

# Health problems of internationally adopted children

## Condizioni di salute dei bambini adottati dall'estero

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### Summary

**Objective.** In the last few years the number of internationally adopted children has increased in Italy. This study assesses the health status of these children at their arrival in Italy.

**Methods.** A total of 136 children adopted from abroad was evaluated (complete physical examination and laboratory testing) at arrival and their health status was compared with their pre-adoptive medical records.

**Results.** Gestational age, Apgar score, birth weight and length were reported respectively in 44, 39, 44 and 32 pre-adoptive medical records. False and alarming diseases were often described in pre-adoptive medical records, whereas other disorders diagnosed at the clinical evaluation had not been reported. Growth delay ( $Z$  score  $\leq 2$ ) for weight and height was observed in 25 and 26 adoptees, and iron deficiency anaemia, rickets, dyscrasic oedema and delayed bone age respectively in 74, 21, 2 and 17 children. Delayed gross motor skills (28.7%), delayed fine motor skills (24.3%), delayed social emotional skills (30.9%) and cognitive delays (27.9%) were also present. Growth and developmental delays were related to length in orphanage placement. Undiagnosed infectious diseases were observed: latent tuberculosis infection (6.6%), detectable hepatitis B surface antigen (2.3%), detectable hepatitis C antibodies (2.3%), intestinal parasites (8.8%), skin infections (15.4%). Immunization status of internationally adopted children was often incomplete, despite pre-adoptive vaccination schedules documented previous full vaccinations.

**Conclusions.** New inter-country adoptees are at increased overall health risk and should be the object of special medical evaluation once they arrive in Italy.

### Riassunto

**Obiettivo.** Conoscere le condizioni di salute dei bambini adottati dall'estero al loro arrivo in Italia.

**Metodi.** 136 bambini adottati dall'estero sono stati valutati (esame clinico completo e screening di laboratorio) al loro arrivo in Italia. Le loro condizioni di salute sono state confrontate con quanto riferito nelle cartelle cliniche di accompagnamento del paese di origine.

**Risultati.** Le cartelle cliniche del paese di origine riportavano notizie sull'età gestazionale, sull'indice di Apgar, sul peso e l'altezza alla nascita, rispettivamente in 44, 39, 44 e 32 bambini. Di sovente gravi stati morbosi che poi venivano esclusi erano riferiti nelle cartelle cliniche di accompagnamento, mentre altre volte importanti condizioni patologiche che non erano riportate venivano diagnosticate. Alcuni bambini avevano grave ritardo ( $Z$  score  $\leq 2$ ) della crescita, o ponderale (25 soggetti) o staturale (26 soggetti), e 74, 21, 2 e 17 di loro presentavano rispettivamente anemia ferrocarenziale, rachitismo, edemi discrasici, e ritardo dell'età ossea. Frequenti i ritardi nei movimenti grossolani (28,7%) ed in quelli fini (24,3%), così come i ritardi comportamentali (30,9%) e cognitivi (27,9%). I ritardi dello sviluppo motorio e cognitivo comportamentali, così come quelli gravi della crescita erano correlati alla durata della permanenza in orfanotrofio. Frequentemente erano presenti malattie infettive non riportate nelle cartelle cliniche di accompagnamento: tubercolosi latente (6,6%), epatite B (2,3%), epatite C (2,3%), parassiti intestinali (8,8%) ed infezioni cutanee (15,4%), mentre l'immunizzazione nei confronti delle vaccinazioni era molto spesso insufficiente nonostante le cartelle cliniche del paese di origine riportassero precedenti e complete vaccinazioni.

**Conclusioni.** I bambini adottati dall'estero costituiscono un gruppo di soggetti a rischio sanitario e devono ricevere all'arrivo in Italia un'attenta e completa valutazione clinica e di laboratorio.

### Key words

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## Introduction

International adoption is a new worldwide phenomenon involving more than 40,000 children a year<sup>1</sup>. During the last few years the number of inter-country adoptions has increased in Italy. They were less than 300 in 1982, whereas 14,832 internationally adopted children came to Italy from January 1, 2001 to June 30, 2006: 1,797 in 2001, 2,225 in 2002, 2,772 in 2003, 3,403 in 2004, 2,850 in 2005 and 1,449 in the first six months of 2006<sup>2</sup>.

Internationally adopted children require special medical attention at arrival in their adoptive countries. Before adoption most of them reside for a long time in orphanages where they may experience malnutrition, infectious diseases, environmental deprivation, behavioural and emotional maladjustments<sup>3</sup>. In addition, it is likely that physicians and paediatricians are not aware of their health problems, as they wrongly believe that internationally adopted children undergo a full clinical evaluation in their country of origin and that their pre-adoptive records are reliable. Consequently, a high number of international adoptees do not receive proper medical evaluation at their arrival.

The health of adoptees from abroad at arrival in the adoptive country has been described and compared with medical records from their countries of origin in studies conducted in both Europe<sup>4-7</sup> and the USA<sup>8-16</sup>. However, sometimes there are serious doubts concerning the accuracy and reliability of their pre-adoptive medical records, because of undetected physical abnormalities or reports of false and alarming medical notices<sup>3</sup>. In Italy only few studies have evaluated the health problems of internationally adopted children and the reliability of their medical records, and the reports available tend to be limited to some specific conditions (i.e. infectious diseases, immunization status, precocious puberty)<sup>17-19</sup>. These reasons have prompted us to perform a complete evaluation of the health status in 136 children adopted from abroad, referred to our International Adoption Centre at their arrival, and to compare the results with the pre-adoptive records of their country of origin.

## Methods

A cross-sectional study was performed, including 136 internationally adopted children evaluated between April 2002 and May 2006 at the International Adoption Centre of our Paediatric Department. Two of these adoptees came from South Asia (India), 1 from Latin America (Columbia) and the remaining 133 from Eastern Europe: Ukraine (84), former Soviet Union (29), Poland (9), Hungary (6), Rumania (3) and former Yugoslavia (2).

These children (74 boys and 62 girls, age at adoption from 12 months to 15 years, mean age at adoption  $78.5 \pm 36$  months, median age 72 months) were referred to our Centre within 2-6 weeks of their arrival

in Italy. All of them had resided in orphanages before adoption and were referred to our Department by their primary paediatricians, their adoption agencies or the Juvenile Law Court of Palermo.

Twenty-six sibling pairs were adopted by the same families at the same time, including three sets of twins. Four families adopted simultaneously three siblings while two families two unrelated children. Two other families had previously adopted another child, and ten had biological children at the time of the adoption.

The healthy status (complete physical evaluation and laboratory testing) of the 136 children was evaluated at arrival at our Department and compared with their pre-adoptive medical records. The clinical evaluation included a review of the pre-adoptive records with particular attention to the medical and social history of the biological parents, gestational age, birth weight and birth length, Apgar score, child's medical history and child's laboratory evaluations performed in the country of origin before adoption. A complete physical examination, including anthropometric measurements, developmental evaluation and, if needed, specialist consultations (odontologist, oculist, orthopaedist, dermatologist, otolaryngologist, etc.) followed the review of the pre-adoptive records.

Evaluation of each child's development was performed using the Revised Denver Pre-screening Developmental Questionnaire (R-DPDQ)<sup>20</sup>. Although the R-DPDQ is known to have some limitations (it is not fully sensitive in children older than 6 years and is based on a retrospective parents' recall) we had no other simple means able to provide information on developmental status of the children studied in the initial post-adoption period. Therefore parents were asked to recall retrospectively their children's developmental status when they first met in the orphanage at the beginning of the adoption. The R-DPDQ questionnaire comprises 105 items concerning four developmental domains (personal-social, fine motor-adaptive skills, language and gross motor skills) which are arranged according to the ages at which 90% of children are able to accomplish them. A child was considered "delayed" in a given domain when the score was below 90% the child's age.

Laboratory testing, according to *Gruppo di Lavoro Nazionale per il Bambino Immigrato* (GLNBI) affiliated to Italian Society of Paediatrics<sup>21</sup>, included a complete blood cell count, urinalysis, sidaeremia, serum ferritin, serum calcium, serum phosphorus, serum alkaline phosphatase, glycemia, azotemia, creatininaemia, serum aminotransferases and bilirubin, protenaemia and electrophoresis of serum proteins, serum immunoglobulins (IgA, IgG, IgM and IgE), erythrocyte sedimentation rates (ESR), haemoglobin electrophoresis, serum thyrotropin and thyroxine levels. Fresh fecal matter was examined for ova and parasites, stool cultures and serology for toxocara were also performed on 60 children. The tuberculin skin test (TST) was done on all children by the Mantoux technique with purified protein derivate (PPD, five tuberculin units).

Serum specimens of 126 children were evaluated for syphilis antibody; human immunodeficiency virus type 1 and 2 (HIV-1 and HIV-2) antibody; hepatitis A virus (HAV) IgM antibodies; hepatitis B virus surface antigen (HBsAg), antibody (HBsAb) and core antibody (HBcAb); hepatitis C virus (HCV) antibody and immunization status against vaccine-preventable diseases (poliovirus 1-2-3, diphtheria, tetanus); tests were carried out by standard methods as previously described<sup>18</sup>. Chest and wrist Rx (to evaluate bone age) were also performed on all children.

The results of the clinical evaluation and laboratory tests were compared with the pre-adoptive records.

The study was approved by the Ethics Committee of our Department and informed consent was obtained from the parents of all the children involved in the study.

### STATISTICS

Weights and heights of children of different ages and ethnic backgrounds were compared by converting the data to Z scores (the difference between the child's measurement and the age mean divided by the standard deviation [SD] for the child's age). Z scores were calculated using the Epi Info 2004 software, Version 3.2.2 based on means for age and SDs published by the Centre for Diseases Control and Prevention<sup>22</sup>. Statistical analyses were performed using  $\chi^2$ -test, and a P-value of < 0.05 was considered to indicate significance.

## Results

### PRE-ADOPTIVE MEDICAL RECORDS

Medical records from the countries of origin were available for 129/136 children; the reasons leading to placement in orphanages were reported only in sixty adoptees: abandonment (n = 23), maternal alcoholism (n = 22), parent's death (n = 6), parents' drug abuse (n = 6), single motherhood (n = 2), maternal mental illness (n = 1). The background concerning heredity was always lacking, and the parents' medical problems were occasionally listed (mothers' syphilis n = 6, parents' tuberculosis n = 1).

Gestational age and birth weight were reported only in forty-four records and birth length only in thirty-two of them. Nineteen children were reported to be born prematurely (fourteen at 8th month and five at 7th month) and, according to birth weight corrected for gestational age, ten were small for gestational age. Apgar score at birth was reported in thirty-nine cases (twenty-nine had scores  $\geq 8$  and ten  $\leq 7$ ).

Most of the adopted children's medical records reported severe and alarming diseases (in several cases more than one disease), especially severe central nervous pathology, but physical examination and laboratory testing at arrival excluded them in many cases. Table I lists the frequencies of the diseases reported in medical records and subsequently excluded in our Centre.

**Tab. I.** Number of medical diagnoses reported from the countries of origin and excluded at arrival.

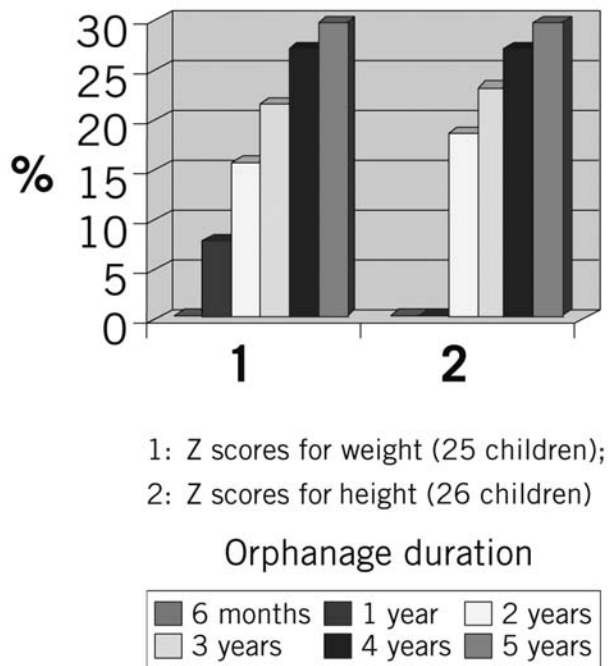
	N. of children
<b>NEUROLOGICAL DISEASES</b>	
Mental retardation	23
Psycho-neuro-muscular delay	23
Language delay*	17
Perinatal encephalopathy	4
Hydrocephalus	3
Malformations	1
<b>CARDIAC DISEASES</b>	
Cardiac myopathy	5
Heart murmur	3
Mitral prolapse	3
Tricuspid prolapse	2
Myocardiosclerosis	2
<b>GASTROINTESTINAL DISEASES</b>	
Cholecystic and biliary dyskinesia	6
Gastroduodenitis	5
Pancreatitis	5
Food intolerances	3
Mucoviscidosis	1
Past hepatitis B infection	1
Enlarged liver	1
<b>URINARY DISEASES</b>	
Hypoplastic kidney	1
Urinary tract dyskinesia	1
Urinary recurrent tract infections	1
Hydronephrotic kidney	1
Enlarged bladder	1
<b>ORTHOPEDIC ABNORMALITIES</b>	
Scoliosis	2
Sacrum-iliac arthritis	1
Congenital hip dysplasia	1
Congenital clubfoot	1
<b>MISCELLANEOUS</b>	
Visual impairment	6
Hypothyroidism	5
Enuresis	5
Rubinstein-Taybi syndrome	2
Anaemia	1
Failure to thrive	1
Congenital myopathy	1
Hypogonadism	1
Cheilo-gnatho-palatoschisis	1
Bruton hypogammaglobulinaemia	1
Ehlers-Danlos syndrome	1

\* Since all of the children were non-English speakers, language development was assayed in their primary language.

### MEDICAL PROBLEMS AT ARRIVAL

On arrival Z scores for weight ranged from -3.97 to 2.27 (mean -0.97), for height from -5.98 to 2.17 (mean -1.30) and for head circumference from -2.1 to 3.3 (mean -0.58). Z scores less than  $\leq 2$  for weight, height

Fig. 1. Z scores for weight and height less than 2 and orphanage duration.



and head circumference were respectively found in 25/136 (18.4%), 26/136 (19.1%) and 12/136 (8.8%) adoptees. Z score less than  $\leq 2$  for weight and height were associated in 18 cases. Growth delay was related to length in orphanage placement (Fig. 1), because the

Tab. II. Nutritional problems in 136 adopted children at arrival in Italy.

Nutritional problems	N	(%)
Iron deficiency anaemia	74	(54.4)
Clinical sign of rickets	21	(15.4)
Delayed bone age	17	(12.5)
Nutritional edema with serum hypo-proteinemia	2	(1.4)

rates of adoptees with Z scores less than  $\leq 2$  increased with the duration of orphanage confinement, both for weight ( $\chi^2$  for trend: 5.16; P: 0.0231) and height ( $\chi^2$  for trend: 6.21; P: 0.0127).

Seventy-four children had iron deficiency anaemia, 21 clinical signs of rickets (16/21 with elevated serum alkaline phosphatase levels, and 3/21 with radiographic skeletal rachitic changes), and two children had nutritional edema with serum hypo-proteinemia; delayed bone age was observed in 17/136 cases (Tab. II).

In addition to nutritional problems, many and sometimes serious diseases not reported in pre-adoptive medical records were diagnosed (Tab. III). No children had clinical evidence of fetal alcoholic syndrome.

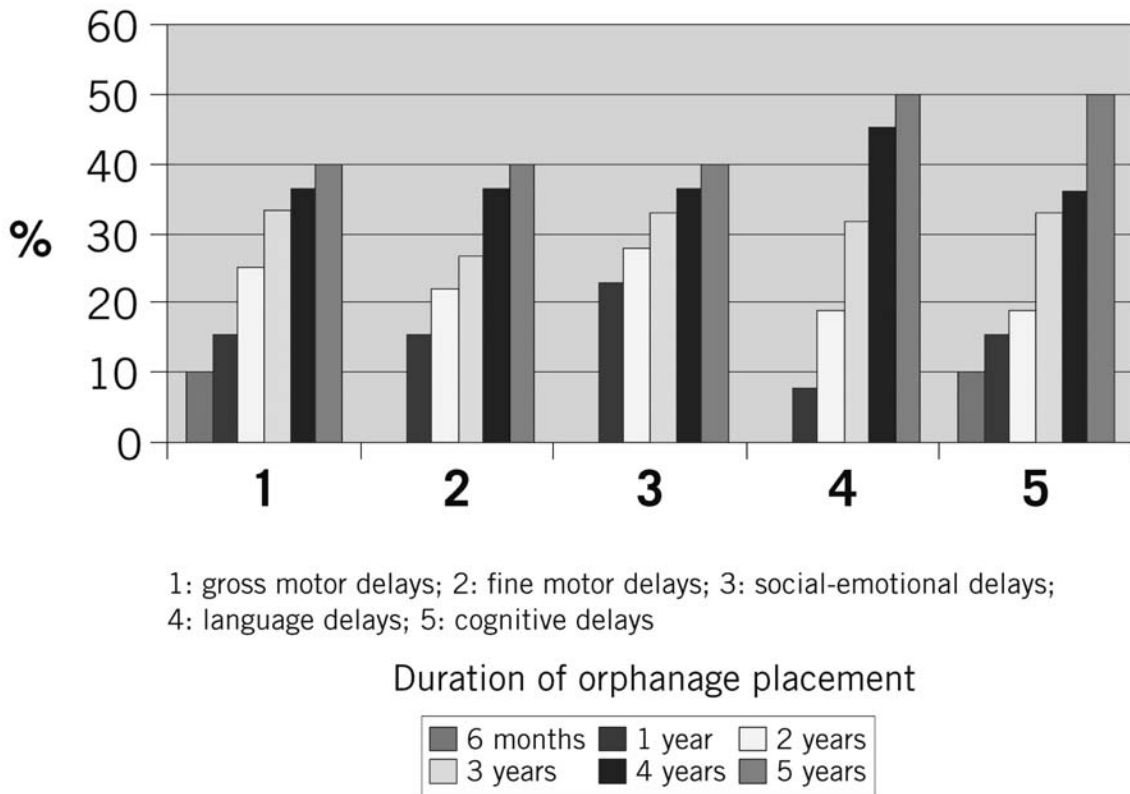
Developmental delays were common, and in several cases more than one in the same adoptee. Thirty-nine (28.7%) children had delayed gross motor skills, 33 (24.3%) delayed fine motor skills, 40 (29.4%) delayed social emotional skill, 36 (30.9%) language delays and 38 (27.9%) cognitive delays. The rates of developmental delays increased with the duration of orphanage

Tab. III. Medical problems in 136 adopted children not reported in preadoptive medical records and disclosed at arrival in Italy.

MEDICAL PROBLEMS	N. of children
ORTHOPAEDIC ABNORMALITIES (scoliosis, kyphosis, kypho-scoliosis, flat-foot)	21
SKIN DISEASES (vitiligo, cavernous haemangioma, atopic dermatitis, café-au-lait spots)	12
OCULAR DISEASES (amblyopia, myopia, heterotropy, astigmatism)	9
PHYSICAL ABUSE	7
BRONCHITIS OR PNEUMONIA	6
CARIES	4
INGUINAL HERNIA	3
FUNCTIONAL HEART MURMUR	3
UMBILICAL HERNIA	2
LIMBS' HYPERTONIA	2
SEXUAL ABUSE	2
OTITIS MEDIA	2
PREVIOUS LAPAROTOMY (for unknown reasons)	2
PREVIOUS SPLENECTOMY (for unknown reasons)*	2
URINARY TRACT INFECTIONS	2
HETEROTOPIC AND HYPOPLASTIC THYROID**	1
PSYCHO-NEUROLOGICAL DELAY (result of neonatal meningitis)	1
GLOMERULONEPHRITIS	1
PERIANAL FISTULA	1
CRYPTORCHIDISM	1

\* Diagnosis substantiated by means of both clinical examination (presence of an abdominal scar of a previous laparotomy) and abdominal echography (absence of the spleen). \*\* Diagnosis substantiated by means of clinical examination (presence of a swelling in the neck), echography and scintigraphy.

Fig. 2. Developmental delays\* and duration of orphanage placement (\* in several cases more than one in the same adoptee).



placement (Fig. 2) (gross motor delays:  $\chi^2$  for trend: 4.33; P: 0.0374; fine motor delays:  $\chi^2$  for trend: 4.728; P: 0.028; social emotional delays:  $\chi^2$  for trend: 4.728; P: 0.0332; language delays:  $\chi^2$  for trend: 12.464; P: 0.0004; cognitive delays:  $\chi^2$  for trend: 7.076; P: 0.0078), and they were higher in adoptees with Z scores for weight and height  $\leq 2$  (data not shown).

#### TUBERCULOSIS

Pre-adoption immunizations schedules were available for 129 children. All of them reported a previous Bacillus Calmette-Guerin (BCG) vaccination, but 35 adoptees had no BCG scar. All of the 101 children with a BCG scar did not undergo TST, but only ESR and chest radiography, which were normal in all. The remaining 35 internationally adopted children performed TST. Six of them resulted moderately TST positive (TST  $\geq 5$  mm) with normal chest-X-ray and without clinical signs of tuberculosis. They were diagnosed as having latent tuberculosis infection (LTBI). Three other adoptees without BCG scar resulted highly positive for TST (TST  $\geq 10$  mm). They were without tuberculosis symptoms and their ESR and chest-X-ray were normal. They were diagnosed as having LTBI and treated with isoniazid. On the whole, the prevalence of LTBI among all the adoptees studied was 6.6% (9/136), and its prevalence among the ones without BCG scar was 25.7% (9/35).

#### HEPATITIS B

As concerns HBV infection, 52/126 adopted children reported HBV vaccination in their pre-adoptive records. Forty of them were positive for hepatitis B surface antibodies, 6 for both anti HBs and HBc antibodies, and 6 had no HBV serological markers.

The pre-adoptive records of the remaining 74 internationally adopted children did not report any previous HBV vaccination. 15/74 of these children had hepatitis B surface antibody, 4/74 both HBs and HBc antibodies, 3 both HBs antigen and HBc antibody, and 52/74 no HBV serological markers. None of the adoptees with HBs antigen had either clinical signs or laboratory data suggestive of active hepatitis.

The 10 inter-country adoptees with a previous HBV infection (all with both anti HBs antibody and HBc antibody) came from Ukraine (n = 9), ex-Yugoslavia (n = 1) and Poland (n = 1). The 3 children with both HBs antigen and HBc antibody came from Ukraine (2 adoptees) and Poland (1 child). In all the pre-adoptive records of the adoptees it was not reported whether a HBV testing had been performed in the country of origin before the adoption.

#### OTHER INFECTIOUS DISEASES

No child had clinical and serological evidence of HIV or syphilis infection, although maternal syphilis was reported in six pre-adoptive medical records.

Three of 136 (2.2%) adoptees (all over 3 years of age) had hepatitis C virus (HCV) antibodies by Elisa test, but none had clinical signs or laboratory data (serum aminotransferases, bilirubin, etc.) suggestive of active hepatitis, although polymerase chain reaction for HCV RNA and RIBA were positive in 1 of them.

None of the adopted children assayed for HAV IgM antibody resulted positive.

Intestinal parasites were found in twelve children: giardiasis (n = 9), ascaris (n = 2), giardiasis and ascaris (n = 1). Serology for toxocara was negative in all adoptees who were assayed (60/136).

Skin infections, such as contagious molluscum, verrucas, pediculosis, scabies, impetigo were found in 21 adoptees.

### VACCINATIONS

The antibody titres against the other compulsory vaccinations in Italy (poliovirus, tetanus and diphtheria) were also assayed. Though pre-adoptive immunization schedules reported previous vaccinations ( $\geq 3$  vaccine doses) against poliovirus 1-3, diphtheria and tetanus in all adoptees studied, protective titres were absent in many cases. Protective titers ( $> 1:8$ , micro-neutralization assay according to the guidelines for WHO/EPI) for poliovirus 1-3 were found respectively in 79.3%, 93.6% and 56.3% of children. For tetanus and diphtheria protective antibodies were observed in 92.0% and 95.2% of children.

## Considerations and conclusions

In the present study we evaluated the health status of 136 internationally adopted children upon arrival in Italy and compared it with their pre-adoptive records. Our investigation has some limitations, such as the not too large sample size collected in only a single Centre, the cross-sectional design, and the fact that the adoptees evaluated came mainly from Eastern Europe rather than other areas of the world (i.e. Latin America and South Asia) from where many internationally adopted children come. Therefore, our findings must be considered with caution and need to be confirmed by non cross-sectional, larger studies, evenly distributed across Italy, that include also children adopted from other areas of the world. Nevertheless, despite these limitations, the present study is the largest reported in the literature concerning internationally adopted children from Ukraine and, notably, it is the first in Italy to perform a complete evaluation of the health status on adoptees from abroad at their arrival. Thus, it may represent an important step towards the goal of supporting these children, who need careful medical attention also in our nation.

Our study, first of all, shows that the pre-adoptive medical records of adoptees from abroad are often scarcely reliable. Indeed, data regarding family history, pregnancy, gestational age, delivery, Apgar score, birth weight and birth height were often lacking. In addition, as Table I shows, most of the pre-adoptive medical records report-

ed severe and sometimes alarming diseases that were subsequently excluded by clinical examination and laboratory testing. On the other hand, various and sometimes severe diseases (orthopaedic abnormalities, ocular diseases, etc.) not reported in the pre-adoptive records were detected in many adoptees after a complete clinical and laboratory evaluation. These findings are in accordance with previous studies<sup>4,5,8-11</sup>; we are unable to address the reasons of the discrepancy between pre-adoptive records and clinical evaluation at arrival: some medical information might have been deliberately forgotten or consciously falsified in the pre-adoptive records in order to facilitate the adoption, other information inaccurately translated from the original language into western medical terminology and some diseases undiagnosed because of neglect in orphanages. However, our findings clearly show that internationally adopted children are a group of subjects with increased health risks, and that they need a complete and careful evaluation at their arrival in the adoptive country, in order to verify their "real" health status.

A clinical examination of the adoptees showed that many of them at arrival were malnourished (25/136, 26/136 and 12/136 had Z scores respectively for weight, height and head circumference  $\leq 2$ , 74/136 iron deficiency, 21/136 rickets, 17/136 delayed bone age and 2/136 nutritional edema with serum hypo-proteinaemia). These findings may likely be the effect, at least for weight and height, of institutionalization, because the duration of orphanage confinement was proportional to the rates of weight and height impairment. The developmental delays we observed in many adoptees were also related to the duration of orphanage confinement and, likewise the nutritional problems may likely be consequence of the poor care, emotional deprivation and neglect these children suffered during their pre-adoptive life.

Another risk factor for developmental delays we observed might be maternal alcoholism. Alcohol abuse is widespread in Eastern Europe<sup>5,10</sup>, the world area from where most of our adoptees come, and maternal alcoholism can cause long-term neurobehavioral impairments<sup>23</sup>. Although we did not observe clinical features suggestive of foetal alcohol syndrome, this risk factor might have an important role in explaining developmental disorders in the present cohort of children, because maternal alcoholism was specifically mentioned in 22/60 (36.7%) of the pre-adoptive medical records as the cause of children's placement into orphanage.

We observed many adoptees with previously undiagnosed infectious diseases (LTBI, hepatitis B and C, intestinal parasites, skin infections). This finding is not surprising because internationally adopted children come from areas where these infectious diseases are endemic<sup>24,25</sup> and because many of them before adoption lived in crowded conditions with poor standards of medical care and hygiene<sup>3</sup>. For these reasons all the newly foreign adopted children should receive an appropriate screening aimed to detect the more common infective agents in their country of origin, in order to

receive prompt and adequate treatment in the event of a previously undiagnosed infectious disease. In addition, screening for some infections (i.e. hepatitis B and C, HIV, tuberculosis) should be repeated six months after arrival to identify children who may have been screened during a seronegative period. In this respect, the importance of a subsequent anti-infective screening is emphasized also by the chance of intra-familial and household transmission of infectious diseases from adopted children, as well described for tuberculosis, hepatitis A and hepatitis B<sup>26-28</sup>.

There were no tropical infections (i.e. malaria, Chagas disease, leprosy, etc.) among our inter-country adoptees, and this absence can be explained by the countries of origin (only 2/136 came from India and no one from African and South American, where exotic infections are common). In addition, none of the adoptees we observed had HIV infection or syphilis, although maternal syphilis was reported in 6 pre-adoptive records. Our data are in accordance with previous studies showing that syphilis and HIV are very rare in inter-country adoptees<sup>24,25</sup>. Indeed, screening and consequent treatment of syphilis usually occur in the children's countries of origin, while the identification of HIV-infection is a criterion for removal from international adoption. Nevertheless, because syphilis and HIV cause remarkable anxiety among adoptive parents, their serological screening are always recommended in new adoptees from abroad.

As concerns vaccinations, pre-adoptive immunization schedules reported previous BCG vaccinations and previous full vaccinations against poliomyelitis, diphtheria and tetanus in all the adoptees studied, whereas many of them had no protective titres of antibodies, especially against poliovirus 1-3, nor did they have a BCG scar. In addition, 74 pre-adoptive immunization schedules did not report any information about previous HBV vaccination, and 6 of the 52 adoptees who reported HBV vaccination were negative for hepatitis B surface antibody. These findings, which emphasize

again the scarce reliability of the pre-adoptive records, are in accordance with previous studies<sup>17,18,29-31</sup> that found a good status of immunization against vaccine preventable diseases in only a part of the internationally adopted children, despite vaccination records documenting complete and full vaccinations. The reasons for the divergence between the records of the original countries and the immunization status of the internationally adopted children are uncertain and might be due to out-dated, poorly stored or biologically less powerful vaccines, inaccurate or false vaccination records of the countries of origin. Furthermore these findings are consistent with the fact that hepatitis B vaccination is not usually performed in most countries from which they come and where instead the virus is highly spread. However, although nowadays there is no definitive consensus<sup>24,32</sup>, our data suggest that all internationally adopted children should be tested for their immunization status as soon as they come to the adopting country in order to perform an immediate active prophylaxis against vaccine preventable infections if their immunization status is inadequate.

In conclusion, inter-country adoptees are increasing in Italy and must be recognized as a group of subjects requiring special medical attention. Our investigation, despite its limitations, shows that: 1) pre-adoptive medical records of the adoptees from abroad often are scarcely reliable, as important medical notices and diseases are lacking, while false and alarming disorders are reported; 2) many internationally adopted children are malnourished and suffer from developmental delays that increase in relation to the time spent in orphanage; 3) many undiagnosed infectious diseases are present in inter-country adoptees, and their immunization status against vaccine preventable diseases is often inadequate. Therefore, children adopted from abroad are at increased health risks and our efforts should be addressed to promote a proper and complete medical evaluation as soon as they come to the adopting country.

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