

Health status of internationally adopted children. The experience of an Italian “GLNBI” paediatric centre

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ABSTRACT

BACKGROUND: according to ISTAT (National Institute of Statistics-Italy), in 2011 20.7% of the foreign population in Italy is composed by children, either coming along with their families or alone, like in international adoptions. Immigrant children have some peculiarities related to their previous living conditions, although there are no significant differences between immigrant and native children's diseases.

METHODS: in 3.5 years we evaluated every adoptee that reached our university centre, by using GLNBI (Gruppo di Lavoro Nazionale del Bambino Immigrato) diagnostic – aiding protocol, in order to assess infectious diseases, nutritional deficiencies, immunization status, intestinal parasitosis or other pathologies; this protocol is actually applied only in research centres.

RESULTS: we evaluated 358 international adoptees from 4 different Zones of the world; average age at first visit was approximately 5 years. Health certifications concerning vaccination history records were considered “valid” in 59.2% (212/358), 49.5% (105/212) of which had a complete panel of immunization. QuantiFERON®_TB Gold In-Tube (QTF) test resulted negative in 94.0% cases (313/333) and positive in 6.0% (20/333).

HIV, HCV and Syphilis tests resulted in 0.3% positive test for each serology (1/358). Cysticercosis' serology was positive in 8.9% (32/358) using immunoenzymatic assay (not confirmed by immunoblotting) and Toxocariasis in 13.1% (47/358). Parasitological investigation of faeces were found positive on 42.7% (153/358) children, throat swabs in 11.5% (41/358) children. There were 82.4% (295/358) abnormal blood count, 41.9% (150/358) low ferritin, 89.9% (322/358) endocrine abnormalities and 20.4% (73/358) various pathologies evaluated by specialists.

CONCLUSIONS: pathologies affecting our study group are the same affecting other categories of immigrant children, because they often share similar living conditions as orphanage or crowded residencies, low and poor intake of appropriate nutrients for growing ages, leading to malnutrition, vitamin D deficiency, iron deficiency anaemia and intestinal parasitosis. Vaccination records are often not available or reliable. A similar protocol could therefore be helpfully used as an initial management of children coming from a different setting.

Key words: Immigration, International adoption, Intestinal parasites, Immunization

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INTRODUCTION

Migration flows have been a growing phenomenon, since the beginning of the 20th

century when first Italy along with other European countries used to be part of the massive emigration to the United States and South America; stable and strong economic Italian situation made Italy one

of the main migration destination.

Every year thousands of people arrive to Italy, coming mostly from developing countries all over the world. According to ISTAT (National Institute of Statistics-Italy) reports, on January 2011, the resident foreign population in Italy accounted for 4.9 million people, representing approximately 8% of the entire Italian population (1).

The main cause of this massive displacement is the worsening living conditions existing in home countries.

This phenomenon caused a mutation in the population composition, with emerging social, epidemiological and cultural problems, well comprehensible considering just the principal States of provenance of people migrating to Italy to January 2011: Romania (968 576 persons), Albania (482 627), Morocco (452 424), China (209 934) and Ukraine (200 730), followed by Asian States such as Philippines (134 154) and India (121 1036) (1).

Children, usually coming along with their families, but also alone, principally coming from warzone, compose 20.7% of this particular population (2); moreover, many of the so-called "immigrated children" are born in Italy from parents immigrated some years before, forming a particular subgroup of "Italian" immigrants (accounting for 13.9% of the overall Italian newborns in 2011) (2).

A different aspect of immigration is

represented by international adoptions.

International adoptions are a fairly more recent phenomenon in Italy; it became culturally and politically accepted only at the end of the past century, and since then there has been an appreciable increase, with 36 117 adopted children between November 16, 2000 and December 31, 2011 (3), making Italy the leading country in Europe and the second one worldwide, following United States. Adopted children come from developing or struggling countries.

Although there are no significant differences between immigrant and native children's infectious diseases, denying the old theory that immigrant children are more susceptible to this kind of diseases (4, 5), it is possible that immigrant children have some peculiarities, related to their previous poor living conditions or crowded environments, needing thus a specific check (6, 7).

Consequently to these considerations, in 1992 a group of paediatricians founded the "Gruppo di Lavoro Nazionale per il Bambino Immigrato"-GLNBI (National Working Group for Immigrant Children) to study and deal with these new aspects of Italian paediatric population. Among its activities, GLNBI drew up a diagnostic-aiding protocol (8) for examining internationally adopted children at their entry to Italy, in order to assess their health status, often poorly documented: we below show the data resulting from our experience using this "ad hoc" protocol.

FIG. 1

NATIONAL WORKING GROUP FOR IMMIGRANT CHILDREN'S DIAGNOSTIC
AIDING PROTOCOL FOR INTERNATIONALLY ADOPTED CHILDREN (2007)

Anamnesis

Physical Examination

Laboratory tests: glycemia, creatinine, blood count and differential white blood count, alkaline phosphatase, transaminase, blood protein electrophoresis, ferritin, ESR (erythrocyte sedimentation rate), HBV and HCV infection markers, TPHA, HIV 1-2 antibodies, intestinal parasite investigation (on 3 samples), urinalysis, Mantoux intradermal reaction. *

According to provenance state:

- Belorussia e Ukraine: TSH and FT₄ dosage;
- Latin America, Africa, Asia: antibodies against cysticercus;
- Eastern Europe, Latin America, India: antibodies against toxocara.

Second level examinations:

- Chest X-Ray if positive Mantoux.
- Hb electrophoresis and/or Glucose-6-Phosphate Dehydrogenase dosage: according to blood count results in children coming from high prevalence areas for hemoglobinopathies and/or red blood cells' enzyme deficiency.

Specialists' consultancies: all of the requested as needed.

Vaccine schedule: serological research of vaccine's immunization or boosts if only one dose was performed on the child, according to the Italian vaccine schedule.

* our center also performs dosage of 25-OH-vitamine D and parathormone.

METHODS

From 1st January 2008 to 31st July 2011 we prospectively evaluated every internationally adopted child whose parents referred to our centre, by using an “ad hoc” GLNBI diagnostic – aiding protocol (Figure 1), in order to identify infectious diseases, nutritional deficiencies, immunization status, intestinal parasitosis or other pathologies.

Data regarding date of birth, sex, birthplace, arrival date in Italy, date of the first visit at our clinic and any possible health certificate they might have carried along were recorded for each child (family history, past and recent medical history, any previously performed laboratory test, vaccine certifications – specifying type of vaccine and date in which it was performed, in order to consider them universally “valid”) (9).

Laboratory blood tests, performed by Catholic University of the Sacred Heart’s Laboratories in Rome, included serological research of vaccine’s immunization (Diphtheria, Tetanus, Pertussis, Poliomyelitis, Rubella, Mumps and Measles) (Table 1), QuantiFERON®-TB Gold In-Tube (IT) (QTF test) aiming to evaluate any ongoing or previous tubercular infection, serological tests for ongoing or previous infections with HIV, Syphilis, HCV, Cysticercosis and Toxocariasis, blood count, and dosing of ferritin, calcium, magnesium, phosphorus, alkaline phosphatase, 25-OH-vitamine D and parathormone (PTH).

Moreover, microbiological test of throat swab, urinalysis, faecal sample for parasitological investigation and thyroid hormones levels (only in children coming from Eastern Europe for the higher risk of pathology related to Chernobyl’s radioactive disaster) were performed (10).

Along with these laboratory tests, a complete physical examination for assessing the overall child health status was performed and, when facing potential specific pathology, a specialist’s visit (paediatric orthopaedist, dermatologist, otorhinolaryngologist, endocrinologist, surgeon, ECG or echocardiogram) were prescribed.

A statistical evaluation on the collected data was conducted, performing χ^2 test; p value < 0.05 was considered statistically significant.

The enrolled children were divided in 4 groups, in order to evaluate discrepancies for certain tests, such as faecal parasites investigation, serological testing for Cysticercosis and vaccination records. Zone 1: EAST EUROPE and RUSSIAN FEDERATION (Armenia, Belorussia, Bulgaria, Russian Federation, Kazakhstan, Latvia, Lithuania, Moldavia, Poland,

Czech Republic, Romania, Slovakia, Ukraine, Hungary); Zone 2: ASIA (Cambodia, China, Philippine, India, Nepal, Thailand, Vietnam); Zone 3: LATIN AMERICA (Bolivia, Brazil, Chile, Colombia, Costa Rica, Guatemala, Mexico, Peru); Zone 4: AFRICA (Benin, Burkina Faso, Ethiopia, Guinea Bissau, Madagascar, Nigeria, Democratic Republic of Congo, Togo).

RESULTS

We evaluated 358 international adopted children, 19.8% (71/358) of which from Zone 1, 37.7% (135/358) from Zone 2, 30.2% (108/358) from Zone 3 and 12.3% (44/358) from Zone 4; 57.5% (206/358) were male, 42.5% (152/358) were female.

The average age at first visit was 5 years 3 months 24 days, ranging from 8 months to 15 years; the average interval between arrival date in Italy and first visit was approximately 4 months.

Health certifications from their countries of origin were often missing. They were mostly concerning vaccination history records, that were considered “valid” (defining “valid” when reporting type of vaccine used and date of performance) only for 59.2% (212/358) children; 9.8% (35/358) arrived to our attention having already started a new course of vaccination in Italy regardless of their previous vaccine status.

It is important to highlight that only 49.5% (105/358) had a complete panel of immunization, defined by World Health Organization (WHO) as the contemporary immunity coverage for Diphtheria, Tetanus, Whooping cough, Poliomyelitis (oral or injective), measles (± mumps and rubella), HBV and Bacillus Calmette Guerin (BCG). Evaluating the presence of complete panels by geographic zones, Zone 1 had 78.8% complete panels out of valid certificates (41/52), Zone 2 had 28% (21/75), Zone 3 had 53.9% (41/76), and Zone 4 only 22.2% (2/9) complete panels.

Protecting titer of antibodies for immunity coverage are shown in Table 1.

We also evaluated the other markers of HBV infection (HBsAg, HbcAb), discovering 2.0% (7/358) undocumented recent past infections (defined by positive HbcAb) and 0.6% (2/358) chronic diseases (positive HbsAg).

Comparing the real actual vaccine immunity and the one expected valid, we found out discrepancies between the two values for every evaluated immunization (Table 2).

BCG vaccination was documented only for

TABLE 1

PROTECTIVE SERUM ANTIBODY CONCENTRATIONS USED IN UCSC LABORATORIES IN ROME		
VACCINE	TEST	PROTECTIVE VALUE
Diphtheria	ELISA	> 1 UI/ml
Tetanus	ELISA	> 0.1 UI/ml
Whooping Cough	ELISA	Positive
Poliomyelitis	Complement Fixation Reaction of Poliovirus Antibodies (type 1, 2, 3)	Dilution 1:4 – 1:8
HBV	Immunochemiluminescence	> 10 mUI/ml
Measles	ELISA	> 150 mUI/ml
Mumps	ELISA	> 230 UA/ml
Rubella	ELISA	> 10 UI/ml

TABLE 2

COMPARISON BETWEEN THE REAL VACCINE IMMUNITY AND THE ONE EXPECTED FROM VALID IMMUNIZATION CERTIFICATION IN OUR STUDY POPULATION (358 CHILDREN)				
VACCINE	REAL %	EXPECTED %	Δ %	P VALUE
Diphtheria	79.3%	92.5%	13.2	< 0.001
Tetanus	83.2%	92%	8.8	0.0002
Whooping Cough	48.9%	89.2%	40.3	< 0.001
Poliomyelitis*	54.2%	85.8%	31.6	< 0.001
HBV	57.3%	78.8%	21.5	< 0.001
Measles	78.8%	79.2%	0.4	0.19
Mumps	55.6%	66.5%	10.9	0.002
Rubella	66.2%	67%	0.8	0.20

*performed until November 2008 on 142 children due to unavailability of the diagnostic kit

37.7% (135/358) children.

QTF test was performed on 333/358 children (93%), resulting in 94.0% (313/333) negative tests and 6.0% (20/333) positive tests.

Mantoux Intradermal Reaction wasn't performed because of the difficulty in checking the site of injection at after 72 hours (children were usually attending our clinic just once); furthermore, QTF was preferable in this setting because of its non-interaction with BCG vaccine previously performed on most children.

About non-infectious diseases, full blood count was abnormal in 82.4% (295/358), of which 39.7% (117/295) microcytic anaemias, 5.8% (17/295) normocytic anaemias, 19.0% (56/295) eosinophilias and 31.9% (94/295) isolated microcytosis; ferritin (normal range 24–336 ng/ml) was low in 41.9% (150/358); 46.6% (167/358) had 25-OH-vitamin D abnormalities - classified in 16.2% (27/167) *insufficiency* (<7 ng/ml) and 83.8% (140/167) *deficiency* (<30 ng/ml), 39.7%

(142/358) had PTH alteration (normal value >50 pg/ml), 3.6% (13/358) had disthyroidism and 20.4% (73/358) had various pathologies evaluated by specialists (Table 3), such as 2 cases of precocious puberty (only 1 of which confirmed by specific laboratory tests), 6 cases of failure to thrive (defined by WHO as < 3^o percentile of standard growth scales), 1 of which was referring only to height and was associated with obesity; 28 cases of orthopaedic abnormalities and 38 cases of dermatologic lesions.

HIV, HCV and Syphilis tests resulted positive, respectively in a child from Brazil (0.6%, 1/358), a child from Ethiopia (0.6%, 1/358) and a child from Russian Federation (0.6%, 1/358).

Cysticercosis was found in 8.9% (32/358), 68.8% (22/32) of which from Zone 2 (Asia and Indian subcontinent) but this result can't be considered reliable because of the high sensibility of the diagnostic kit available (ELISA - Enzyme-linked immunosorbent assay); in fact, when repeated by immunoblotting,

TABLE 3

NON-INFECTIVE ABNORMALITIES FOUND IN THE STUDY GROUP (358 CHILDREN)		
ABNORMALITIES	N° OF CASES	% ON THE STUDY POPULATION
Abnormal blood count	295	82,4
Low ferritin	150	41,9
Vit.D deficiency	140	39,1
Vit.D insufficiency	27	7,5
PTH alteration	142	39,7
Disthyroidism	13	3,6
Precocious puberty	1	0,28
Failure to thrive	6	1,7
Orthopaedic abnorm.	28	7,8
Dermatologic abnorm.	38	10,6
Others	30	8,3

none of these tests resulted positive. Toxocariasis test was positive in 13.1% (47/358).

Throat swabs were found positive in 41/358 children (11.5%), 73.2% (30/41) of which for *Streptococcus pyogenes*; the remaining positive children had saprophytic bacteria and fungi.

No cases of hemolymphatic parasites such as Malaria or Leishmania were reported at the time of the first visit, although one child developed Malaria from *P. ovalis* two months later.

Parasitological investigation of faeces was found positive in 42.7% (153/358) children infected with intestinal parasites. Regarding zones distribution, 38% (27/71) children were positive in Zone 1, 29.6% (40/135) in Zone 2, 55.5% (60/108) in Zone 3 and 59.0% (26/44) in Zone 4.

The most frequently isolated pathogenic parasite was *Giardia intestinalis* (43/153 children, 28.1%), while the most frequent non-pathogenic parasite detected was *Blastocystis hominis* (29/153, 19%) (Table 4).

Analyzing positive samples according to age, children 5 years and older had the most numerous parasitic isolations (93 children with parasitic isolations/153, 60.8%), despite the two groups (age greater than 5 years vs. age less than 5) were numerically equal (179 children each).

More interestingly, correlating the intestinal parasite tests with their corresponding blood count, we found that 38.6% (59/153 children having intestinal parasites) had an iron deficiency

(defined as low ferritin, or microcytic anaemia); even though we think this comparison is noteworthy, it didn't result as statistically significant ($p = 0.23$).

We also compared faecal samples' positivity with their corresponding data about eosinophilia, which was found in 20.2% (31/153 children affected with intestinal parasites) ($p = 0.0525$).

DISCUSSION

We evaluated 358 children during a 3.5 year-period.

The mean time between arrival to Italy and first visit at our clinic was about 4 months, which is more than what is commonly advised by the GLNBI (within 1 month from arrival); in fact Paediatric Practitioners should refer in a shorter time welcoming families to specific centres like ours, or prescribe themselves tests they consider the most appropriate for their particular patients. Furthermore, during that prolonged lapse of time, adoptees could be subject to infections present in the welcoming country (e.g. *S. pyogenes* or parasitic intestinal infections), worsening a potential underlying poor health status.

The average age of children among the entire study population was 5 years 3 months; children coming from Asia were in average younger (3 years 3 months) while those ones coming from

TABLE 4

PREVALENCE AND DISTRIBUTION OF PARASITES FOUND IN POSITIVE FAECES' SAMPLES						
	ZONE 1	ZONE 2	ZONE 3	ZONE 4	TOTAL	% ON TOTAL
GIARDIA INTESTINALIS (P)	14	25	12	14	65	28.3 %
BLASTOCYSTISHOMINIS (P)	9	3	27	5	44	19.2 %
ENTAMOEBACOLI (P)	8	3	16	10	37	16.1 %
HYMENOLEPIS NANA (H)	1	10	10	1	22	9.6 %
ENDOLIMAX NANA (H)	2	3	14	3	22	9.6 %
DIENTAMOEBAFRAGILIS (P)	1	1	5	1	8	3.5 %
ENTAMOEBAHARTMANNI (P)		3	3	2	8	3.5 %
ASCARIS LUMBRICOIDES (H)		3	2	2	7	3.1 %
ENTAMOEBADISPAR (P)		1	2		3	1.3 %
TRICHURIS TRICHIURA (H)		3			3	1.3 %
STRONGYLOIDES STERCORALIS (H)	1			1	2	0.9 %
IODAMOEBABUTSCHLI (P)			2		2	0.9 %
SARCOCYSTIS HOMINIS (P)			1	1	2	0.9 %
CRYPTOSPORIDIUM (P)				2	2	0.9 %
ENTEROBIUS VERMICULARIS (H)	1				1	0.4 %
ISOSPORABELLI (P)		1			1	0.4 %
					229	

P= protozoa, H= helminth

Eastern Europe and the Russian Federation were the oldest (7 years 5 months), reflecting different adoption policy in those areas.

Most children were coming from Zone 2 (Asia), because some of the most important associations managing international adoptions in Rome work in India and South-East Asia; this imply that the overall mean age is lowered by the amount of Zone 2 children, suggesting that most children spent less time in their countries of origin and thus had a lower exposure to environmental risk factor such as endemic infectious diseases, malnutrition, poor living conditions.

A frequent problem for paediatricians is whether to accept a foreign vaccine record, because information about storage, handling, site of administration, and vaccine brand are usually not available (11-13). Adequacy of previous immunization could be accepted if the vaccines, dates of administration, number of doses and intervals between doses are comparable to current Italian schedules, but data on immunization are limited, so serologic tests determining protective serum antibody concentrations is an acceptable solution (14).

Adopted children's health certification is resulted to be poor, both analyzing total number of valid certifications (212/358, 59.2%) and complete immunization's panels (105/358, 29.3%).

It is also important to highlight that the comparison between the real vaccine immunity and the one expected from valid immunization certification resulted in a statistically significant difference in most vaccines (Diphtheria, Tetanus, Whooping Cough, Poliomyelitis, HBV and Mumps), confirming that actual protective serum antibody concentrations were found in a lower number of children than expected from valid certifications.

HBsAg positivity is widespread in the southern part of Eastern Europe, South America, Asia, with different prevalence up to greater than 8% (15). In past studies, international adoptees with evidence of active HBV infection ranged from 2% to 5.9% (16-20) while serologically proven previous infection from 22% to 53% (21, 22).

We therefore found 7 past recent infections and 2 cronic diseases, allowing us to redirect these children to specific consultants and to a long-term follow-up, and confirming the importance of these additional tests in the protocol. The low prevalence of this infection in our cohort is probably due to an increased diffusion of vaccine programmes and greater attention in blood products control and management in most of the HBV endemic countries.

Tuberculosis is the most common infectious

disease in the world (23), and latent tuberculosis is a frequent problem in foreign-born children (24): in a recent study, out of 670 foreign-born children, Tuberculin Skin Test was positive in 31% of the immigrant and 8% of the adopted children groups. The higher percentage in the first group of children can perhaps be explained by their older age at the arrival in the country of immigration (25).

Only 37.7% of our study population was vaccinated with BCG, but the relation between QTF results and the presence of a BCG certification resulted to be statistically significant (p value < 0.001), demonstrating that the presence of BCG is protective for TB infection, since QTF test resulted 99.2% negative if BCG is performed and effective.

QTF test results confirmed this method to be a useful tool for diagnosing TB infection, mostly in BCG vaccinated children (26).

Italian epidemiological data show that tuberculosis is increasing among immigrant population so that tuberculosis cases in immigrants exceeded those in resident population (27); likewise, children from foreign families, even though born in Italy, are more exposed to the risk of catching tuberculosis (28), unlike adoptees that become member of residents and, frequently, well-off families (24).

An additional risk factor for second generation children is that frequently they travel to their home-country, increasing the chance of catching diseases that are epidemic in those territories, especially TB and malaria (29-32).

Low incidence of Syphilis, HIV and HCV is possibly explained by the proved fact that pre-adoption testing is now common and reliable, especially for HIV testing, so that positive children are correctly noticed before adopting processes (17, 18). As a matter of fact, serological positivity previously diagnosed in origin States were 100% confirmed in our laboratories, confirming the reliability of diagnostic assay used in birth country. It is important to add that the adopting families of the very few HIV/HCV/VDRL positive children already knew these results, and these children were part of the so called "special needs adoption".

Concerning serologic tests for Cysticercosis, given the absence of positive results, there is an ongoing debate on the actual usefulness of performing it in asymptomatic children; it is likely that in the future this serologic test could be performed only in symptomatic patients. *Streptococcus pyogenes*' high prevalence in our study population (73.2% of the overall throat swabs' positivities) is a particularly important aspect of

our results, enabling us to prevent possible severe complications, such as Rheumatic Fever and Post Streptococcal Glomerulonephritis, usually occurring in children of age 5 to 15 years, which represent exactly 50% of our population (179 out of 358).

According to CDC and recent papers (33), it is more accurate to collect 3 faeces samples in order to increase of 200% the chance of finding parasitic ova or cysts; we therefore collected many faecal samples (229), finding 153 affected patients.

Intestinal parasites infections in internationally adoptees have a prevalence ranging between 14 and 33%, *Giardia lamblia* being the most frequent detected parasite, mostly in Eastern Europe children (20, 22); other parasitic infestations include *Trichuris trichiura*, *Ascaris lumbricoides*, *Strongyloides stercoralis*, *Blastocystis hominis*, *Dientamoeba fragilis*, as well as ectoparasites such as *Sarcoptes scabiei* and *Pediculus capitis* (16, 18, 19, 21) (Table 4).

A high prevalence of full blood count abnormalities resulted in 82.4% (295/358), the most common being microcytosis and microcytic anaemia. These two abnormalities are often associated with low levels of ferritin, thus probably caused by pre-existing iron deficiency due to either low intake or intestinal parasites; indeed, parasitic infections contribute to decrease iron depots and/or to induce intestinal micro-haemorrhages, destabilizing these children's iron balance (or increasing an underlying iron deficiency).

However, we found the association between iron deficiency and parasitic infection, as well as eosinophilia and parasitic infection as being not statistically significant (Table 5a and 5b), meaning that parasitic investigations on adopted children need to be performed despite blood count results.

Vitamin D abnormalities were found on 46.7% (167/358) of our study group; this deficit is due to several reasons, such as low intake of Calcium and vitamin D, environmental causes such as short duration of ultraviolet rays exposition, and ethnical-racial characteristics, that is the amount of melanin in the skin and its consequent colour (34, 35).

Complete physical examination was performed on every child, leading several times on consulting different specialists belonging to our centre.

The most common specialist problems were dermatological (n=38), followed by orthopaedic ones (n=28), even though the endocrinological anomalies were the most serious being 13 disthyroidisms (10 of them diagnosed in children coming from Zone 1, probably linked to Chernobyl nuclear disaster in 1986), 1 precocious puberty, 6 failures to thrive and 1 obesity.

TABLE 5A

COMPARISON BETWEEN THE REAL VACCINE IMMUNITY AND THE ONE EXPECTED FROM VALID IMMUNIZATION CERTIFICATION IN OUR STUDY POPULATION (358 CHILDREN)					
	ZONE 1 (27)	ZONE 2 (40)	ZONE 3 (60)	ZONE 4 (26)	TOTAL (153)
SIDEROPENIC MICROCYTIC ANAEMIA	8	11	4	5	28
SIDEROPENIC NORMOCYTIC ANAEMIA	1	0	2	0	3
ISOLATED SIDEROPENIA	3	4	5	2	14
MICROCYTOSIS WITH SIDEROPENIA	6	5	2	1	14
TOTAL	18	20	13	8	59
					p = 0.23

TABLE 5B

COMPARISON BETWEEN THE REAL VACCINE IMMUNITY AND THE ONE EXPECTED FROM VALID IMMUNIZATION CERTIFICATION IN OUR STUDY POPULATION (358 CHILDREN)					
	ZONE 1 (27)	ZONE 2 (40)	ZONE 3 (60)	ZONE 4 (26)	TOTAL (153)
EOSINOPHILIA	4	8	15	4	31
					p = 0.0525

According to several studies, precocious puberty is a rare disease whose risk is markedly increased with both national and international adoption (36) but is not influenced by immigration (37).

The case of obesity in our study was diagnosed in a child that arrived in Italy 4 years before our evaluation: it is then very likely that it was a food-related obesity, a phenomenon well described on several publications about Italian immigrated children (37, 38).

The aim of GLNBI protocol is to detect any underlying pathology that could affect newly arrived children from foreign countries. It is evident that pathologies affecting our study group are the same affecting other categories of immigrant children as well as they globally belong to the same continent: these children often share similar living conditions, such as crowded residencies, low and poor intake of appropriate nutrients for growing ages and scarce sanitation, circumstances leading to malnutrition, vitamin D deficiency, iron deficiency anaemia and intestinal parasitosis. Moreover, vaccination records are often not available or reliable (11, 12, 40).

Paediatric practitioners face a new infantile population with particular needs: this protocol could therefore be a helpful diagnostic tool to approach also immigrant children, maybe modifying it according to geographic area of provenance or other family characteristics

(religion, feeding habits, housing condition, etc). Approaching immigrant children and their families is not only a technical problem, but it requires the knowledge of main social, cultural and religious traditions, sanitary practices, level of social integration. The paediatrician must become like a "tutor" for the child and his family and help them to access health services. This accurate approach of paediatric practitioners should also need the creation of a global health training in paediatric residency programs (41), thus allowing paediatricians to adequately confront health problems of world's children (5).

Finally, a similar protocol could be easily used as an initial management of children coming from different settings, since it was first created for this precise purpose.

It is mandatory to take into account that there are different typologies of immigrated children, each one with different needs: children coming along with their families might have not been medically assisted as much as adoptees who lived in orphanages; second generation immigrants likewise have guaranteed primary care but might be more exposed to environmental risk factors than native children.

An early targeted intervention may thus be of primary importance to prevent consequences of neglected problems; in order to achieve this result, academic authorities should be involved in this developing process.

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