

## **The Cuban experience with people from areas affected by the Chernobyl accident.**

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### **Abstract.**

In April of 1990 started the "Cuban Chernobyl Program". This program was designed to offers specialised medical attention and to develops a rehabilitation plan with children from areas affected by the Chernobyl accident radioactive contamination. Up to the moment more than 23 000 children and adults had been assisted in the program, with a significant set of medical procedures done. Dosimetrics, biomedical and psychological research had been also carried out as part of the program. The more significant medical attention activities include the treatment of haematological disorders, among them 120 leukaemia's cases, with 6 bone marrow transplantation, and the treatment of around 400 endocrine and cancer illnesses. The dosimetrics results on more than 7000 children are including in a database with information on internal <sup>137</sup>Cs contamination, internal, external and total doses, children living location, and its contamination by <sup>137</sup>Cs, and other significant information for radiological impact evaluation. The behaviour of all the medical information of the program in relation to the contamination of the land and the internal contamination of the children was analysed using this database. The program has accumulated an experience of interest for physicians, psychologists and in general persons interested in Chernobyl consequences.

Key words: Chernobyl, <sup>137</sup>Cs dosimetry, and biological effects of radiation.

### **Introduction**

The Cuban Program for the medical attention of children from areas affected by the Chernobyl accident was created in May of 1990, as a reply of the Cuban Health authorities to the request of certain social organisations of the former Soviet Union.

The main objective of the program is to offer highly specialised medical attention and to develop, in an appropriate atmosphere, a rehabilitation plan, with integral health actions. The program is not design to carry out epidemiological studies or to establish any correlation between the accident and the health status of the children. The main headquarters of the program is a child summers camp, transformed in to a Sanatorium, and located in the Tarara beach, 25-km east La Havana. This facility of 11 square km, have residences where habitually the children and their companions live, hospitals, stomatologic clinic, ambulances, theatre, diversion park, 2 km of beach, schools and all the necessary additional comforts to carry out the objective proposed for the program [1]. The dosimetrics and specialised biological studies are carrying out at the Centre for Hygiene and Radiation Protection (CPHR).

The program is organised under the Cuban system of the family physician i.e. the medical attention is at the children residence, with a very limited contact with Hospitals, etc. The Program facility has been used to assist children affected by other types of disasters.

This work offers a panoramic view of the work carried out in the program during this 13 years.

### **Selection and Classification process.**

The selection process was firsts performed by visits of the Cuban physicians' teams to the affected territories in Ukraine, Belarus and Russia. Later a similar team was inserted in Kiev, with regulars'

visit only to Ukrainian areas to carry out the process [1,2]. Actually a Cuban physician with strong coordination with local health Ukrainian authorities, does the selection, considering the accumulated experience and the number of cases per year.

The selection process includes the patients clinical examination, evaluation of their possible treatment or rehabilitation in Cuba and classification in one of the following four groups.

- Group I: Children with leukaemia, solid cancer and others severe illnesses. This group represents 3% of the cases.
- Group II: Children with diverse pathologies not considered severe but required hospitalisation at their arrival to Cuba. This group represents 17% of the cases.
- Group III: Children with pathologies that don't need hospitalisation. This group represents around 60% of the cases.
- Group IV: Relatively healthy children. This group represents 20% of the cases.

The total number of persons assisted in the program from 1990 to 2003 is 23096 among then 19 860 children. The maximum number of children assisted in one year was 6415 (1991), in the last five years the average number of children per year is around 600

### **Organisation of the medical attention.**

The medical attention include the following steps [1,2]:

- Cases reception at the La Havana airport
- Children distribution to primary, secondary and tertiary levels of attention,
- Health actions according to children diagnose.
- Long term rehabilitation if necessary
- Children return to home, with medial treatment and recommendations when necessary.



A detail information on the number of cases, and its preliminary classification is available at case reception, this information is provided in advance by the Cuban physician responsible for the selection process in the affected territories. The distribution to the different levels of attention is carried out in the first week of stay in the Tarara Sanatorium. During this time the clinical computerised history is completed.

The primary level of attention is performed in the Tarará Sanatorium to groups III and IV of children classification. It is organised under the Cuban system of the family physician i.e. the attention is mainly at the children residence, generally up to 50 children are under the observance of the physician and a nurse. They are responsible for the organisation of all the necessary investigations including the integral stomatological attention. Specialised medical areas (SAME) for the rehabilitation of children subjected to medical procedures of high risk like organs transplant, cardiovascular surgery and others, are also organised at this level of attention.

The secondary level is performed in the in the Tarara hospital (350 beds) to the Group II of children classification. This attention is performing in an effective collaboration with paediatric and adults' hospitals, and also an important group of Cuban scientific institution.

The tertiary level is carry out in specialised Hospital of the Cuban capital to the Group I of children classification. High complexity medical procedures are performed at this level.

The stay in the Island of children's groups III and IV was for a minimum of 45 days during the 90 – 94 years, actually is for 60 or more days [1]. Children from groups II and I may required recovery stay of 90 or many more days.

### **Main results of the medical attention.**

The more frequent diseases in the children of the groups II, III and IV assisted at the Tarara Sanatorium are: Endocrine (59%), Digestive (58%), Adenopathy (30%), otorrinolaryngologic (29%) and dermatological (20%) [2].

In group I were significant the treatment of: 290 patients with haematological affectations, among them, 120 leukaemia and 6 bone marrow transplant's.

Others significant results of the medical program have been the treatment of the vitiligo, the alopecia and the psoriasis . Until the moment in the cases under treatment positive results have been obtained in 99.8% of the vitiligo patient, 93.9% of the psoriasis patient and 60% of the alopecia patient.

### **Psychological attention**

This process is carrying out by a specialised psychological team. The members of the team are Russian speaking people. The attention is designed to evaluate anxiety, depression, post-traumatic stress, material and psychosocial losses, and satisfaction with medical treatment in Cuba. A number of psychosocial disorders related with the Chernobyl accident had been detected. Detail information about some of these results may be see at [4]



### **Dosimetric evaluations.**

The dosimetric evaluations include the measurement of the internal  $^{137}\text{Cs}$  contamination and the estimates of internal, external, and total dose.

The internal contamination measurement is performed using a whole body counter, with a detection limit of 76 Bq and measurement time of 15 minute, different variables like  $^{137}\text{Cs}$  decorporation, due to the time elapsing between measurement moment and the stop of the intake have been considering. The doses have been calculated using ICRP recommendations, details of the models, equations etc, are shown in [3]

The dosimetric studies done until the moment includes more than 7000 children with ages between 1 and 17 years. Published results cover 4500 children [3], a second dosimetric report is in preparedness.

The results of the dosimetric studies evidence that around 60 % of the children showed contamination by  $^{137}\text{Cs}$ , the doses in thyroid reach in some regions values of up to 2 Gy. The total doses for the year of study fluctuate between <1 - 85 mSv and for 70 years the values oscillate between <1 - 170 mSv [3].

### **Radiation impact on health.**

The radiation impact on health is difficult to evaluate in this group of children considering the low doses received the selection process performed and the limited time of the children in the island. Nevertheless, the analysis of the behaviour of all the medical information generated in the medical program in function of the  $^{137}\text{Cs}$  contamination of the children living location and of the  $^{137}\text{Cs}$  internal contamination of the children was performed [3]. It was significant that, even with the limitations mentioned, the thyroid hyperplasia showed a significant increment when increasing the contamination by  $^{137}\text{Cs}$ . For the rest of medical and conventional haematological and endocrinological indicators similar value were obtained in groups despite the differences in  $^{137}\text{Cs}$  levels of contamination [3]. More specific biological indicators of radiation damage have been also used. Chromosomal aberration and micronucleus frequency show normal values in 69 children from 3 different Ukrainian settlement [3] while high frequency of micronuclei were found in a child with a cat scratch disease. [5]. Actually a correlation between  $^{137}\text{Cs}$  internal contamination of the children and DNA damage is evaluate by the comet assay method. Preliminary results show not influence of the children internal contamination on DNA damage.

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