Food and Agriculture Organization of the United Nations.** "Economic and Social Department: Food and Nutrition: Nutrition country profiles". UN Food and Agriculture Organization. (online), available from <http://www.fao.org/es/esn/nutrition/arg-e.stm>, (last accessed 2003–12–03).
12. **Federicci M.I., Gatica, C.I., Nalda, G., Pannocchia, C.G., Racioppi, L.F. and Senosiain, M.L.** 1999. Missed Opportunities for vaccination. Participation of Health Sector. Archivos Argentino de Pediatria. **97:** 3–6.
13. **Government of Chile. National Council of School Health.** "Junaeb: Operacion de los Programas. Programa de Salud Escolar". Bienvenidos al sitio web de JUNAEB. Junta Nacional de Auxilio Escolar y Becas. (online), available from <http://www.junaeb.cl/3saluesc.htm>, (accessed 2003–12–03).
14. **Hersch Martinez, P.** 1992. Social Participation in Health: spaces and actors determining its development. Salud Publica Mex. **34:** 678–688.
15. **Lear, J.G.** 1992. Building a Health Education Partnership: The role of school-based health centers. Pediatric Nurs. **18:** 172–173.
16. **Lear, J.G., Montgomery, L.L., Schilitt, J.J. and Rickett, K.D.** 1996. "Key issued Afectting School Health Centers and Medicaid". Journal of School Health. **66:** 83–88.
17. **Ministry of Health of Province of Cordoba. General Secretary.** "P.A.I.COR". Gobierno de la Provincia de Cordoba. (online), available from <http://www.cba.gov.ar/vercanal.jsp?idCanal=9218>, (last accessed 2003–12–03).
18. **Ministry of Health of the Nation Argentina.** "Estadisticas: nacidos vivos, defunciones menores de un ano". Ministerio de Salud de la Nacion. (online), available from <http://www.msal.gov.ar/htm/site/tablas_estadistica.asp>, (last accessed 2003–12–03).
19. **National Institute of Statistics and Census of Argentina.** "Estadistica de la pobreza e indigencia en el total urbano y EPH y por region estadistica-Mayo 2003". INDEC: INSTITUTO NACIONAL DE ESTADISTICA Y CENSOS DE LA REPUBLICA ARGENTINA. (online), available from <http://www.indec.mecon.ar/>, (last accessed 2003–12–03).
20. **O'Donnell, A.M.** 1997. Preventing Iron Deficiency in Infants and Preschool Children in Argentina. Nutrition Reviews. **55:** 189–194.

21. **Panamerican Health Organization.** 2001. "Health promoting schools: Health promotion an innovative and effective approach". PAHO. (Online), available from http://paho.org/English/DPI/100/100/feature47.htm), (last accessed 2003–12–03).
22. **Panamerican Health Organization.** "Sobre Escuelas Promotoras de Salud". Sobre Escuelas Promotoras de Salud. (online), available from, <http://www.paho.org/Spanish/HPP/HPM/HEC/hs_about.htm>, (last accessed 2003–12–03).
23. **Panamerican Health Organization.** 2000. Argentina: Health Situation Analysis and Trends, 1986–1995. Epidemiological Bulletin. **21:** 1.
24. **Petersen, M.C., Piasco, M. and Polack, D.** 1994. El examen medico de ingreso a primer grado en un distrito escolar de la ciudad de Buenos Aires. Archivos Argentino de Pediatria. **92:** 333–337.
25. **Pediatric Argentina Society.** "Sociedad Argentina de Pediatria: calendario de vacunaciones recomendado por la SAP". Portal de la Sociedad Argentina de Pediatria. (online) available from <http://www.sap.org.ar/comunidad/info/vacunas.htm>, (last accessed 2003–12–03).
26. **Pediatric Argentina Society.** "Sociedad Argentina de Pediatria: Graficas para la Evaluacion del Crecimiento- 2da Edicion". Portal de la Sociedad Argentina de Pediatria (online) available from <http://www.sap.org.ar/profesionales/percentilos/index.htm>, (accessed 2003–12–03).
27. **President of the Nation. National Council of Social Politics. Siempro. Sistema de Informacion, Monitoreo y Evaluacion de Programas Sociales.** "INFORME DE LA SITUACION SOCIAL DE LA PROVINCIA DE CORDOBA- mayo 1998-Mayo 2002". Sistema de Informacion, Monitoreo y Evaluacion de Programas Sociales| **SIEMPRO**. (online), available from <http://www.siempro.gov.ar/informes/integrales/informes_integrales.htm>, (last accessed 2003–12–03).
28. **Skaire, M.** 2000. School Health News. School Screening Physical Exams for school and for sports "An idea whose time has gone": 1–6.
29. **Smith, L.C. and Haddad L.** 1999. "Explaining child malnutrition in developing countries: A cross - country analysis". Explaining child malnutrition in developing countries: a cross-country analysis. (online), available from <www.ifpri.org/divs/fcnd/dp/papers/dp60.pdf>, (last accessed 2003–12–03).
30. **Spain General Direction of Public Health. Council of Extremadura.** "Programas: Atencion al nino y al adolescente. Programa de Salud Escolar Curso 2001/2002". Revista Sanidad Digital. (online), available from <http://www.sanidaddigital.org/paginas/programas/atencion_ni%F1o_salud.htm>, (last accessed 2003–12–03).
31. **Torun, B.** 2001. Child Health. Etiology, epidemiology, physiopathology and clinical symptoms. (**Modulo II**): 3–66.
32. **Torun, B.** 2001. Protein-energy malnutrition. Hunter's tropical medicine. 8th ed. Philadelphia. Samders: 927–940.
33. **Torun, B.** 1999. Protein and Energy malnutrition. Modern Nutrition in health disease. 9th ed. Baltimore. Williams and Welkins: 963–988.
34. **United Nations Children's Fund.** "UNICEF Statistics Child mortality". UNICEF End Decade Databases-Child Mortality. (online), available from <http://www.childinfo.org/cmr/revis/db1.htm>, (last accessed 2003–12–03).
35. **University of New York.** The State Education Department. 1997. School Scoliosis Screening Guidelines. 1–10.
36. **World Bank. World Bank Office for Argentine.** 2002. "Argentine's crisis and its impact on household welfare: poverty". World Bank Group. (online), available from <http://www.worldbank.org/>, (last accessed 2003–12–03).
37. **World Bank. World Bank Office for Argentine.** 2002. "The Argentine health sector in the context of the crisis": World Bank Group. (online), available from <http://www.worldbank.org/>, (last accessed 2003–12–03).
38. **World Health Organization.** 2002. World Development Indicators. "Nutrition and Mortality". 114: 125.
39. **World Health Organization.** "Declaration of Alma —Ata. International Conference on Primary Health Care, Alma-Ata, USSR, 6–12 September1978". WHO-World Health Organization. (online), available from <http://www.who.int/hpr/NPH/docs/declaration_almaata.pdf>, (last accessed 2003–12–03).