

An insufficient recognition of epidemiological situation of *Ascaris* in the population and the consideration above reasons of the family epidemic

Milan Klobusicky, Anna Totkova, Renata Holkova, Michal Valent and Jarmila Galatova

Institute of Parasitology, School of Medicine, Comenius University, 811 08 Bratislava, Sasinkova 4/a, Slovakia

Corresponding author: Milan Klobusicky, Institute of Parasitology, School of Medicine, Comenius University, 811 08 Bratislava, Sasinkova 4/a, Slovakia

ABSTRACT. The authors have examined 31 children from the nursery, out of which 8 children were positive, and 16 employees, out of which 3 persons were positive. They also wanted to examine the family members of positive children and positive employees, however the offer was accepted only by one cleaner's family (infected with *Ascaris lumbricoides*, *Enterobius vermicularis* and *Entamoeba coli*). All the 8 members of this large family except of a cleaner (member of the family 1 = fm 1) and her grandson (fm 4) were without clinical and laboratory findings. They have formed 3 independent families living in 1st category flats. At that time a sewage disposal breakdown took place at the ground floor flat owned by the family number 2, and the flat was flooded by the sewage. All adult members of the families as well as the members of the family number 4 being the friends of family number 2 worked on flat cleaning. As the clinical symptoms showed later, during the prepatent period and just after its burning out (within 73–78 days), laboratory findings in members of the families proved that this event resulted in a heavy family infection equal to a family epidemic of intestinal parasites. The species *Ascaris lumbricoides* was diagnosed in 8 members (61.5%) of involved families and *Giardia intestinalis* in 7 members (53.85%). The species *Enterobius vermicularis* was found in 2 and *Entamoeba coli* in 1 member of the involved families. The family epidemic proved several times more frequent incidence of *Ascaris lumbricoides* and *Giardia intestinalis* than sporadic findings in children and adults. The fact that, after long years of low prevalence of *Ascaris lumbricoides* such a mass infection has happened can be treated as a surprise. And the same concerns *Giardia intestinalis*. The authors discussed the incidence of *Ascaris lumbricoides* and *Giardia intestinalis* and preventive measures taken against them in the population.

Key words: ascariidosis, breakdown of sewage system, children, employees, family epidemic, giardiasis.

Introduction

The insufficient monitoring of intestinal parasitological diseases and neglecting this monitoring have led to the decrease of interest in prevention incidence and underestimating of professional precautions attested in the past. The evaluation of environment influence for health according to the level of bio-indicators incidence was discontinued. In our case there are different stages of intestinal parasites. Their expulsion into environment by the hosts is equal to the negative effects of other abiotic and biotic agents [1].

Fluctuation in monitoring allowed to record changes in the prevalence of infection by *Ascaris lumbricoides* and the degree of environmental contamination. The occurrence of *Ascaris lumbricoides* 2/0.1% and *Trichuris trichuria* 11/0.6% in 1947 children in Bratislava in the 80s led to the conclusion that its development is underestimated. Findings of 85 strains *Giardia intestinalis* despite of the repeated precautions still reached 4.4%. The similar results were demonstrated by Engyelova [2], Jedlicka et al. [3], Čunta et al. [4] in the same period. Basing on Straka and Skracikova [5] the prevalence of geohelminths in children in pre-school and

school institutions is very similar to the mentioned trend in the 80s. Geohelminths in nurseries and kindergartens were not found. In primary schools out of 6780 children 13/0.2% have *Trichuris trichiura* and 1/0.1% *Ascaris lumbricoides*. In the total amount of 1763 secondary school students [5] *T. trichiura* was found in 7/0.4% and *Ascaris lumbricoides* in 5/0.3% cases.

On the basis of these facts it seemed that growing risk of population over-contamination by these helminths species does not exist. That fact was generally accepted by the specialists. They were convinced that the ban on fertilization by human faeces will be kept for ever. The well known ability of *Ascaris lumbricoides* ova to survive in contaminated soil for 1–2 years minimum and 10–12 years maximum, during which the contamination of persons and repeated outbreaks of epidemiological process can happen was also underestimated [6]. The long-recognized low prevalence of geohelminthosis led to the judgement, that from the epidemiological point of view they are of low importance.

Material and methods

In order to find out what the epidemiological situation in prevalence of intestinal parasites is, we examined children and employees from the nursery in the street B in Bratislava in 1998.

From 36 registered children we tested for intestinal parasites 31 of them. We have also tested 16 employees, out of which 11 were nurses or nannies, two kitchen workers and 3 cleaners. Out of parasitologically positive employees our offer to examine also the members of their families was accepted only by 1 positive cleaner (born in 1946). Thus, we examined 8 members of her family, living separately in 3 different families. The family number 1 comprises mother (1946) and her daughters (1978 and 1985). The family No. 2 includes cleaner's pregnant daughter (1970), her son-in-law (1965) and their son (1996), being a grandson of the cleaner (1946). In the 3rd family lived her son (1966) and daughter-in-law (1978), and their daughter (1990). This granddaughter from time to time lived also with her grandmother (1946). Families No. 1–3 lived in 1st category flats. Mrs. Cleaner (1946) with the members of the family number 2 were parasitologically tested in May and the grandson (1996) was also examined in June. He suffered from diarrhoea at that time, a pediatrician treated him with Entizol.

Other family members were negative.

On August 31st there was an extensive technical breakdown of sewage pipeline at the ground floor of the flat owned by the family number 2. The whole flat was flooded by the sewage to the height of 50 cm and more. All equipment and walls of the flat were foul, wet and devastated. The 1st category flat suddenly sunk into hygienic category D and became uninhabitable. After technical repairs the flat-dwellers started to work on renovation immediately. Later on, other relatives and even four adult members of family number 4, being the friends of family number 2, helped them with cleaning and they sanitized the flat together.

Mrs. (1970), mother of the 2-year old son (1996) came to the health center because her son was frequently ill. A pediatrician prescribed him the medicines but the problems did not disappear. His mother was not satisfied with his health, so at the beginning of November 1998 she asked us to examine him against parasites. Shortly after her son's health problems, the mother (1970), also indicated the symptoms of 'virus' (pain in her throat, dry cough and irregular stool). She did not check her temperature. Her husband suffered from the same symptoms and temperature slightly over 37°C. The granddaughter (1990) of Mrs. Cleaner (1946) had the same symptoms at the same time and temperature over 38°C.

The similar symptoms found in several members of Mrs. (1946) large family led to examination for parasites of the whole family and 4 members of family number 4. The first, after the breakdown, examination for parasites, of all 13 person, was made on 12–17th November 1998, at the end of the mentioned clinical demonstration and at the end of prepatent time. The examination was repeated on 18–24th November 1998 and 1–9th December 1998.

The stool samples and perianal PVC tapes were examined from children and employees and in one case also from members of the cleaner's family three consecutive days. The family members of positive children and two positive employees did not accept our offer.

The stools were examined by thick smear method by Katoh, modified by Jirovec et al. [7] and by concentrated method MIFC (merthiolat-iodone-formaldehyde) [8], in valid cases at diagnostic of protozoans we coloured the samples by Heidenhein hematoxylin except from the samples coloured by Lugol's solution, and also by Giemsa-Romanovsky, all by in Jirovec et al. [7]. We coloured oocysts of cryptosporidia by Ziehl-Neelsen method according

to Henriksen and Pohlenz [9].

The samples taken by sticky PVC tapes' modified by the Graham-Brumpt method [10, 11] were checked under microscope (Amplival Zeiss Jena). The microscopic examination and evaluation was

done by the same experienced persons.

Results

The parasitological examinations revealed the

Table 1. The survey of positive findings in family members of positively diagnosed cleaner after the sewage disposal breakdown in family number 2

Family members	A. l.	E. v.	G. i.	E. c.
Family 1.				
mother-grandmother 1946 member 1	●	●	○	○
daughter 1978 member 2	●	○	●	○
daughter 1985 member 3	○	○	○	○
Σ 3	2/1	1/2	1/2	--
Family 2.				
Daughter 1970 of member 1 Member 4	●	○	●	○
Son- in-law 1965 of member 1 Member 5	●	○	●	●
Son 1996; grandson of member 1 Member 6	●	○	●	○
Σ 3	3/0	-	3/0	1/2
Family 3.				
Son 1966 of member 1 Member 7	○	○	○	○
Daughter-in-law 1978 of member 1 Member 8	○	●	○	○
Daughter 1990; Granddaughter of member 1 Member 9	●	○	●	○
Σ 3	1/2	1/2	1/2	-
Family 4., friends				
father 1967 member 10	●	○	○	○
mother 1971 member 11	○	○	●	○
son 1991 member 12	●	○	●	○
Daughter d1996 Member 13	○	○	○	○
Σ 4	2/2	-	2/2	-
Σ 13	8	2	7	1
%	61.5	15.4	53.85	7.7

● — positive finding, ○ — negative finding; A.l — *Ascaris lumbricoides*, E.v.- *Enterobius vermicularis*, G.i. — *Giardia intestinalis*, E.c. — *Entamoeba coli*

presence of four species of intestinal parasites in children: one case of *Ascaris lumbricoides*, 1 case of *Giardia intestinalis*, two cases of *Enterobius vermicularis*, one case of *Hymenolepis nana* and 1 case of double infection: with *A. lumbricoides* and *G. intestinalis*. Among the staff we diagnosed *A. lumbricoides* and *G. intestinalis* in one nurse, *A. lumbricoides* in one kitchen worker, and *A. lumbricoides*, *Enterobius vermicularis* and *Entamoeba coli* in one cleaner.

At the request of the positive diagnosed cleaner (1946 — marked as family member 1 = fm 1), who was afraid about her pregnant daughter (fm 4), we examined in May 1998 also the members of family number 2, but we did not detect any parasites. The results of repeated examination of the grandson (fm 6) made in June, were also negative. At the beginning of November, just after the breakdown, we diagnosed cysts of *Giardia intestinalis* in his faeces together with ova of *Ascaris lumbricoides* (Table 1). We sent him to a pediatrician with recommended therapy. The results of laboratory tests made after the treatment were successful. At the same time, in stool of his mother (fm 4) we diagnosed *Ascaris lumbricoides* and *Giardia intestinalis*. The father (fm 5), and also the cleaner's son-in-law was infected by *Ascaris lumbricoides*, *Giardia intestinalis* and *Entamoeba coli*. The most frequent intestinal parasites found in families were *Ascaris lumbricoides* and *Giardia intestinalis* (Table 1).

The finding of *Ascaris lumbricoides* and *Enterobius vermicularis* in the cleaner's (fm 1) family number 1 was proved for the second time. Her daughter (fm 2) was expelling ova of *Ascaris lumbricoides* and cysts of *Giardia intestinalis*. In the granddaughter (fm 9) who stayed in this family very often, *Ascaris lumbricoides* and *Giardia intestinalis* were detected. While checking the treatment results, *Giardia intestinalis* was again found in her stool. The treatment was repeated. From the third family the test results of the cleaner's son and daughter's (fm 9) father (fm 7), staying very often in the family number 1, were negative. His wife (fm 8), daughter-in-law of the cleaner (fm 1) was infected by *Enterobius vermicularis*.

Besides them we examined the mother (born in 1920) of cleaner (fm 1) who visited her daughter's flat nearly everyday. Her parasitological examination was negative.

In the family number 4 we examined 4 members. In the father (fm 10) we found *Ascaris lumbricoides* and his wife and mother (fm 11) had cysts of

Giardia intestinalis in the stool. Their son (fm 12) was infected by both intestinal parasites: *Ascaris lumbricoides* and *Giardia intestinalis*. In his sister (fm 13) we did not find any parasite (Table 1).

Altogether we tested for parasites 13 persons in 4 families, out of which 8 were adults and 5 were children. Two children and 1 adult man were parasitologically negative. As to the species we diagnosed the most often *Ascaris lumbricoides* (8/61.5%) and *Giardia intestinalis* (7/53.85%). Twice we detected *Enterobius vermicularis* (15.4%) and in one case *Entamoeba coli* (Table 1).

Discussion

The aim of the presented study was to investigate the prevalence of intestinal parasites in children collectives at day care centers in Bratislava, their families and employees of those centers, as in our opinion there are more incidents of intestinal parasites in day nursery, especially *Ascaris lumbricoides* than it is stated in the findings of some other authors [2, 12–14]. It was supposed that the ban on using faeces dunging (sewage still spreading) in agriculture brought a radical turn in the incidence of geohelminths with a long-lasting effect. At the end of the 80 s and at the beginning of 90 s professionals considered the problem as having been solved and under control. It was replaced by more struggling problems with giardiasis, cryptosporidiosis, enterobiosis and toxocarosis. The problem of geohelminthoses was considered as a less important.

In studies dealing with the presence of intestinal parasites in sewage plants of all types Horak [15] and Plachy [16] took the number of *Ascaris* ova in 100 g faeces as a unit. The findings were as follows: *Ascaris* spp. ova, 24–105 items, *Trichuris* spp. ova, 2–33 items. A part of them may originate from animals, but much come from people. This is a clear evidence, that there are much more people infected by these parasitic worms than traditionally believed.

Plachy [16] found *Ascaris* spp. ova in all 8 tested sewage plants. In the samples of stabilized faeces before they had been used in the agriculture, there were found 78.2 % of positive vital helminths ova. The main questions concerned inadequate number of ova findings in sewage plants in comparison with a very low incidence of ascariasis in human population. Additionally, the use of faeces in agriculture enables the circulation of numerous helminths infection.

These facts made us looking for the articles and

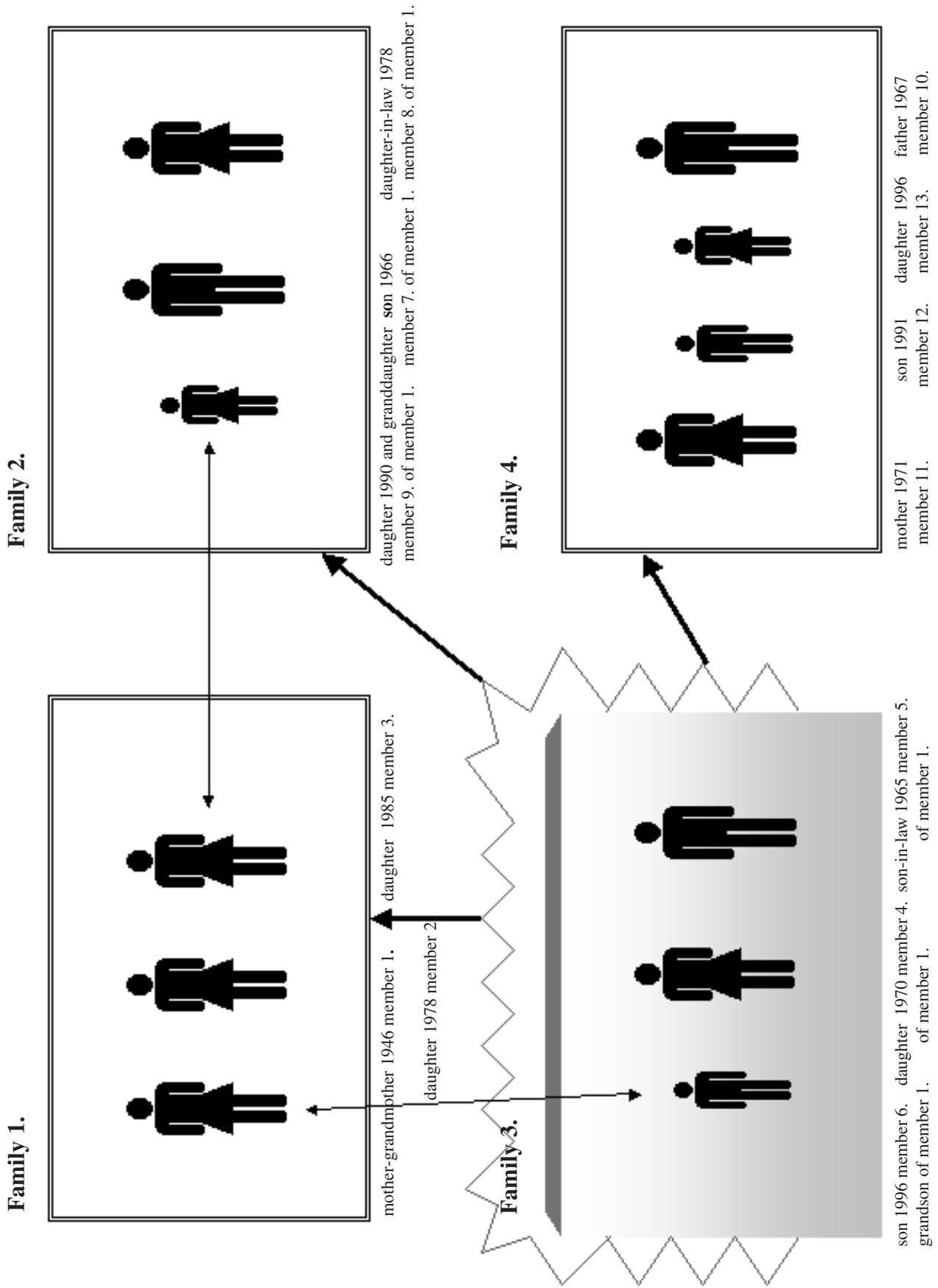


Fig. 1. Spreading of intestinal parasitoses from the flat of family number 2. to other family members

studies which would show at least a little bit increased findings of *A. lumbricoides* and *T. trichiura*. Just on the contrary, we have not found that kind of articles. Skracikova and Straka [14] diagnosed *A. lumbricoides* and *T. trichiura* in the stool of 5/0.3% respectively 7/0.4% persons from 1763 secondary school students. A year later Flakova [17] diagnosed *A. lumbricoides* in 111/1.7% and *T. trichiura* in 139/2.13% in 6519 stool specimen. Such results admit the feasibility of worms incidence increase. Straka et al. [18] from Martin published charts listed contrary facts to those mentioned above. In the 1997–1999 report written by National Reference Center for Intestinal Parasites [19] showed an increase of *A. lumbricoides* and *T. trichiura* from 0.51% to 0.65% in the years 1997, 1998 and 1999, respectively from 0.27% to 0.29%. The increase in 1999 compared to 1997 *A. lumbricoides* meant 12 500 newly diagnosed cases in Slovakia. It seems that these signals are more and more expressive and confirm the increased prevalence of *A. lumbricoides*.

Epidemic situation of geohelminthoses demonstrates regional differences and the change of their prevalence. We thoroughly examined 2050 children from Bratislava at the age of 2–15 and we asserted an important increase of *A. lumbricoides* findings from 3.95% in kindergartens to 5.34% in primary school [20–24]. The reports of Konakova [19] and Totkova [20, 22–24] fit better into the series of explanations why the environment became contaminated by *A. lumbricoides* after the breakdown of sewage system. If the incidence of this parasitic worms had been such as it has been reported since 80s, we could not have discovered its high occurrence in the sewage system. If we add to this fact another one that it is a frequent avoiding of already mentioned ban, it is more than probable, that consumers are exposed to infection with geohelminths ova or protozoan cysts [7, 25–27].

Consumption of nutritious fruits and vegetables by pre-school and school children is multiplying the risk of parasite infection. If the fruits or vegetables are not washed properly, the protozoan cysts and geohelminth ova stay on the surface of fruit and vegetables [7]. The occasional parasite infections did not come as surprise for us.

There are many more other causes of possible parasitic infection like in case of the epidemic process in the good-sized family of cleaner (fm 1). There was a breakdown of sewage system in the flat of her daughter (family number 2), leading to

destruction of the flat and degradation of the hygienic standard. During the cleaning works at the flat and removing the effects of the breakdown, all adult family members were helping and all children were also exposed to possible infection (families number 1–4). The contagiousity of ascariasis was increased and resulted in general infection (Fig. 1). Ten (76.92%) persons from 13 exposed family members were infected. Out of laboratory positive persons 7/70.0% showed several clinical signs in prepatent period. The prepatent period last 73–78 days according to the data stated in all parasitology compendia [7, 25–29]. *A. lumbricoides* ova were first detected in stools on November 12th to 17th 1998.

Giardia intestinalis was the second most often diagnosed intestinal parasite in 7(53.85%) people staying in the contaminated flat. Last years many workplaces noticed a dropping rate of *G. intestinalis* and *A. lumbricoides*, but not in children in Bratislava. In 2002 Totkova [20] detected *G. intestinalis* in the group of children at pre- (9.9%) and primary schools (8.4%). In comparison with previous years epidemic situation of certain parasitoses got worse.

Regional differences are not surprising us. The results of Straka et al. [18] serve as the right opposite example to the findings in Bratislava. They claim, that the situation in incidence of intestinal helminths and protozoans got much better in children of the Martin District, especially in geohelminths incidence. A sharp fall was even registered in intestinal protozoans.

Some questions arise. If such a breakdown had taken place in Martin, would the findings have been similar? What species of intestinal protozoans would have been detected in sewage water? We suppose the intensity of infection would not have been lower than in Bratislava.

The prevalence of intestinal parasites in collectives reflects the long-lasting influence of many factors. The four families taking part in sanitation work in the flat of family number 2 and being exposed to massive invasion have the same hygiene problems at the same time.

The best image can be provided by the scheme presented on the Fig. 1, showing the beginning and the intensity of infection at the time when in the primary source of infection (family number 2) all persons were infected. The infection spread to family number 1, in which 66.67% persons were infected, and also to family number 3. In the family number 4 the infection was high, 75.0%. The time when the

persons were infected could be registered exactly and the infection was coupled with clinical symptoms typical for individual parasitosis during the prepatent period. The number of persons with clinical problems and persons with laboratory checked parasitosis expresses the degree of intensity of epidemic process and reflects its activity in the limited time. It is expressed by the degrees of morbidity. If morbidity reaches a degree which can be considered as a normal in the given field and in the observed period, we speak about sporadic incidence. If the number of infected persons is large in a certain place and time and if it remarkably exceeds the sporadic incidence [30, 31] and if additionally there is a connection between individual cases [32], we can speak about epidemics. Such intensive degree of incidence could have been registered in the case of the large family of the cleaner and their friends after the breakdown which served as an opportunity for infection. This case can be considered as a family epidemics although a small one because of the number of infected persons and very rare as far as ascariasis is concerned. *A. lumbricoides* species were diagnosed 6.4 and 3.3 times more often in adults and children as compared with sporadic incidence. *G. intestinalis* was detected 5.6 and 8.6 times more often.

There were 4 new sources and 9 already existing sources of intestinal parasites infection. We want to stress that similar situations should be taken for real but not coming at once and spontaneously. If we looked for similar situations, we have to remember about the floods coming back regularly. Flooded flats and houses can be contaminated to the height of 50 cm and more and the degree of infection can be different in each case. The same refers to the biological agents which can also be different in each case. However we should be aware that epidemiological effects are even more serious than we can imagine or register.

Conclusion

We would be glad if the positive attitude of the cleaner (1946) and her family members towards examination for parasites was not so rare nowadays. In all cases people should be concentrated on observing and catching the sources of intestinal parasites infection. As a positive example of responsible attitude we can mention these positive employees who did not refuse the examination on parasites made on the members of their families. They under-

stood that every other carrier of infection in the family means increased possibility of infection spreading for other members of family or collective.

Thanks to responsible attitude of all participants of the sanitation work, who accepted the laboratory examination, even repeated ones, who also accepted treatment and after treatment control, the epidemic situation was managed. In this way all opportunities of repeated infection were avoided as well as all ways of transmission interrupted and seats of infection eradicated.

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