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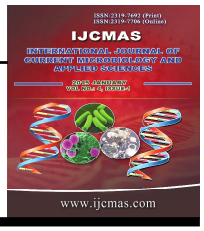

Original Research Article

Neglected Tropical Diseases in Nigeria: A Case Study of Ascaris Worm Infestation among Pupils of Selected Primary Schools in Owerri, Imo State, Nigeria

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A B S T R A C T

Ascariasis is a common disease worldwide though it occurs more in developing countries with poverty, poor living conditions and an ignorant population and is a major contributor to the prevalence and burden of neglected tropical diseases globally. The aim of the study is to assess the prevalence and pattern of *Ascaris lumbricoides* infestation among pupils in primary schools in Owerri, Imo State, Nigeria. This was a school based descriptive cross sectional study conducted from June to December 2013 among six hundred primary school children selected by multistage sampling technique. A semi structured interviewer administered questionnaire was used to collect information from participants. Stool samples were collected processed with formol ether concentration technique and examined for viable eggs of *Ascaris.* The overall prevalence of *Ascaris* infection found in this study was 22.7%, with pupils in public schools, (29.0%), having higher prevalence of infection than their counterpart in private schools, (16.3%), (χ^2=13.72, df =1, p=0.000). Majority, (77.2%) of those infected had mild worm infestation. Owing to the relatively high prevalence of *Ascaris* found in this survey, there is need to institute appropriate control measures in schools across the country to reduce the burden of the disease.

Introduction

The Neglected tropical diseases (NTDs) are a group of tropical infections which are especially endemic in low-income populations in developing regions of Africa, Asia and the Americas including Nigeria. In Sub-Saharan Africa, the impact of these diseases as a group is comparable to malaria and tuberculosis (Hotez and Klamath, 2009). The seventeen NTDs prioritized by World Health Organization are endemic in 149 countries of which ascariasis is one of the seventh most common and they affect more than 1.4 billion people, costing developing countries' economies billions of Dollar

every year (WHO, 2013). NTDs are the most common afflictions of the World poorest people, those who subsist on less than 1.25 Dollar per day. They infect one in six people, including more than half a billion children around the world (WHO, 2013; Global Network, 2014). NTDs kill an estimated 534,000 people worldwide every year and individuals are often affected with more than one parasite or infestation (CDC, 2011). While NTDs rarely cause death, they can cause significant disability that persists for a lifetime. They can cause fatigue, blindness, and disfigurement. Sufferers miss school, are unable to work, or are too embarrassed to seek medical care. By diminishing quality of life and opportunities to succeed, NTDs can reinforce the cycle of poverty among the world's disadvantaged populations (NIAID, 2014). Helminthic infestations caused by soil transmitted helminthes of which *Ascaris* is the commonest, constitute a major public health and developmental challenges in the vast majority of developing tropical and sub-tropical regions of the world (WHO, 2002).

Ascariasis an intestinal parasitic infection caused by *Ascaris lumbricoides,* a round worm belonging to the soil transmitted helminthes is a major contributor to the prevalence and burden of NTDs worldwide. Ascariasis is a common disease worldwide, but its prevalence is more in the developing countries with poverty, poor living conditions and an ignorant population. It affects all humans especially children from age six to twelve years and is estimated to affect about 1 billion people worldwide (GNNTD, 2014; Easy *et al.,* 2010). The prevalence rates of soil transmitted infections in studies around Nigeria was high, 16.9% and 38.5% were reported in the South East while figures as high as 64.0% was reported among school children in the South West regions of the country (Uneke *et al.,* 2007 Oyibo *et al.,* 2011; Adeyeba and Akinlabi, 2002). Similar parasitological surveys of soil transmitted helminthic infections among school children in other parts of Nigeria revealed prevalence rates greater than 68% (Dada *et al.,* 2005)

The world health organization (2001) noted that the morbidity due to these infections can be controlled at a reasonable cost by means of periodic chemotherapy using effective drugs and deworming campaign targeted at high risk groups such as school aged children (Oyibo *et al.,* 2011). Ascariasis is perhaps not neglected because it is a disease of the forgotten poor but also for its low fatality that calls for less global attention. However, its morbid tendency will remain if faeces is not properly disposed off and awareness of its damages not harped on to children, their mothers, and global health leaders.

Thus, the objective of this study was to identify the prevalence and pattern of distribution of *Ascaris* infection among school children in selected schools in Owerri, Imo State, Nigeria.

Materials and Methods

Owerri is the capital city of Imo State, a South Eastern State in Nigeria. It is located at latitude 58^{o} $22''^{I}$ 50^{o} $23'$ Nand longitude 7^{o} $2''$ 149^{o} $33'$N. Owerri consists of three Local Government Areas which include Owerri Municipal, Owerri North and Owerri West. It is an urban town and has an estimated population of about 400,000 and approximately40square miles (100sq.km) in area (NPC, 2006). Owerri is bordered by the Otamiri River to the East and Nworie River to the South. The climate is tropical and the vegetation is characteristic of the rain forest with an annual rain fall of about 2500 mm, and average atmospheric temperature of

30°C. Civil service, trading and farming are the major occupation of the people and the dominant tribe is Ibo.

The predominant source of water is Bore hole, owned mostly by individuals and the main sewage systems are flush to septic tanks, pour flush to pit latrine, VIP toilet and pit latrines. There has never been a centrally piped sewage system. Both open bush defecation and "Package system"; where nylon bags are used to contain faeces and thrown into refuse bin are sparingly practiced (Osundu, 2004). Wastes are collected in waste bins located visibly along major roads and are evacuated by refuse trucks to open dumps situated in the suburb by a government agency.

Study design and study population: The study is a school based descriptive cross sectional survey of the prevalence and pattern of *Ascaris lumbricoides* infection among pupils in selected primary schools in Owerri, Imo State, Nigeria.

Inclusion and exclusion criteria: Only pupils in the selected primary schools who agreed to participate in the survey were enrolled and studied. Those who refused to participate and pupils from non-selected schools were not studied.

Sample determination and Sampling technique: A minimum sample size of 600 pupils, 300 each from both public and private schools was obtained using the Cochran formula for cross sectional survey and population above 10,000 and attrition rate of 20%. Prevalence rate of *Ascaris* infection of 10.9% recorded in previous study was used (Oyibo et al, 2011). Substituting for the formula below;

$$n = \frac{Z^2pq}{E^2}$$

Where n = sample size; E = Tolerable error margin = 0.05; p = proportion of target population estimated to have a particular characteristics (10.9%); q =1-p = 1-0.11 = 0.89; while Z= standard normal deviate at 95% confidence interval set at 1.96.

A multistage sampling technique was used to select a total of 600 participants who participated in the survey. The first stage involved the stratification of the schools into public and private primary schools. The second stage involved the selection of schools to be studied from the list of primary schools in Owerri. A total of 10 schools each from public and private schools were selected from the sampling frame of schools in Owerri using simple random sampling by balloting. The third and final stage involved the selection of the individual participants. Sixty participants were studied in each of the ten schools. The pupils were proportionately allotted to each stratum of the classes in each of the schools. One arm in each stratum of classes was randomly selected and systematic random sampling method was used to select the final participants using the class registers of the children in the selected schools.

Data collection and analysis: A semi-structured interviewer administered questionnaire was used to obtain information on the socio-demographic and household characteristics of participants, personal and environmental hygiene practices. Early morning stool specimens were collected using specimen cups and applicator stick. This was done by the teachers and parents, who were taught on how to collect the stool specimen of their wards. Stool samples where preserved in 10% formol saline. Stool was examined by direct examination techniques using normal saline and then with formol ether concentration technique using 10% formol

water/ether. Both were viewed microscopically at X 10 and X 40 objective lens for viable Ova of *Ascaris* (Monica, 2003). The result was reported as (+ve) for presence of ova, while intensity was reported as; mild intensity (+ve) if one viable ovum per 100 field of view was seen, moderate intensity (2 +ve), if 2 ova per 100 field of view was seen and severe intensity, (3+ve) if three or more ova per 100 field of view was seen. Data analysis was done using computer software (EPI-INF7.1). Frequency table and graphs were generated and chi-square test of significance was used to test association between variables. P-value was set at 0.05.

Ethical Approval: Ethical approval was obtained from the Ethics Committee of the State Ministry of Education. Also written approval was obtained from the heads of the schools studied. Before the questionnaires were administered and stool specimen collected, the concept of the study was carefully explained to the parents and teachers of the participating children and written consent obtained from them.

Results and Discussion

The mean age of participants in this study was 8.5±0.03 years with a male to female ratio of 1:1.1. Equal numbers of pupils were studied in both private and public primary schools with a majority of their mothers attaining secondary, 238 (39.7%) and tertiary, 256 (42.7%) education. About 25% (147) of the pupils were from social class I and II (Table 1).

Table 2 revealed that majority of the pupils in both public 183 (61.0%) and private, 193 (64.0%) have seen *Ascaris* worm before and were able to describe it as being round and long. The commonest vehicles for transmission of the worm mentioned by the pupils, were dirty hands in both public, (33%) and private (62.0%) schools, this was followed by ingestion of unwashed vegetable (30%), among pupils in public schools and intake of dirty/contaminated water (16.0%), in those from private schools. This variation in response was statistically significant (x^2=31.25, df=4, p=0.000*). Abdominal pain was the commonest symptom mentioned by pupils in both public (18.27%), and private (18.0%) schools, this was followed by nausea (18.3%), and vomiting (17.7%), among pupils in public schools, and watery stool (15.3%), and nausea (15.0%) among pupils from private schools. This variation in response was not statistically significant, (x^2=3.15, df =6,p=0.076). The main source of information about *Ascaris* worm was gotten by pupils in both schools from their school teachers [public (50.0%) and private (60.7%)} and mothers, {(public,(40%) and private,(32.7%)]. The difference was statistically significant (x^2 =8.62, df =2, p= 0.003). The main method of fecal disposal practice among pupils in public schools was the use of VIP latrine, (59.0%), while water closet was commonly used by pupils in private schools (93.0%). Some students (6.0%) practiced open defecation in public schools. This difference in use was statistically significant (x^2 = 219.91, df=1, p=0.000), Regular hand washing was the main method of prevention practiced among the pupils in all the schools (50.0%), though some significant variation exist, (x^2 = 81.14 df = 2, p = 0.000).

The overall prevalence of ascariasis infection found in the study was 22.7% with majority of those infected having mild (77.2%) to moderate (16.9%) infestation (Figure I and II). Pupils in public schools have higher prevalence of *Ascaris* infection (29.0%) than their counterparts from private schools (16.3%). The difference was

statistically significant (x^2 = 13.72, df = 1, p = 0.000*). The intensity of ascariasis infestation varied a little, with public schools having higher moderate (18.4%), to heavy, (19.2%), infestation while their counterparts in the private schools have higher occurrence of mild infestation (85.9%). This variation was not statistically significant (x^2 = 3.15, df = 1, p = 0.076). Age had no significant effect on the prevalence of ascariasis among pupils, though it was slightly higher among those aged, 5–8 years (24.7%) (x^2 1.38, df = 1, p = 0.239), but the intensity of infestation varies significantly, with pupils in lower age group having higher occurrence of mild infestation (90.3%), when compared with their counterpart in the higher age group which had higher occurrences of moderate (29.7%), and heavy,(7.8%), infestation (x^2= 10..30, df =1, p = 0.001*). There was a higher prevalence of worm infestation in males, 26.2%, than females, 19.4% (x^2= 4.01, df = 1, p = 0.045*), though the pattern of intensity was similar with more than two-third of cases in both sexes having mild worm infestation. Least prevalence of ascarisis occurred in pupils from high social class families; I (14.3%), and II (16.7%) (x^2 = 9.41, df = 5, p = 0.002*), while intensity of worms infestation increases with decreasing lower social classes (x^2 = 9.40, df = 4, p = 0.002*).

The overall prevalence of ascaris found in this study was high 22.7%. This was consistent with findings from other studies in Nigeria (Uneke *et al.*, 2007; Oyibo *et al.*, 2011; Dada *et al.*, 2005; Adeyeba and Akinlabi, 2002). Also recent estimates indicate that ascaris lumbricoides is the most encountered soil transmitted helminthes in the tropics. This high prevalence found in this study will likely be due to poor hygiene practices among the pupils which enhanced egg transmission. Also the knowledge of the pupils about the main vehicle for the transmission of the worm was poor as only a few of them mentioned faeces as the main vehicle of transmission. This poor knowledge about the vehicle of transmission coupled with insanitary method of faecal disposal and preventive practices played an enormous role in the transmission of the disease. Also the pupils received information mostly from their mothers and teachers, the problem could lie on the quality of information given and the method of teaching applied which can greatly influence learning.

Ascariasis causes considerable illness in sub Saharan African and children constitute the highest group at risk. The prevalence of ascariasis was higher among public school pupils (29.0%) than in private school pupils (16.3%). This could be attributed to differential environmental sanitation and personal hygiene practices observed by pupils in the schools as seen in the finding of the study that some pupils in the public schools defecate in the open with greater proportion of them using VIP Latrines which could likely be shared with other families that may also have poor hygienic practices which encourages disease transmission.

Higher prevalence of ascariasis was seen among pupils aged 5-8 years (24.7%), this finding was also reported by Ekpenyong *et al.* (2008), Amadi *et al.* (2010), Sowemimo and Asaolu (2011) and Stephenson *et al.* (2000). The difference noted between the different age groups could be immune related or due to ignorance of the younger age group to both personal hygiene and mode of worm transmission.

Sex related prevalence rate was higher for male than females, agreeing with Oyibo *et al.* (2011), Amadi *et al.* (2010) and Narian *et*

al. (2000), who implicated level of exposure, noting that females paid greater attention to hygiene than males, in addition males are involved in more risky behaviours. This finding however contrasts with the observations from another study, which did not report a statistically significant difference in the prevalence of helminthic infections between male and female children (Uneke *et al.*, 2007)

Table.1 Socio-demographic and economic characteristics of participants

Socio-demographic Characteristics	**Frequency n=600**	**Percentage**
Sex		
Male	290	48.3
Female	310	51.7
Total	600	100.0
Age Group (yrs)		
5-8	291	48.5
9-12	309	51.5
Total	600	100.0
Mean age 8.56±0.03		
Type of school		
Public	300	50.0
Private	300	50.0
Total	600	100.0
Level of Education Of mothers		
None	3	0.5
Primary	10.3	17.1
Secondary	238	39.7
Tertiary	256	42.7
Total	600	100.0
Social class		
(Class I)	63	10.5
Class II	84	14.0
Class III N	130	21.7
Class III M	121	20.2
Class VI	95	15.8
Class V	107	17.8
Total	600	100.0

N=Non Manual, M=Manual

Table.2 Awareness and knowledge of ascariasis infection and fecal disposal method practiced in public and private schools

Variable	Public FREQ (%)	Private FREQ (%)	Total FREQ (%)	x^2/p-value
Have you seen Ascaris worm n(600)				
Yes	183 (61.0)	193 (640)	376 (62.7)	0.712
No	117 (39.0)	107 (36.0)	224 (37.3)	df=1
Total	300 (100.0)	300 (100.0)	600(100.0)	p=0.398
Main Vehicle for Transmission n= 600				
Dirty Hands	100(33.3)	186(62.0)	326(54.3)	31.25
Dirty water	80(27.0)	48(16.0)	128(21.3)	df=4
Unwashed fruits/vegetable	90(30.0)	24(8.0)	114(19.0)	p=0.000*
Faeces	20(6.0)	26(9.0)	46(7.7)	
Cold food	10(3.3)	22(7.3)	32(5.3)	
Total	300(100.0)	300(100.0)	600(100.0)	
Commonest symptom Known by pupils (n=600)				
Abdominal pain	56(18.7)	54(18.0)	110(18.3)	3.15
Nausea	55(18.3)	45(15.0)	100(16.7)	df=6
Vomiting	53(17.7)	37(12.3)	90(15.0)	p=0.076
Noisy Stomach	42(14.0)	39(13.0)	81(13.5)	
Watery stool	30(10.0)	46(15.3)	76(12.6)	
Loss of appetite	34(11.3)	40(13.3)	74(12.3)	
Blood loss	30(10.0)	39(13.0)	69(11.5)	
Total	300(100.0)	300(100.0)	600(100.0)	
Main source of information (n=600)				
School |(Teacher)	150(50.0)	182(60.7)	332(55.3)	8.62
Mother	120(40.0)	98(32.7)	218(36.3)	df=2
Father	30(10.0)	17(5.6)	47(7.8)	p=0.003*
Mass media	0(0.0)	3(1.0)	3(0.5)	
Total	300(100.0)	300(100.0)	600(100.0)	
Main method of fecal disposal				
Water closet system	106(35.0)	280(93.0)	386(64.3)	219.90
VIP Latrine	176(59.0)	20(7.0)	196|(32.7)	df=1
Open defeacation	18(6.0)	0(0.0)	18(3.0)	p=0.000*
Total	300(100.0)	300(100.0)	600(100.0)	
Main Method of prevention practiced				
Regular hand washing/bathing	200(67.0)	100(33.3)	300(50.0)	81.14
Use of Pipe borne water	82(27.0)	100(33.3)	118(19.7)	df=2
Defeacate only in Toilets	18(6.0)	100(33.4)	182(30.3)	p=0.000*
Total	300(100.0)	300(100.0)	600(100.0)	

* = significant

Figure.1 Bar chart showing the prevalence of ascariasis infestation among participants

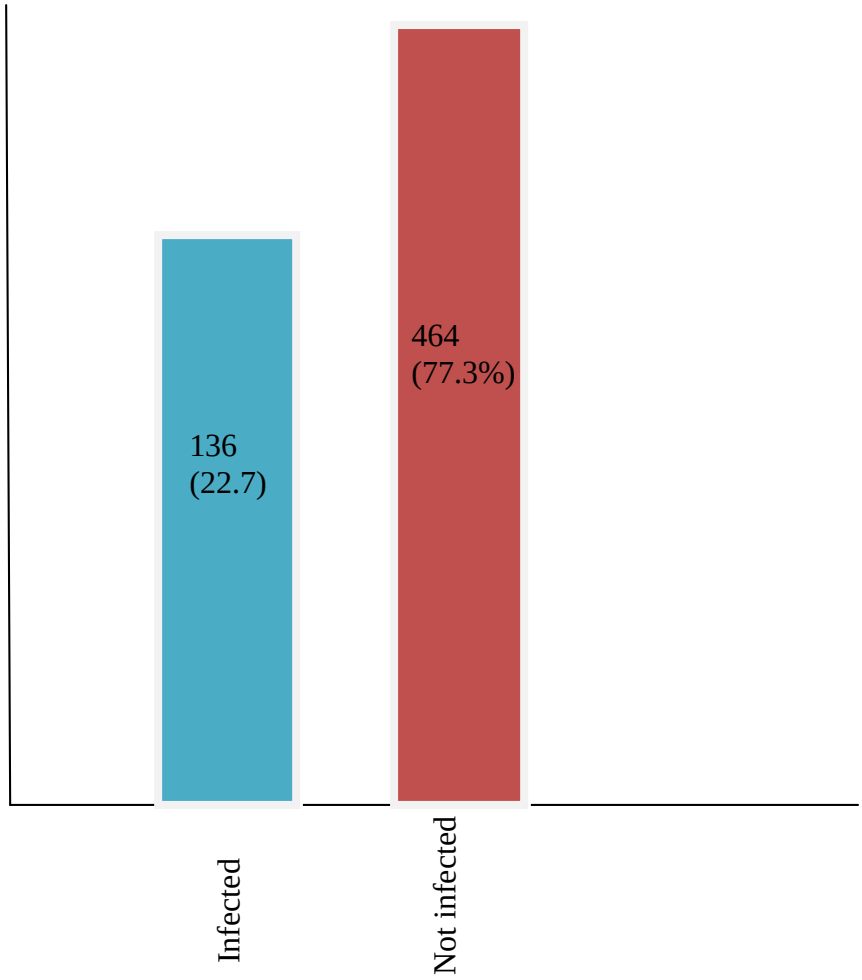
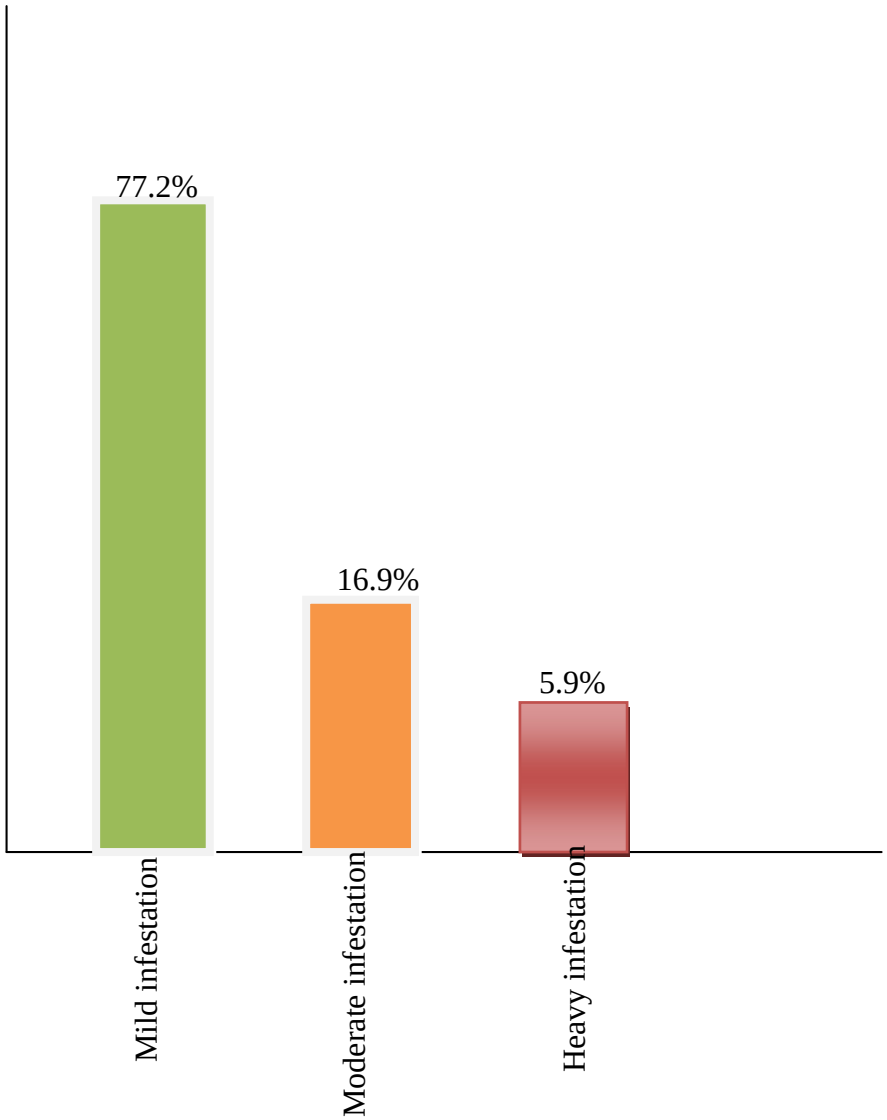


Figure.2 Bar chart showing the intensity of Ascariasis infestation among participants



Heavy infestations were reported in only public schools while moderate to heavy infestations of worms were significantly reported among pupils 9–12 years of age. This level of soil contamination is correlated to transmission and worm burden. It is likely that poor hygiene practices in public schools enhanced the chain of transmission. This intense infestation has significant adverse health outcomes than mild worm infestations (Belizaria *et al.*, 2003).

Social class of the pupils was associated with the pattern of prevalence and intensity of infestation. Prevalence and intensity were worse among pupils in lower rung of the social strata III – V. This can be partly explained by the fact that most of the lower social class families are less educated, poor, attended public schools, lacked access to clean water and live in overcrowded slums with dirty environment and poor sewage

disposal which will all enhance disease transmission including *Ascaris* infection.

In conclusion, the prevalence of *Ascaris* infection was found to be high in this study despite being done in an urban setting and there was also vague knowledge about worm infestation and poor preventive practices. This is of grave public health concern as worm transmission will continue among these pupils with attendant problems if no control measures are instituted. Also school health programmes which should tackle these issues are almost non-existent in our schools. Based on our findings, there is need to institute appropriate control measures and programmes by the relevant authorities. School health programmes should be instituted and monitored closely by relevant authorities for compliance through regular school visitations. The level of infestation can correlate to the level of school sanitation and other infections could also be transmitted including the dreaded Ebola disease that is currently ravaging some African countries in the sub-region. Mass deworming of pupils every semester, provision of clean water and adequate toilet facility including proper refuse and sewage disposal should be made available in the schools.

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