# Human Myiasis in Western Jamaica: Five Years after the Implementation of a Screwworm Eradication Programme

SC Hemmings, KJM Matthews, J Alexander

***ABSTRACT***

***Objective:*** *To determine the distribution of cases of human myiasis admitted to the Cornwall Regional Hospital (CRH), Jamaica, between 1999 and 2003, following the inception of the National Screwworm Eradication Programme (NSEP) in 1998, and the risk factors associated with the condition.*
***Method:*** *A total of 144 cases of myiasis were retrieved from the database of the department of Medical Records at the CRH for the years 1999 to 2003. A data extraction form was devised to review the circumstances of each case. The data were analyzed using EpiInfo version 6.*
***Results:*** *Of 144 cases, 54.9% were female and 45.1% male. The largest groups were <10 years, 52.8% [76/144 (M-21, F-55)] and 60 years and over, 18.8% [27/144 (M-16, F-11)] (*$p < 0.001$*). Case distribution for the years 1999–2003 showed 16, 39, 31, 30, and 28 cases respectively. Three-quarters (74.6%) of all cases affected the scalp/head, one-fifth (20.3%) affected the lower limbs. Ninety-six per cent of those < 10 years had scalp/head myiasis (*$p < 0.001$*; OR = 23.29; CI: 6.14 < OR < 104.11). Two-thirds (66.6%) of those 60 years and over had lower limb myiasis (*$p < 0.001$*; OR = 19.09; CI: 6.20 < OR < 61.12). Mean duration of treatment was 3.5 days (SD = 1.4 days) and 69.7% required hospitalization for seven or more days. There was no difference in duration of treatment for myiasis or in length of hospitalization in relation to method used to eliminate maggots. Risk factors identified included Tinea capitis for myiasis of the scalp/head (*$p < 0.001$*) and diabetes mellitus for lower limb myiasis (*$p < 0.001$*; OR = 14.48; CI: 2.37 < OR < 133.25).*
***Conclusion:*** *Human myiasis remains a public health issue in western Jamaica with no significant decreasing trend in the number of cases admitted to the CRH since 1999. It is recommended that this zoonosis become a Class 1 notifiable disease to the Ministries of Health and Agriculture because of the existing NSEP.*

# La Miasis Humana en el Occidente de Jamaica Cinco Años Después de la Implementación del Programa de Erradicación del Gusano Barrenador

SC Hemmings, KJM Matthews, J Alexander

***RESUMEN***

***Objetivo:*** *Determinar la distribución de casos de miasis humana ingresados en el Hospital Regional Cornwall (CRH), Jamaica, entre 1999 y 2003, tras el comienzo del Programa Nacional de Erradicación del Gusano Barrenador (PNEGB) en 1998, y los factores de riesgo asociados con esa con la condición.*
***Método:*** *Un total de 144 casos de miasis fueron recuperados del banco de datos del Archivo de Historias Clínicas del CRH, correspondientes a los años 1999 al 2003. Se diseño un formulario de extracción de datos con el fin de examinar las circunstancias de circunstancias de cada caso. Los datos fueron analizados usando Epi-Info, versión 6.*
***Resultados:*** *De 144 casos, 54.9% eran hembras y 45.1% varones. Los grupos más grandes fueron < 10 años, 52.8% [76/144 (V-21, H-55)] y 60 años y más, 18.8% [27/144 (V-16, H-11)] (*$p < 0.001$*). La distribución de casos durante los años 1999–2003 mostró 16, 39, 31, 30, y 28 casos respectivamente. Tres cuartos (74.6%) de todos los casos presentaban afecciones del cuero cabelludo/cabeza, una quinta parte (20.3%) tenían afectados miembros inferiores. Noventa y seis por ciento de < 10 años tenían el miasis del cuero cabelludo/cabeza (*$p < 0.001$*; OR = 23.29; CI: 6.14 < OR < 104.11). Dos terceras*

From: Cornwall Regional Hospital and the Epidemiology and Research Unit, Western Regional Health Authority, Ministry of Health, Montego Bay, Jamaica

Correspondence: Dr SC Hemmings, 7 Darlington Avenue, Kingston 8, Jamaica, West Indies. E-mail: kcheadboy96_97@yahoo.com

*partes (66.6%) de 60 años y más, presentaban miasis de los miembros inferiores (*p < *0.001; OR = 19.09; CI: 6.20 < OR < 61.12). La duración promedio del tratamiento fue 3.5 días (SD = 1.4 días) y 69.7% requirieron hospitalización durante siete o más días. No hubo ninguna diferencia en la duración del tratamiento por miasis o la longitud de hospitalización en relación con el método usado para eliminar gusanos. Los factores de riesgo identificados incluyeron Tinea capitis para la miasis del cuero cabelludo/cabeza (*p < *0.001) y diabetes mellitas la miasis de los miembros inferiores (*p < *0.001; OR = 14.48; CI: 2.37 < OR < 133.25).*

***Conclusión**: La miasis humana sigue siendo un problema de salud pública en el occidente de Jamaica, sin que se hay producido una tendencia decreciente significativa en el número de casos de ingreso al CRH desde 1999. Se recomienda que esta zoonosis sea una enfermedad de clase 1 para los Ministerios de Salud y de Agricultura en virtud del PNEGB existente.*

**West Indian Med J 2007; 56 (4): 342**

## INTRODUCTION

Various species of flies account for cases of human myiasis in the tropics. These include *Dermatobia hominis* and *Cochliomyia hominovorax* throughout the New World and *Cordylobia anthropophaga* in Africa. *C hominovorax*, commonly known as the New World Screwworm (NWS), was eradicated from North Africa in 1991 after the parasite's introduction in 1988, using the sterile insect technique (SIT) (aerial dispersal of sterile male flies) (1, 2). The SIT has been used successfully in eradication of the NWS from the United States of America (USA), Mexico and Central America extending down to Panama and the island of Curacao (3–5).

*D hominis* is now established in Trinidad and Tobago, after its introduction in livestock from the South American mainland, with reports of human cases since the mid to late 1980s (6, 7). Among the other islands of the Caribbean, only one case has been reported which was from Jamaica. That was acquired in Belize (8). The majority (> 80%) of human cases of myiasis seen in Jamaica were caused by *C hominovorax* (National Screwworm Eradication Programme, personal communication) which was first reported as a parasite of humans in French Guiana in 1858 (1, 9).

Human myiasis caused by *C hominovorax* is associated with open wounds and the smell of blood and occurs mostly among persons in rural areas (10) where it is associated with livestock farming. Those especially at risk include babies, the disabled, mentally non-alert persons, wounded adults and residents of areas where there is a high prevalence of screwworm in the environment. The progressive nature of myiasis due to the NWS infestation in humans can be devastating. Occasionally there is permanent injury, and in the absence of treatment there is death (1, 11).

Eradication of the NWS was initiated in 1957 in the USA in response to high economic losses in livestock. This resulted in the eradication of the parasite as far south as Panama at a cost of US$750 million for the USA and Mexico alone (1, 3).

In Jamaica, the estimated cost for surveillance and medication for screwworm infestation in animals (without an account for losses to meat and hide production) amounted to US$6.78 million annually and an eradication programme was recommended for the island in 1983 (5). The National Screwworm Eradication Programme (NSEP) was eventually launched in July 1998, through the Veterinary Services Division of the Ministry of Agriculture, using the SIT. The proposed project deadline for eradication of the screwworm from Jamaica was 2001 with a total budget of US$4.5 million. Thus far, the programme has been extended four years beyond the deadline and expenditure has exceeded US$12 million, with limited success. Myiasis continues to occur in both humans and livestock and there has been no projected future deadline for eradication (NSEP, personal communication).

The eradication programme requires that all cases of human and animal maggot infestation be reported to the NSEP and specimens submitted to the relevant local authority for identification of the type of maggot. This is done in order to differentiate saprophytic species from the parasitic screwworm species. When the NWS is identified in a particular case, the geographic area of origin of the case is visited and sterile male flies are released. Follow-up surveillance is also carried out to implement control in the affected locale. The NSEP reports low reporting of myiasis by farmers and medical personnel, with only 11 confirmed cases of screwworm myiasis reported in humans from the western parish of St James for the period 1999–2003 (NSEP, personal communication). However this passive surveillance system used in Jamaica may underestimate the true number of human and animal cases that are occurring annually.

The success of an eradication programme is dependent on quality active surveillance, as demonstrated in Libya (1). Hospital data, while biased to those individuals who seek medical attention, may be a good indicator of cases which may have occurred and which were not reported to the NSEP.

The Cornwall Regional Hospital (CRH) is a 355 bed, referral hospital located in Montego Bay, the capital city of the parish of St James. It serves a wide cross-section of the population of western Jamaican parishes (total population of 600 581) including many rural areas and the inner-city communities of Montego Bay (Statistical Institute of Jamaica, personal communication).

## SUBJECTS AND METHODS

The aim of this study was to review the number and characteristics of cases of human myiasis which were admitted to the Cornwall Regional Hospital in Montego Bay, St James between January 1, 1999 and December 31, 2003. This period covers the five years following the inception of the NSEP. The findings will suggest how effective the surveillance system of the NSEP is functioning and give an indication of the success of the programme.

All cases of maggot infestation filed in the computer database of the Department of Medical Records at the CRH between January 1, 1999, and December 31, 2003, were reviewed. Data prior to this were not readily available as computerized record keeping only began at the hospital in 1998. Ethical approval for this review process was obtained from the ethics board of the Western Regional Health Authority.

One hundred and fifty-two cases of maggot infestation were reported in the period. The authors have full data for 144 (94.7%) cases. A data extraction form was devised to collect information from each patient's record including: age, gender, site of infestation, year of presentation, co-morbid illnesses, duration of myiasis, length of hospitalization, method used to eliminate maggots and location of residence. All data were analyzed using EpiInfo version 6 and statistical significance was achieved when $p < 0.05$.

## RESULTS

There were a total of 144 cases of myiasis between 1999 and 2003. The number of cases rose from 16 in 1999 to 39 in 2000 and remained at about 30 cases for 2001 and 2003 (Fig. 1). No seasonal variation was observed in the occurrence of human myiasis ($p = 0.22$) (Fig. 2).

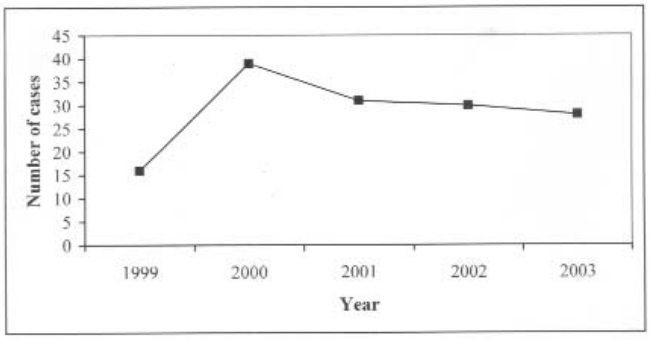


Fig. 1: Cases of maggot infestation distribution by year.

Most cases were female, accounting for 54.9% (79/144). Cases that presented to hospital were mostly for those below 10 years of age (52.8%) [76/144 (M-21, F-55)], followed by those > 60 years at 18.8% [27/144 (M-16, F-11)] ($p < 0.001$). Fewer than 10% of cases occurred within each of the other age group categories (Fig. 3).

The most frequently affected sites were the scalp/head, which accounted for 74.6% of cases (106 of 144) while

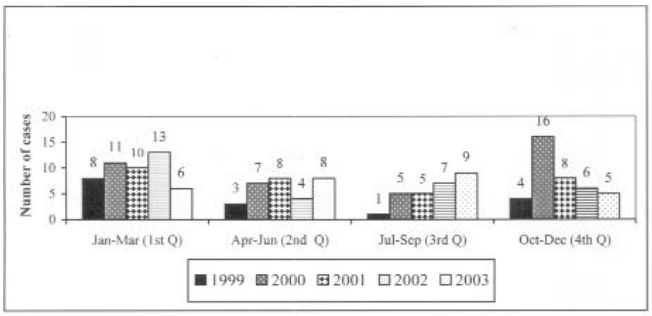


Fig. 2: Case distribution by quarter over the five year study period.

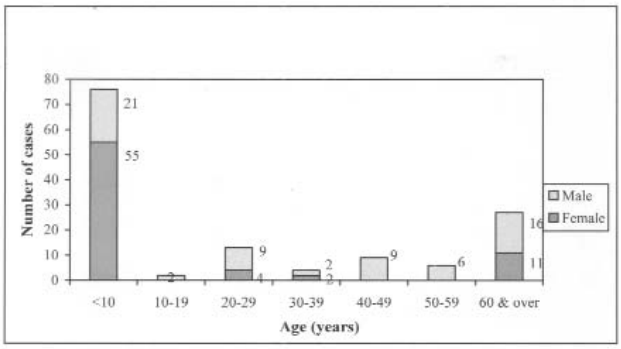


Fig. 3: Age distribution of cases of human myiasis by gender.

20.3% of infestations were of the lower limb(s) (29 of 144) (Fig. 4). Ninety-five per cent (72/76) of patients < 10 years

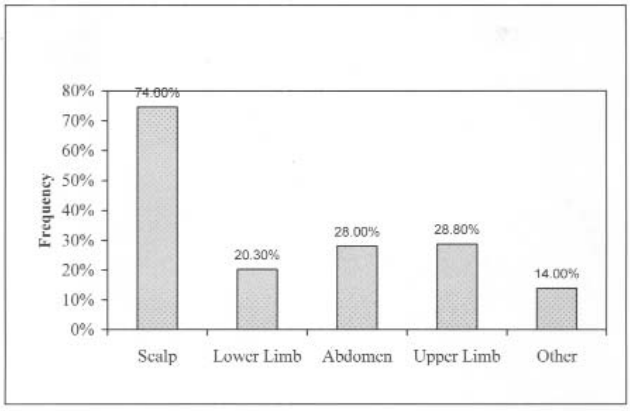


Fig. 4: Site of maggot infestation.

of age had scalp/head myiasis and this group accounted for 67.9% of all scalp/head cases ($p < 0.001$; OR-23.29; CI-6.14 < OR < 104.11). Two-thirds (18/27) of patients 60 years and over had lower limb myiasis and this group accounted for 62.1% of cases of lower limb myiasis overall ($p < 0.001$; OR-19.09; CI-6.20 < OR < 61.12).

The mean duration of treatment to eliminate myiasis was 3.5 days (SD = 1.4 days). However, hospitalization was for a longer period, as 69.7% of patients required hospitalization for seven or more days. Various methods were used to

remove and/or kill maggots. Nearly 80% (79.2%) of cases had manual removal, while mintosol, hydragammon and the use of ether were reported in 38.9%, 29.9% and 26.4% of cases, respectively. There was no association ($p > 0.05$) between the methods used to eliminate maggots and length of hospital stay or duration of treatment.

The major concurrent illnesses identified were: *Tinea capitis* (37.8%), chronic ulcers (leg or other sites) (11.9%) and psychiatric illness (11.2%). Diabetes mellitus (5.6%) and HIV/AIDS (4.9%) were also identified. Factors significantly associated with myiasis included: *T capitis* for myiasis of the scalp/head ($p < 0.001$) and diabetes mellitus for lower limb myiasis ($p < 0.001$; OR = 14.48; CI: 2.37 < OR < 133.25).

Most cases (67.4%) were residents of the rural communities of western Jamaica with a further 29.1% of patients coming from the inner-city communities of Montego Bay.

## DISCUSSION

The results of this study indicate that the problem of maggot infestation in humans remains an important public health issue in western Jamaica, six years after the initiation of the NSEP. There was no significant decline in the number of patients admitted to the CRH with myiasis, with a total of 152 cases being admitted during the period under review. The least number of cases admitted in a year was 16 in 1999, and most cases (39) were admitted in 2000, with about 30 cases per year for the rest of the study period.

There were 11 reported cases of human screwworm infection from the parish of St James by NSEP for the study period (NSEP, personal communication). In contrast, human cases of maggot infestation totalled 152 admissions to the CRH. No documentation was made to indicate that specimens of maggots were submitted for laboratory identification. Therefore, it is unknown what percentages of these cases of myiasis were due to NWS *versus* saprophytic maggot species. However, most cases (> 80%) of maggot infestation that presented to hospital in Jamaica are caused by *C hominovorax* (NSEP, personal communication). These results may signify notable under-reporting of NWS myiasis by the NSEP, and indeed highlights the lack of support given by medical personnel to the NSEP, as reported in an earlier study (11). The NSEP must do active instead of passive surveillance at hospitals and in communities to more accurately determine the extent of human screwworm infestation. Active surveillance has proven successful in Libya (1). Legislation should be implemented to make human maggot infestation a Class 1 notifiable disease for the duration of the programme, as it is a zoonosis slated for eradication. It is our proposal that humans would then act as sentinel cases and allow for surveillance and effective utilization of the SIT in affected communities.

The epidemiology of human myiasis in our study was in most part in keeping with previous studies of screwworm infections (11, 12). The young and the elderly were mostly affected with 52.8% of cases below the age of 10 years of age. In comparison, 87% of children were infected in a Libyan series (12). The elderly (> 60 years old) represented 18.8% of those affected, which is similar to that seen in an earlier Jamaican series (25%) (11). We suggest that the relative decreased immunocompetence at the extremes of age, coupled with the fact that the young and the elderly were often dependent upon others to attend to their personal hygiene made them at increased risk for maggot infestation of wounds.

The scalp was the most common site of infestation (74.6% of cases) in keeping with other reports (12). *T capitis* was a major risk factor for scalp myiasis, especially among children, since it causes intense itching and scratching of the scalp resulting in minor skin abrasions which then become attractive to the female fly to lay her eggs. Minor abrasions of the scalp from the bite of the head louse *(Pediculus humanus capitis)* were also associated with scalp myiasis caused by *C hominovorax* among children in Libya (12).

The lower limb was the favoured site of infestation in the elderly and in diabetic patients. This finding was not previously reported in the literature and emphasizes the importance of proper foot care to prevent abrasions and injury especially in diabetics. Their impaired immune response and deficient blood flow to the lower limbs compound the problem as this prolongs wound healing. These factors may contribute to the increased risk for maggot infestation of the lower limbs in the diabetic patient.

Seventy per cent of cases required a week or more of in-hospital care. Given that the mean duration of treatment to eliminate maggots was 3.5 days, the rest of the admission would have been for wound care, with possible antibiotic coverage as such wounds often have associated secondary bacterial infections (13).

Most cases originated in the rural areas of the parish of St James or the inner-city communities surrounding Montego Bay. This supports a previous publication that human myiasis is associated with socioeconomic deprivation and rural area living (10). It is likely that these communities would have a high prevalence of screwworm in the environment, among domestic animals and livestock. Furthermore, a large reservoir of stray animals (especially dogs) may be contributing to maintenance of the parasite in these communities.

This is the largest series of cases of human maggot infestation published from the Caribbean. The two previous series out of Jamaica (11) and Trinidad (6) were too small for comparison. The Trinidadian study reported only cases of *D hominis* causing human myiasis while the Jamaican study could only confirm 15% (3/20) of cases attributed to *C hominovorax* infestation, as the rest were discarded by the attending physicians.

This study is limited by the fact that there were no data available prior to the inception of the NSEP to fully assess its impact, if any. However, the number of cases seen since the inception of the programme did not decline over the 5-year

study period. The facts that the NSEP deadline had been exceeded by over four years and the number of confirmed screwworm cases in animals was again on the rise in St James (NSEP, personal communication) indicate that the programme has not met its long term objectives. Another limitation was that we were unable to confirm how many of these cases of human maggot infestation were due to NWS and thus how many cases had been undetected by the NSEP.

Vigilance among healthcare personnel is required in areas where NWS is endemic when managing an open wound to prevent maggot infestation, especially for in-hospital patients, who may be more vulnerable to infestation (11, 14). Healthcare workers must report human cases of maggot infestation to relevant authorities and submit maggots for proper identification of the species, along with the origin of the affected patient to ensure the future success of the NSEP.

This study of maggot infestations five years after introduction of the NSEP showed that these infections continue to be a serious public health problem in western Jamaica. Increased reporting under an active surveillance system coupled with laboratory follow-up may estimate the significance of the parasite more accurately.

## ACKNOWLEDGMENTS

We are grateful to Dr John Lindo (The University of the West Indies), Dr Jeffrey East (Department of Surgery, CRH) and Dr Samuel Rawlins for helpful suggestions on preparing the paper. We also extend our gratitude to Miss J Davis and Mrs E Wilson of the Department of Medical Records, CRH.

## REFERENCES

1. Reichard RE, Vargas-Teran M, Abusowa M. Myiasis: the battle continues against screwworm infestation. World Health Forum; 1992; **13:** 130–8.
2. Lindquist DA, Abusowa M, Hall MJ. The new world screwworm fly in Libya: a review of its introduction and eradication. Med Vet Entomol 1992; **6:** 2–8.
3. Wyss JH. Screwworm eradication in the Americas. Ann NY Acad Sci; 2000; **916:** 186–93.
4. Rawlins SC. Current trends in screwworm myiasis in the Caribbean region. Vet Parasit 1985; **18:** 241–50.
5. Rawlins SC, Alexander FC, Moe V, Caeser E, Moll K, Applewhaite L. Screwworm myiasis in the Southern Caribbean and proposals for its management. J Econ Entomology; 1983; **76:** 1106–11.
6. Chadee DD, Rawlins SC. *Dermatobia hominis* myiasis in humans in Trinidad. Trans R Soc Trop Med Hyg; 1997; **91:** 57.
7. Raju GC, Naraynsingh V, Tikasingh ES, Jankey N. Myiasis due to *Dermatobia hominis* in Trinidad. A case report. Trop Geogr Med; 1998; **38:** 94–5.
8. Sue-Ho R, Lindo JF. Cutaneous furuncular myiasis in a Jamaican resident. West Indian Med J; 1995; **44:** 106–7.
9. Coquerel C. Note sur des larve appartenant a especе nouvelle de diptere (*lucilia hominovorax*) Ann Soc Entomol Fran 1858; **27:** 171–6.
10. Boyd FB, Marr JJ. Medical Microbiology. Boston: Little, Brown & Co;1980.
11. Rawlins SC. Human myiasis in Jamaica. Trans R Soc Trop Med Hyg; 1988; **82:** 771–2.
12. El-Azazy OME. Wound myiasis caused by *Cochliomyia hominovorax* in humans in Libya. Trans R Soc Trop Med Hyg 1990; **84:** 747–8.
13. Estrada B. Ectoparasitic infestation in homeless children. Semin Paed Infect Dis; 2003; **14:** 20–4.
14. Rawlins SC, Barnett DB. Internal human myiasis. West Indian Med J; 1983; **32:** 184–6.