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ORIGINAL ARTICLE

INTESTINAL PARASITIC INFECTIONS IN A LOW-INCOME URBAN COMMUNITY: PREVALENCE AND KNOWLEDGE, ATTITUDES AND PRACTICES OF INHABITANTS OF PARQUE OSWALDO CRUZ, RIO DE JANEIRO, BRAZIL

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ABSTRACT

Intestinal parasitic infections (IPIs) are present in Brazil from upper-to low-income communities, with varying infection estimates; however, they affect those living in urban and rural poverty more severely, without adequate access to consistently safe drinking water, sanitation, waste disposal, medical access and education. Estimates show the need for establishing infection prevalence and socioeconomic features, along with population knowledge, attitudes and practices (KAP) regarding IPIs. The purpose of this study is to assess the prevalence and KAP regarding IPIs of residents of an urban low-income community (Parque Oswaldo Cruz/Amorim) of the Complexo de Manguinhos, Rio de Janeiro, Brazil. The Lutz sedimentation technique was used for parasite detection (n=1,121) and, to obtain data on community KAP regarding IPIs, a KAP survey, adapted from Mello et al. was applied (n=505). An overall prevalence of 20.7% was detected with protozoa composing 92.9% (n=235) of the positive samples. Questionnaires revealed generally correct knowledge but with several inconsistencies, unawareness of the association between the etiological agent and the disease, and uncertainty regarding own knowledge of the subject. The population understood the importance of prevention and was willing to utilize prevention strategies despite being unsure of how to prevent infection. Further studies are required to investigate best practices for improving health equity, community health empowerment and IPIs prevention in Rio de Janeiro, Brazil.

KEY WORDS: Parasitology; urban health; health literacy; neglected diseases.

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INTRODUCTION

Intestinal parasites are indisputably widespread, both regionally and globally: more than two billion people worldwide, roughly one third of the global population, are estimated to be parasitized with 42% of the population of Latin America infected (WHO, 2005a; Hotez et al., 2008). Despite lacking published data on the prevalence of national intestinal parasitic infections (IPIs), from 2000 to 2010, 88 data points in Brazil were utilized for determining soil-transmitted helminth (STH) frequency with the majority of these points presenting a prevalence between 20-50%, and mostly light to moderate infection intensities (Saboyá et al., 2013). In urban communities, roundworm (*Ascaris lumbricoides*) and whipworm (*Trichuris trichiura*) are the most common geo-helminths (Crompton & Savioli, 1993; Colli et al., 2014). However, protozoa infections are far more usual than STH amongst urban populations, specifically amebiasis and giardiasis, estimated to affect 15.5 million school-aged children, with a prevalence of 30% (Ferreira et al., 2002; Visser et al., 2011). Despite protozoa prevalence, these are rarely addressed by IPI programs and prevention policies (Colli et al., 2014). Globally the focus of these programs has been on helminth control among school age and preschool-age children through preventive chemotherapy (PAHO, 2013).

Although present in upper- and middle-income communities, intestinal parasites overwhelmingly affect those living in poverty, both urban and rural. IPIs may lead to malnutrition through various mechanisms including reducing nutrient absorption capacity, provoking micro-hemorrhages, and reducing physical and mental functions of infected individuals in these communities, evidencing a loss of professional productivity and academic capacity perpetuating an ongoing cycle of poverty and disease (Marquez et al., 2002; Araújo-Jorge, 2011; WHO, 2005b). Living conditions associated with urban poverty, which facilitate the transmission of IPIs — contaminated water, inadequate sanitation and garbage disposal and overcrowding — favor contact with parasite eggs and cists via fecal-oral transmission (Uchôa et al., 2001). While socio-environmental conditions, knowledge and sanitary measures such as handwashing remain unchanged in combination with inadequate access to primary health care services, frequent reinfection will occur despite the advances made in anthelmintic drugs (Jia et al., 2012; Brooker et al., 2004; Andrade et al., 2010).

In addition to prophylactics, strategies that go beyond the parasite itself and target the environmental and social conditions associated with poverty should be applied to reduce IPI prevalence in urban slums since it is these conditions that maintain the parasite in the community and favor transmission. These include intervention measures based on popular knowledge, attitudes and practices (KAP) developed using culturally appropriate language (Pereira et al., 2012). However, to design such measures the local infection profile and KAP must be investigated. The purpose of this study is to assess the prevalence and KAP regarding IPIs of residents of an urban low-income community (Parque Oswaldo Cruz/Amorim) of the Complexo de Manguinhos, Rio de Janeiro, Brazil.

METHODS

Study area and population

Parque Oswaldo Cruz (POC) (22º52'20.1"S, 43º14'54.1"W), also known as "Amorim", was the first community of the Complexo de Manguinhos (CM) in the Northern Zone of Rio de Janeiro, RJ, Brazil. 939 families, totaling approximately 3,000 residents, acknowledged by the Family Health team of the Brazilian Unified Health System (SUS) (Teais Escola Manguinhos, 2014) live in 0.079 km^2 of hilly landscape, presenting a maximum altitude of 35m.

Survey of resident socioeconomic conditions

For this cross-sectional study, a population survey was performed utilizing a questionnaire answered by a household representative in each participating home to evaluate the socioeconomic profile of the household. The household representative was an adult residing in the home and willing to exercise this role at the time of the home visit.

Collection and processing of KAP for IPIs

A KAP survey, adapted from Mello et al. (1988) and pre-tested with residents of a neighboring community (n= 33), was performed, in which a questionnaire was answered by the household representative (n= 505). The questionnaire consisted of 23 open- and closed-ended questions on various aspects of IPIs including life cycle, diagnosis, symptoms, treatment and prevention. The answers were distributed in a frequency table, developed after survey application and based on categories which arose from the open answers provided by the participants. Questions fell into the following categories: etiology, life cycle, disease (diagnosis, signs and symptoms), treatment and prevention. Answers to an open- ended question such as "What do you know about intestinal worms?" were categorized as correct, partially correct, incorrect and unknown according to established and recognized concepts of parasitology (Rey, 2008).

Collection and processing of fecal sample data

A specimen container for each eligible resident was appropriately labeled and given to the household representative, along with oral instructions on how to collect and store the samples. Residents were eligible to return fecal samples if they were at least two years old and not pregnant or nursing at the time of the study. The research team returned to each participating house every day for three days to collect the stool samples. Fresh samples were analyzed utilizing the modified Lutz sedimentation method.

Treatment of parasitized individuals

Every individual with a positive sample was home-treated by physicians at the participating Family Health clinic. The drugs used were provided by Farmanguinhos, FIOCRUZ, and by the public health authorities of the municipality of Rio de Janeiro. Negative results were delivered to the participants at their homes directly by the study team.

Data management and statistical analysis

Data were entered into an ACCESS (Microsoft Office 2007 for Windows) database created specifically for this study and exported to Statistical Package for the Social Sciences (SPSS Version 21) for statistical analysis. P-values were calculated using the Chi Square Test to test for significance of associations between socioeconomic characteristics and infection.

Ethics

This study was approved by the IOC/FIOCRUZ Committee for Ethics on Research (Protocol Number 548/10). All study participants received an oral and written explanation on their rights, the procedures utilized, and the purpose of the study in accessible language. Recruitment occurred only after obtaining signed consent and each household received a copy of the Free and Informed Consent form (TFIC). Household representatives were adults over 18 years, present in the residence at the time of the visit, willing to answer the questionnaires and serve as the main household contact. Individuals were excluded from the study if pregnant, under the age of two years, and/or incapable of understanding the TFIC, yet their information was included in the socioeconomic survey answered by the household representative.

RESULTS

A total of 1,862 residents of POC from 505 households were registered in the study from March 2010 to December 2011. Socioeconomic and household characteristics of residents of POC are presented in Table 1. Regarding monthly household income (MHI), 63.0% (n=318) of the residents reported a MHI of 2-4 monthly minimum wages (MMW). At the time of this study, the MMW in Rio de Janeiro was R$581.88 equaling roughly USD$330 with an inflation rate of 5.9% (Law nº 5.627, de 28 de dezembro de 2009). The only statistically significant difference among household and/or socioeconomic characteristics among participants with and without intestinal parasitic infections was the number of residents per household.

Of the 1,671 residents eligible to return fecal samples, 67.1% (n=1,121) participated from 79.01% (n=399) of the visited households. Parasites were detected in 20.7% of the samples (n=232) and in 40.85% of the households (n=163). The greatest infection prevalence was among younger children (2-9 years) and adolescents (10-19 years) (25.4% and 22.7%, respectively). Protozoa were the most predominant in the stool samples with *Endolimax nana* being the most common (n=136) (Table 2).

Monoparasitism was detected in 90.1% of the positive samples. The most frequent cases of polyparasitism involved two infections: *E. nana* and *E. coli* (n=12), and *E. nana* and *E. histolytica/dispar* (n=6). Triple infection consisted of *G. intestinalis, E. vermicularis* and *E. nana*.

Table 3 shows answers to dichotomous questions meant to obtain self-proclaimed KAP regarding IPIs. As for treatment, 94.85% (n=479) would seek treatment with a doctor or health station and 74.3% (n=376) took medication for treating IPIs.

When asked “What do you know about intestinal parasitic infections?” (question asked in Portuguese with three locally relevant terms used in the place of “intestinal parasitic infections”) residents provided correct and partially correct information in 47.1% (n=238) and 8.3% (n=42) of the questionnaires. Although only 11.3% of respondents reported knowing nothing about IPIs when presented with a closed, dichotomous question, 38.% (n=192) of the respondents said that they did not know anything about IPIs when the question was open-ended. It is noteworthy that when the original 11.3% who claimed to know nothing about IPIs were asked the open- ended follow-up question, variations of correct answers were provided, such as (translated) “those things that itch a lot and look like little lines”, “a little bug that can show up on your butt or vagina”, “you have to wash your food and hands not to get this”, “lack of hygiene causes it”, “a little animal that causes problems”, “I’ve heard that they are protozoa”, and “they cause diarrhea”.

Table 1. Distribution of socioeconomic and epidemiological characteristics of residents of Parque Oswaldo Cruz, Rio de Janeiro, RJ, Brazil.

SOCIOECONOMIC CHARACTERISTICS		ANSWER	ALL n_1	ALL SAMPLES n_2	ALL POSITIVE SAMPLES n_3	P-VALUE
Individual Characteristics n_1=1,862 n_2=1,121 n_3=232	Age bracket	0-9 y.	266 (14.3)	203 (18.1)	41 (18.3)	0.609
		10-19 y.	319 (17.1)	182 (16.2)	42 (18.8)	
		20-59 y.	1013 (54.4)	537 (47.9)	106 (47.3)	
		≥60 y.	257 (13.8)	199 (17.8)	35 (15.6)	
		No answer	7 (0.4)	-	-	
	Sex	Male	873 (46.9)	474 (42.3)	105 (46.9)	0.120
		Female	989 (53.1)	647 (57.7)	119 (53.1	
	Educational level *	Illiterate	40 (3.2)	25 (4.2)	8 (5.7)	0.384
		Incomplete elementary	396 (31.2)	231 (38.8)	68 (48.2)	
		Complete elementary	181 (14.2)	81 (13.6)	17 (12.1)	
		Incomplete high school	115 (9.0)	50 (8.4)	8 (5.7)	
		Complete high school	416 (32.7)	160 (26.9)	32 (22.7)	
		Some college, no degree	49 (3.9)	13 (2.2)	2 (1.4)	
		College degree	54 (4.2)	22 (3.7)	2 (1.4)	
		No answer	20 (1.6)	13 (2.2)	4 (2.8)	

Household Characteristics n_4=505	Monthly household income (MHI)	≤ 1 MMW	109 (21.6)	83 (21.1)	32 (19.9)	
		2-4 MMW	318 (63.0)	251 (63.9)	110 (68.3)	0.293
		≥5 MMW	76 (15.1)	59 (15.0)	19 (11.8)	
		Unknown	2 (0.4)	0	0	
	People per household	1-3	246 (48.7)	181 (46.0)	49 (30.4)	
		4-6	223 (44.2)	185 (47.1)	96 (59.6)	0.000
		7-13	36 (7.2)	27 (6.9)	16 (9.94)	
	Water for human consumption	Canalized water	478 (94.7)	376 (95.7)	224 (96.5)	
		Mineral water	25 (5.0)	17 (4.3)	8 (3.5)	0.305
		Unknown	2 (00.4)	0	0	
	Floor material	Wood	14 (2.8)	12 (3.0)	5 (3.1)	
		Ceramic	442 (87.5)	339 (86.3)	143 (88.8)	0.329
		Concrete	40 (7.9)	34 (8.7)	9 (5.6)	
		Other	9 (1.8)	8 (2.0)	4 (2.5)	
	Wall	Bricks without rendering	36 (7.1)	26 (6.6)	13 (8.1)	
		Bricks with rendering	463 (91.7)	364 (92.6)	146 (90.7)	0.405
		Other	6 (1.2)	3 (0.8)	2 (1.2)	

Household Characteristics n_4=505	Toilet	Inside the house	481 (95.2)	378 (96.2)	155 (96.3)	0.997
		Outside with a septic tank	5 (1.0)	5 (1.27)	2 (1.2)	
		Outside without a septic tank	16 (3.2)	10 (2.54)	4 (2.5)	
		Unknown	3 (0.6)	0	0	

*The educational level was only determined for all adults (n=1,271), adults with fecal samples (n=736) and adults with stool samples positive for helminths or protozoans (n=141). MMW: Monthly Minimum Wages.

Only 3.6% (n=18) of the residents of POC associated intestinal parasites with any biological agent, of these only 0.6% (n=3) mentioned that parasites were involved at all (Table 4). When describing how IPIs were acquired, the most common answers could be placed in the handwashing (13.7%, n=69) or food (13.3%, n=67) categories. A sample of common answers categorized into the "food" category, translated, were: "food left out on the table for too long", "food not washed or handled properly", "contaminated food", "eating too much junk", "undercooked food", "dirty vegetables". A third of the population (33.5%, n=169) cited the mouth, 11.3% (n=57) the feet, and 10.3% (n=52) the skin as the mode of entry of intestinal parasites; while, 26.7% (n=135) did not know how intestinal parasites entered the body. The intestines and "belly" were cited as the habitat of intestinal parasites by 40.0% (n=202) and 17.4% (n=88) of the participants, respectively. However, 26.7% (n=135) and 19.2% (n=97) declared not knowing how IPIs were acquired nor where the parasites resided within the body. The majority of the participating residents (53.3%, n=269) believe that intestinal parasites die once they are no longer within the human body and 29.7% (n=150) did not know. Stomach pain (15.8%, n=80), itching (14.1%, n=71), and a decreased appetite (10.7%, n=54) were symptoms most often associated with IPIs, yet 15.1% (n=76) did not know of any IPI symptoms.

Table 5 shows prevention and treatment practices reported by the residents of POC. The practice most utilized for preventing IPIs reported was being hygienic and the following are some examples of these answers: "have hygiene" (most common), "wash the bathroom to maintain hygiene", "I'm hygienic because I always clean the house", "maintain hygiene by cleaning everything with lots of soap". Seeking medical attention (1.7%) and taking medications (0.6%) as prevention were included in the "other" category. Medication and/or teas are used for treating IPIs in POC, however 9.6% (n=46) would not use anything to treat IPIs.

Table 2. Frequency and profile of intestinal parasitic infections in residents of Parque Oswaldo Cruz, Rio de Janeiro, RJ, Brazil.

AGE (YEARS) Sample size	2-9 n (%)	10-19 n (%)	≥ 20 n (%)	Total n (%)
Total tests	177	181	763	1121
Total prevalence	45 (25.4)	41 (22.7)	146 (19.1)	232 (20.7)
Parasites	49 (19.4)	42 (16.6)	162 (64.0)	253 (100.0)
Protozoa	42	39	154	235 (92.9)
E. coli	10	8	40	58
E. nana	19	26	91	136
E. histolytica/dispar	0	2	15	17
G. intestinalis	12	3	6	21
I. bütschilli	1	0	2	3
Helminth	7	3	8	18 (7.1)
A. lumbricoides	2	1	1	4
E. vermicularis	5	2	1	8
S. mansoni	0	0	1	1
S. stercoralis	0	0	3	3
Taenia spp	0	0	2	2

Table 3. Answers to close-ended questions concerning intestinal parasitic infections of residents of Parque Oswaldo Cruz, Rio de Janeiro, Brazil. (n=505).

QUESTIONS	YES n (%)	NO n (%)	UNKNOWN/ UNANSWERED
Do you know of IPIs?	448 (88.7)	57 (11.3)	0
Do you know of more than 1 type of intestinal parasite?	239 (47.3)	263 (52.1)	3 (0.6)
When you/ your child has an IPI, do you go to:			
Doctor or health center	479 (94.9)	25 (4.9)	1 (0.2)
Pharmacy	117 (23.2)	388 (76.8)	0
Faith healer or witchdoctor	14 (2.8)	490 (97.0)	1 (0.2)
Do IPIs cause problems for people?	488 (96.6)	12 (2.4)	5 (1.0)
Are IPIs a bad disease?	486 (96.2)	19 (3.8)	0
Do you know how to prevent IPIs?	375 (74.3)	129 (25.5)	1 (0.2)
Do you do something to prevent IPIs?	425 (84.2)	76 (15.0)	4 (0.8)
Is it important to prevent IPIs?	490 (97.0)	5 (1.0)	10 (2.0)

Table 4. Frequency of knowledge and attitudes concerning intestinal parasitic infections of residents of Parque Oswaldo Cruz, Rio de Janeiro, Brazil. (n=505).

QUESTIONS	ANSWER		TOTAL n(%)
Cause of IPIs	Any biological agent	Parasite	3 (0.6)
		Bacteria	6 (1.2)
		Worm	9 (1.8)
		Total	18 (3.6)
	No biological agent mentioned		487 (96.4)
Infection source	Water		28 (5.5)
	Food		67 (13.3)
	Hygiene		85 (16.8)
	Not washing hands		69 (13.7)
	Candy/ sweets		30 (5.9)
	Barefoot		92 (18.2)
	Soil/ sand		19 (3.8)
	Other		36 (7.1)
	Unknown		75 (14.9)
Entry site/ point of entry	Feet		57 (11.3)
	Mouth		169 (33.5)
	Cuts		14 (2.8)
	Skin		52 (10.3)
	Hands/ nails		35 (6.9)
	Other		43 (8.5)
	Unknown		135 (26.7)
Habitat in the human body	Intestines		202 (40.0)
	Stomach		45 (8.9)
	Liver		5 (1.0)
	Blood		25 (5.0)
	Anus		4 (0.8)
	Skin		6 (1.2)
	Stool		7 (1.4)
	Belly		88 (17.4)
	Other		26 (5.2)
	Unknown		97 (19.2)

Fate of parasites outside of the human body	Die	269 (53.3)
	Toilet or sewage	7 (1.4)
	Infect others	27 (5.4)
	Live	28 (5.5)
	Other	21 (4.2)
	Unknown	150 (29.7)
Symptoms	Diarrhea	11 (2.2)
	Stomach pain	80 (15.8)
	Nausea/ Vomiting	38 (7.5)
	Weakness	29 (5.7)
	Itching	71 (14.1)
	Dizziness	12 (2.4)
	Lack of appetite	54 (10.7)
	Anemia	17 (3.4)
	Swollen belly	37 (7.3)
	Insatiable hunger	18 (3.6)
	Yellow/ pale skin	17 (3.4)
	Skin rash	12 (2.4)
	Other	33 (6.5)
	Unknown	76 (15.1)

Table 5. Frequency of practices regarding the prevention or treatment of intestinal parasitic infections reported by residents of Parque Oswaldo Cruz, Rio de Janeiro, Brazil. (n=505).

QUESTIONS	ANSWER	TOTAL *n*(%)
Prevention techniques	Use filtered water	42 (6.6)
	Wear shoes	67 (10.6)
	Avoid sweets	16 (2.5)
	Hygiene	186 (29.4)
	Wash food	135 (21.3)
	Hand washing	112 (17.7)
	Other	48 (7.5)
	Unanswered	19 (3.0)
	Unknown	8 (1.3)
Treatments used	Nothing	46 (9.7)
	Only tea	42 (8.3)
	Medication	376 (74.3)
	Tea and medication	26 (5.1)
	Other	16 (3.2)

DISCUSSION

In this study, we assessed some socioeconomic and household vulnerabilities, the KAP of residents and the prevalence of IPIs in an urban low-income community, POC/Amorim, of the Complexo de Manguinhos (CM), Rio de Janeiro, Brazil. Costa et al. (2012) found a strong association between socioeconomic status and IPIs. According to the Censo Favelas, a census performed by the State of Rio de Janeiro to determine the living conditions of residents within the state's slums, residents of POC presented a better educational average and higher household incomes than the borough of Manguinhos (EGP-Rio, 2010). Although this study found that residents of POC had higher socioeconomic levels than the CM in its entirety, insufficient schooling and low income could still serve as a risk factor for disease in this community, negatively affecting the adoption of preventive measures despite some knowledge regarding the disease and risk factor (Rodrigues et al., 2012; Batistella, 2007).

Compared to the 2000 Census, the percentage of homes connected to a water distribution system increased from 92.8% to 99.5% in 2010 (IBGE, 2000; IBGE, 2010). Sanitary improvements, such as treated and piped water, have been found to reduce the incidence of roundworm infection (Strunz et al., 2014), supporting the low prevalence of roundworm found in POC. However, to compensate for a lack of public connections, piping was generally clandestine, installed by the residents themselves, often in proximity to sewage pipes, without proper maintenance, presenting leakage and with frequent supply shortages. Similar studies have found high levels of water contamination, despite canalization, which favor the transmission of fecal-oral diseases (Moraes Neto et al., 2010); where the most frequent infections detected were *E. nana* and *E. coli*, considered commensal protozoa that serve as bio-indicators of water contamination, utilizing the same fecal-oral route of infection as other pathogenic intestinal parasites (Rocha et al., 2000). Therefore, a constant piped water supply, although ideal, does not guarantee adequate quality for human consumption and further studies are needed to evaluate the water quality in this community.

The most frequent helminth was pinworm (*E. vermicularis*), with a prevalence of 0.7% in the study population, representing 3.2% of the parasitic infections found. This finding is supported by Souza et al. (2007) and Tavares-Dias & Grandini (1999). It is worth noting that the appropriate test for detecting pinworm is the Graham's Test, which utilizes an adhesive strip on the anal region for egg collection. The utilization of the Graham "scotch-tape" method increases 6.6 times the chance of detecting infections with pinworm when compared with conventional stool sample analysis; and, when this parasite is detected through stool samples, it is indicative of a high parasite burden (Silva et al., 2008). Therefore, further studies utilizing this complementary test are required to obtain a more accurate prevalence of pinworm infection despite the stigma and public wariness regarding Graham's Test and pinworm. These infections are characterized by uncomfortable pruritus ani and, due to the ease of transmission, generally all members of the same household are infected once one of the members has pinworm. Of the respondents, 14.1% cited "itching" as a symptom of IPIs suggesting familiarity with this parasite and possibly a much higher prevalence of *E. vermicularis* among the residents of POC.

When considering the KAP of residents of POC, generally correct knowledge was present yet there were several inconsistencies. Only 17.7% cited handwashing as a preventive technique despite the strong association between handwashing and IPI prevention (Strunz et al., 2014). Knowledge regarding the association of handwashing with disease acquisition could stimulate this easily performed preventive activity in this community. The second most common source of infection cited was through "food"; however, the answers in this category mixed established concepts of contamination, such as undercooked meats, as sources of intestinal parasites with non-established concepts like junk food, dairy products and fats. In their answers respondents were aware of the stool as the point of exit for parasites generally, but it was widely held (53.3%, n=269) that intestinal parasites died once outside the host's body with very few mentions of the sewage (1.4%, n=7) or the possibility of infecting others (5.4%, n=27). A lack of understanding of how and where the environment may be contaminated by intestinal parasites promotes transmission and maintenance of the infection cycle. In order to build upon preventive behaviors, core concepts of IPI source and mode of transmission, that highlight the passive (fecal-oral) and active (through the skin) routes of transmission, discuss the role of the environment in their life cycles, and are adapted to the realities and infection profile of the community must be available to vulnerable populations.

Correct answers provided by those who claimed no familiarity with IPIs and the sudden increase of "I don't know" when asked to specify their knowledge suggest participant insecurity and highlight the importance of question design. Despite lacking a sense of security in their own knowledge, participants felt that IPIs caused problems requiring prevention and most claimed to know how to prevent these infections suggesting willingness to participate in prevention strategies. However, it must be noted that a greater percentage of the inhabitants claimed to take preventive action than those who claimed to know how to prevent IPIs. Population support regarding prevention must be fostered by basic knowledge on which to develop practices that promote health and prevention.

In conclusion, a moderate level of infection was found in Parque Oswaldo Cruz, Rio de Janeiro despite improvements in socioeconomic conditions over time in this community. The infection profile suggests a need for further studies on the local environmental conditions, other indicators of socioeconomic status and the social determination process of disease.

Furthermore, KAP survey answers show a need for educational interventions based on the local infection profile which empower participants and provide the necessary knowledge to take appropriate preventive measures. Such initiatives should utilize the few established sources of health education in the community, hence encouraging studies on the role of the family health teams in Brazilian low-income communities.

Although the prevalence and profile of monoparasitism and polyparasitism in POC was similar to other studies (Colli et al., 2014; Moraes Neto et al., 2010; Gil et al., 2013; Damazio et al., 2013), the collection of a single fresh sample and the utilization of no more than a sedimentation method (Lutz) for parasitological analysis, could have limited parasite detection. This method was selected, not only because of the method's ability to detect a wide variety of parasites at a low cost, but also because the Lutz Method is utilized for routine parasitological stool tests in laboratories associated with the primary care clinics of the Brazilian Unified Health System, allowing for posterior comparisons with available public sector data (Souza et al., 2007).

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