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The impact of well-developed preventative strategies on the eradication of head lice

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Abstract

In the 1970s Donaldson applied the principles of infectious disease surveillance to pediculosis capitis infestation with head lice. This provided a lasting insight into an effective strategy for prevention. Research in Teesside, UK, proved that the first step in breaking the chain of transmission is the engagement of parents in an intensive detection/treatment campaign. United action halved the infestation rate, even though failing lindane treatments were in use. Subsequently although effective malathion treatment was introduced, it became clear that the late detection of light cases of head lice still undermines eradication.

This paper analyzes the development by the health charity, Community Hygiene Concern, of the Bug Busting programme based on this solid evidence. In the 1990s the charity solved the problem of detecting asymptomatic lice using a specially designed Bug Buster louse comb in wet, conditioned hair. It undertook the popularization of this method and the co-ordination of national detection days (Bug Busting Days) through primary schools.

In 2004 this structured approach to prevention was adopted in Chester. It produced a 24% reduction in health authority spending on treatment products in the first year and appreciable savings in professional time.

It is concluded that participation in the Bug Busting programme benefits community health providers and schools. Provision of dependable detection combs with the correct instructions to families at risk, empowers them to gain sustainable, cost-effective control of head lice.

INTRODUCTION

Individual cases of pediculosis capitis are not only a personal problem but intrinsically a community problem. Between 1986 and 1990 exploratory studies were made in the UK on the incidence of head lice in all members of families where some children attended playgroup, primary or secondary school. The results suggest that outbreaks are perpetuated by a transient reservoir of undetected but contagious cases, in primary school-aged children.^{1,2} Typically child A is found to have lice, treatment immediately follows detection, concurrent precautions are taken with other family members, and child A returns to school. At school child A comes into contact with child B, who has undiagnosed lice. Child A becomes re-infested and so on. Although point prevalence

can be relatively low, between half and two thirds of primary school children may suffer repeated episodes of head lice, reaching 10 consecutive times.¹ This feature of an outbreak can push the annual incidence rate among pupils very high.^{1–7} In 2003 Harris *et al.*⁷ recorded a 2.03% point prevalence in primary school children in North Essex, assessed by questionnaire survey of their parents. The responses also showed that 37.4% of the children had caught head lice at some time during the past year. This figure did not take the number of recurrences per child into account. However distressed parents complaining about head lice almost invariably emphasize the frequency with which they have to treat their children.

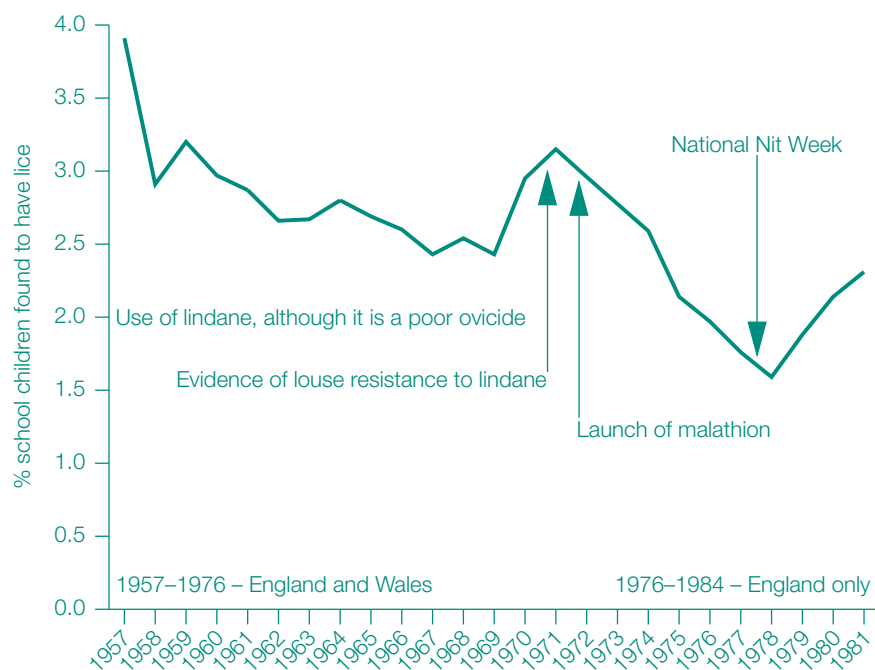
Monitoring is essential to determine the effectiveness in the community of measures to

eradicate head lice. Prevalence and incidence studies,^{1,7–15} survey of healthcare providers and families at risk^{16–21} and expenditure on treatment and services^{22–26} serve as monitoring tools. In the past, official figures on infested schoolchildren were collected for England and Wales.^{27,28} Legislation to control lice dates back to the 19th century. Before the establishment of the School Medical Service in 1907, obligations had already been placed on school nurses under the Children Act 1902 to manage the re-admittance of children to school following exclusion for head infestation. From 1918 onwards a child with head lice has had the right to state-funded treatment (Fisher Education Act). Powers to enforce the 'cleansing' of persons found to have lice, particularly schoolchildren and their families, were vested in the local authority medical officer of health (Public Health Act 1936 and 1961; Butler Education Act 1944).²⁹ In practice, nurses inspected children attending state-maintained schools using visual inspection. This consists of parting the hair with the fingers and looking for evidence of lice, unhatched eggs and empty eggshells (nits). Home visits were made to those found to be positive and treatment instigated. The figures collected express the number of cases identified in school over a year in routine inspections, regardless of whether some children were re-inspected several times or others not at all, as a percentage of the maintained school population.^{1,3,4} From the late 1950s to the early 1980s a trend is apparent related to the efficacy of the most popular treatment (Figure 1). The figures reflect a cumbersome war of attrition. Nurses, pressed for time to devote to each child screened, were unable to diagnose all active cases in school.^{8,9}

Counterproductively many parents had come to believe that nurses could control head lice on their behalf. The lowest incidence recorded resulted from a co-ordinated inspection during the 1977 National Nit Week, combined with a public awareness campaign (Figure 2). This prompted the treatment of diagnosed cases, largely with 0.5% malathion in an alcohol base. Today the resource-consuming, routine inspections

Figure 1

Official figures for England and Wales 1957–1981



The percentage of school children found to have head lice, related to the efficacy of the most popular treatment.

Sources: *The Health of the School Child: Reports of the Chief Medical Officer 1957–1972*; DHSS form 8rn(i)

have been withdrawn as they were evidently a flawed control measure. However the findings of the research conducted by Donaldson when medical officer of health in Teesside, on which National Nit Week was based, remain valid.^{10,12,30,31} They provide a lasting insight into an effective strategy for prevention. This paper examines the lessons learned in Teesside, their development in the Bug Busting programme and the results when this was implemented in Chester 30 years later.

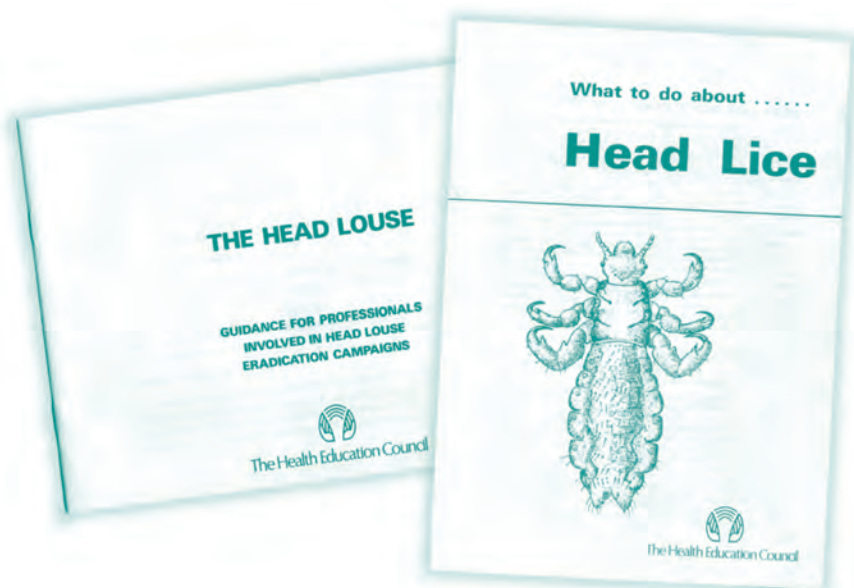
THE DONALDSON TEESSIDE LEGACY 1970–1978

Donaldson led the application of the principles of infectious disease surveillance³² to pediculosis capitis. The source, or reservoir, and the susceptible host are identified for all practical purposes as human scalp hair.¹² The source and susceptible host are

interchangeable because infestation with head lice does not bestow any post-infection immunity (Figure 3). Donaldson argued that a major opportunity for spread between children occurs at school during close contact while studying and at play. To break the chain of transmission, the appropriate intervention proved to be the engagement of parents in an intensive detection/treatment campaign.^{10,12,30} Nurses monitored the effect by conducting point prevalence surveys in school during the academic year in September, January and April. Donaldson standardized the visual inspection method for the purpose. Four categories were defined: 'No evidence of lice or nits', 'Few nits', 'Many nits' and 'Nits and lice'.^{10,12} In October 1970 a leaflet was distributed to each parent intended to teach recognition of lice and nits. It was accompanied by a letter threatening exclusion from school of children found to have any degree of

Figure 2

Health Education Council publications for National Nit Week 1977

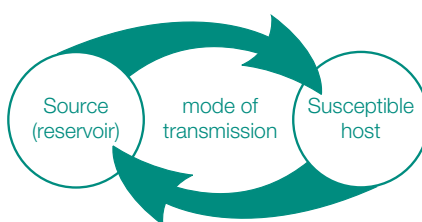


Sources: Anon. *What to do about...Head Lice* HEC, 1977;
J Maunder *The Head Louse* HEC, 1977

infestation.¹⁰ The September 1970 infestation rate of 16% in Teesside primary schoolchildren was cut by half by January 1971. This occurred even though lindane, a poor ovicide, with a failing ability to kill lice due to insecticide resistance, was commonly used for treatment. The introduction in October 1971 of the new insecticide, malathion, to which lice and their eggs were highly susceptible,³¹ produced a further reduction in the infestation rate. However screening in 1972 and 1973 showed that a low level of infestation still persisted (Figure 4).¹² Resistance to malathion in the louse population had not had the opportunity to develop at this point. Donaldson concluded that the late detection of light cases is partly responsible for ongoing incidence even when the treatment of identified cases is successful.³³ In fact it was established in the 1940s that the majority of infestations amount to just 10 lice or less.^{34,35} Each noticeable case is surrounded by other asymptomatic but contagious cases.

Figure 3

Donaldson's application of the principles of infectious disease surveillance to *Pediculosis capitis*



Sources: RJ Donaldson, lecture diagram. (with kind permission of LJ Donaldson)

Overcoming the stigma of lice

In Western society an association in the public mind of lice with a lack of cleanliness is deeply entrenched. Donaldson risked considerable adverse publicity when the Teesside campaign

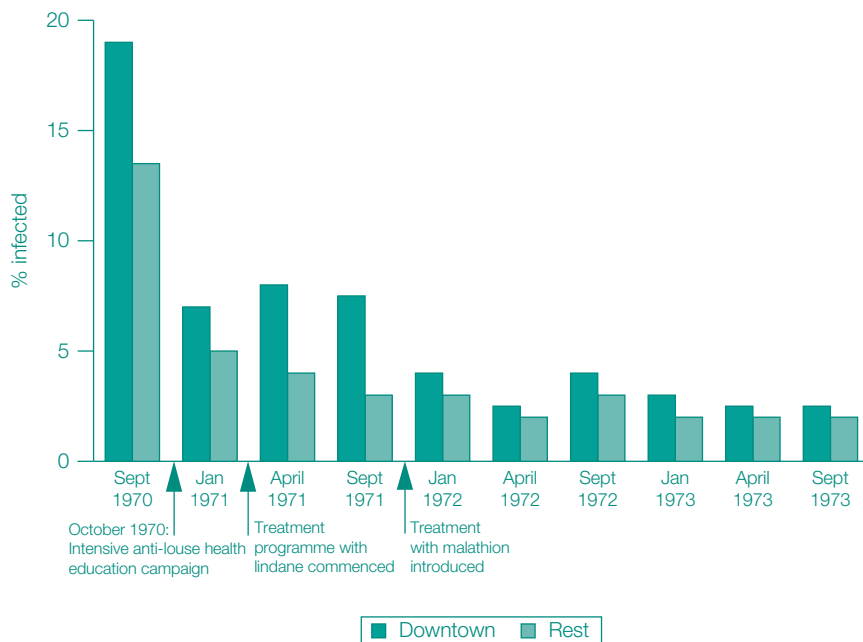
launched in 1970. Teesside municipal dignitaries were forced to admit that lice were rife in their midst, information many would have preferred to keep under wraps. However having weathered the initial storm, Donaldson solved the problem that people were reluctant to admit they have lice by adopting a co-ordinated approach. The onus was placed on parents to find and treat lice in their own families – no less, no more. Contact tracing, an embarrassing mission, particularly outside the family circle, became unnecessary for the majority of families because they responded to pressure to act together. Thus no obligation was placed on any parent to cause offence to another by saying 'I think my child caught lice from your child.'

Decline of fine-tooth metal combs

From 1900 to 1971 while the insecticides in use were poorly ovicidal, the removal of live eggs was an important curative element of treatment. The incubation of head louse eggs relies on scalp heat and may take 10 or 11 days to complete.^{36,37} The eggs are cemented individually to the hair shaft, many positioned near the root or touching the scalp.^{5,35} Usually there is only one live egg on a shaft, although after a period of infestation there might also be several empty shells on the same shaft. Nurses running local authority treatment clinics (1918–1982) were anxious to remedy an infestation in one session. They tended to depend on an application of insecticide to kill as many lice as possible, followed by 'nit' combing the wet hair. An indispensable tool was the fine-tooth metal Sacker comb, cut from hard composite brass and silver-plated. It was a high-quality precision instrument, developed between the two World Wars and then officially endorsed by the Ministry of Health. The deeply bevelled leading edge of the teeth facilitates insertion between the egg and the hair root. The egg catches against the square tooth shanks, spaced the breadth of a single hair apart, as the comb is drawn through the hair. Any empty shells on the same shaft are drawn off as the comb is swept to the tip. In skilled hands

Figure 4

Levels of head infestation halved by a co-ordinated campaign in Teesside
September 1970 / January 1971



Malathion treatment further reduced levels from October 1971, but late detection of asymptomatic cases impeded eradication
Source: RJ Donaldson *Parasites and Western Man* p69 (diagram redrawn)

the Sacker comb was both efficient and fairly comfortable. In 1956 a cheap moulded copy, the Derbac comb, became available for parents to use in conjunction with lindane soap. The bevel of the teeth was shallow compared with the Sacker comb, and the space between them wider. It was probably responsible for more tears than any other nit comb because it is so difficult for the layperson to use without hurting the patient. In spite of this shortcoming, the measures used in the October 1970 Teesside campaign produced such intensive anti-lice activity among parents that infestation rates dipped dramatically. Donaldson remarked 'Public education is, indeed, a most effective insecticide.'¹²

With the introduction of ovicidal insecticides late in 1971, egg removal ceased to play a curative function.³¹ The National Nit Week 1977 leaflet issued by the Health Education Council informed parents 'It is not necessary to use a fine-toothed metal comb after treatment', as

did the instruction leaflet for Prioderm Lotion (0.5% malathion).³⁸ Indeed Maunders proposed that the term 'nit' should thenceforth be reserved for the empty eggshell,³⁹ pointing out that their removal is a cosmetic measure.

Production of the Sacker comb ended in 1979 and the Derbac comb had all but disappeared by 1995. Round-tooth metal combs replaced them. This type of tooth point cannot be inserted under an egg attached to the shaft at scalp level. Only eggs and empty eggshells located some distance from the roots are caught in the tightly spaced teeth. Round-tooth combs are genuine 'nit' combs in Maunders' terminology.³⁹

DEVELOPMENT OF BUG BUSTING FROM 1988

Wet detection with a plastic louse comb

The main habitat of head lice is also in the roots of the hair, enabling access to

the scalp where they regularly bite and take blood feeds.³⁵ In dry hair lice move swiftly away from disturbance, evading detection. Ibarra observed that when bathed in moisture they stay still. Moreover wet lice can be comfortably lifted from the hair with a specific type of plastic louse comb. The edge of the teeth on this group of plastic combs was slightly bevelled, copied from the Derbac metal comb. In 1988 Ibarra proposed that parents should fine-comb thoroughly wet hair to diagnose asymptomatic lice or to prove that a suspected infestation is active.⁴⁰ From 1989 onwards the health charity Community Hygiene Concern (CHC) has organized an educational programme on head lice through primary schools. Pupils help to take the message about the wet detection of head lice to their parents. They also motivate their parents to use this knowledge in united action at home on designated Bug Busting Days, a refinement of the Donaldson model.

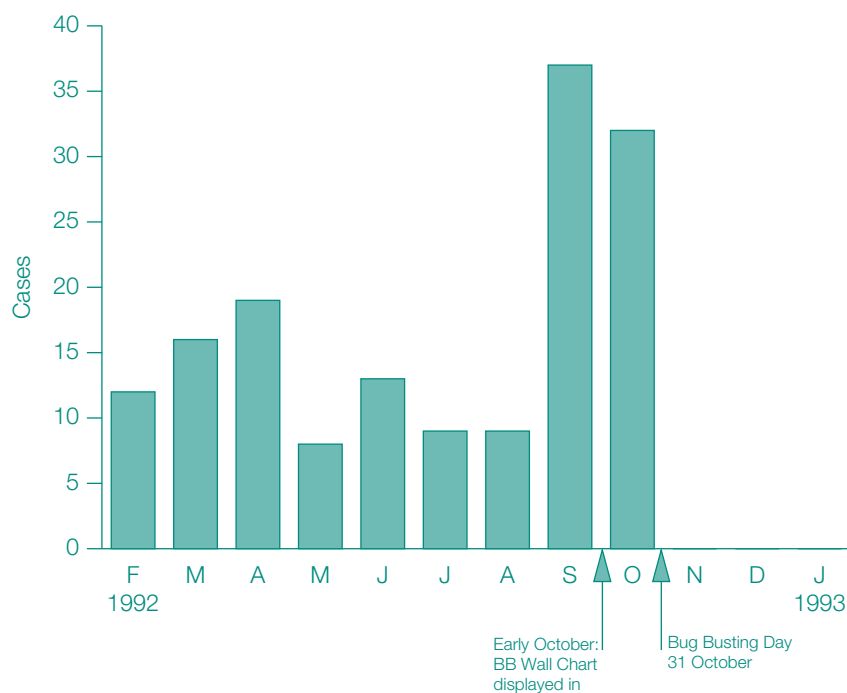
Implementation of the Bug Busting programme in 1992

A Bug Buster Teaching Pack was piloted in North London for Bug Busting Day, 31 January 1992. The centrepiece of the pack is a large wall chart that shows how to detect head lice with a Bug Buster comb, illustrated step by step with full colour photographs. A small primary school on the Island of Orkney, Scotland, used the teaching pack to encourage parents to participate in Bug Busting Day, 31 October 1992. The wall chart was displayed in school at the beginning of October in the lobby, where parents, collecting their children after school, could see it easily. Each of the 59 pupils took home a Bug Buster comb (original model) with a child-friendly teaching sheet on its use, plus a cheerful sticker bearing the words 'I'm a Bug Buster'.

Parents were advised to use malathion lotion to treat infestations diagnosed by isolating a louse. This was the treatment policy followed by local community health staff who also advised follow-up nit removal. Three months later the intervention was assessed using a confidential questionnaire completed by

Figure 5

Eradication of head lice by the celebration of Bug Busting Day by a small primary school in 1992



the parents. They were asked to note down cases in the whole family, comprising children (up to 18 years old) and older family members, month by month, from 1 January 1992 (nine months before Bug Busting Day) to 31 January 1993 (three months afterwards). It was requested that only cases that had been identified by finding lice (not eggs or nits alone) should be recorded. There was an 84% return of the questionnaires, which defined a survey population of 163 subjects by age and sex. In the nine months leading up to Bug Busting Day these subjects were affected by a total of 155 cases (95% cumulative incidence). Sixty nine cases affected the 59 pupils at the school. The incidence during the three months after the Bug Busting Day was zero. The cost of treatment for the identified cases during the previous nine-month period was an estimated £620 (an average of £68 per month) without allowing for any prophylactic treatment of contacts (Figure 5).⁴¹

Bug Buster Kit for detection and eradication – 1995 onwards

By 1995 CHC researchers Fry, Ibarra and Wickenden had fully developed the Bug Busting Wet Combing (BBWC) method. Furthermore they established that systematic louse removal using BBWC can eradicate an infestation. Precise instructions on the use of the Bug Buster comb with ordinary shampoo and hair conditioner must be followed. No medicated product is required to cure an infestation this way.^{2,42,43} This is attractive to families who do not wish to use expensive chemicals, some of which are potentially harmful. The tedious removal of viable eggs is not required either. CHC produced a pilot Bug Buster Kit containing a Bug Buster comb and full instructions for use in the detection and eradication of head lice. It can be re-used for these purposes by a whole family, offering an economical treatment alternative. Also in 1995 the

Departments of Health and Education commended school participation in the Bug Busting programme. It remains their view that this 'whole-school approach' offers the best strategy to prevent lice from circulating.^{44,45,46}

In 1999 CHC launched the current Bug Buster Kit. The teeth of the early Bug Buster comb were modelled on the Derbac shape but the current comb is faithful to the deeply bevelled Sacker design. The space between the teeth has been carefully calculated. The current comb lifts out newly hatched lice but still has an easy passage through the hair and anything caught between the teeth can be easily cleaned out. This Bug Buster Kit includes all the combs and instructions necessary to detect a low level of head lice, clear an infestation mechanically or to check the efficacy of any treatment. It also includes a Nit Buster comb, which can be used to comfortably remove any unsightly eggshells after Bug Busting. The Bug Buster Kit 1998 (Figure 6) became available on National Health Service (NHS) prescription, free for children, in 2002. In a randomized controlled trial to assess its performance as a treatment, it was found to be 57% successful at first use, four times more effective than over-the-counter insecticide treatments.⁴⁷ A year later 97% of parents who reported back from the Bug Buster Kit arm of the trial said that they had detected and treated any new cases in the family by re-using the kit, and 18% of families reporting from the insecticide arm had switched to using the Bug Buster Kit.⁴⁸

When no medication kills louse eggs

In the UK we have entered a period when no medication available for head lice will kill louse eggs with certainty.^{44,45,46} This is so whether the active ingredients are neuro-toxic insecticides, including malathion,^{14,47} of plant origin⁴⁹ or silicone.⁵⁰ In these circumstances both CHC educational materials and the NHS leaflet *The prevention and treatment of head lice* stress the importance of checking for 'baby lice' five days after using medication and again at 12 days.^{45,46}

THE CHESTER EXPERIENCE 1998–2005

Since 1998 health centre staff in a deprived locality of Chester have monitored community opinion on the advice they offer on head lice. People were accustomed to malathion lotion on free NHS prescription for treatment. Prescribing data showed that the same families required numerous repeat prescriptions and this approach was time-consuming and costly. Use of the Bug Busting alternative was piloted and the results were very positive. In January 2003 guidelines based on best practice were developed, with CHC involvement, for application throughout the area covered by the local health authority. A team including the consultant dermatologist, the health visitor leading the pilot, a district nurse and a local parent was formed, chaired by the head of medicines management. They were joined by a general practitioner and two school health advisors to oversee implementation of the guidelines. Prescribers were encouraged to offer one Bug Buster Kit per family as the first treatment option to infested patients. Those families opting for insecticides were required to follow up with a Bug Buster Kit to assess their efficacy. All families with primary schoolchildren were encouraged to purchase a Bug Buster Kit and learn how to use it for detection purposes. It was recommended that primary schools should invite parents to check the whole family at home on the three national Bug Busting Days: 31 January, 15 June and 31 October.

Analysis of the health authority prescribing data showed a 24% drop in the NHS cost of treatments from April 2004 to March 2005 compared with the year before (Figure 7). Prescriptions for insecticide medication, requiring a new prescription for every infestation, fell, whereas prescriptions for Bug Buster Kits, valid for repeated use for both detection and eradication in a whole family, rose.

The locality healthcare staff noticed a marked drop in the time spent on advising parents about head lice.

Figure 6

Contents of the Bug Buster Kit launched Spring 1999

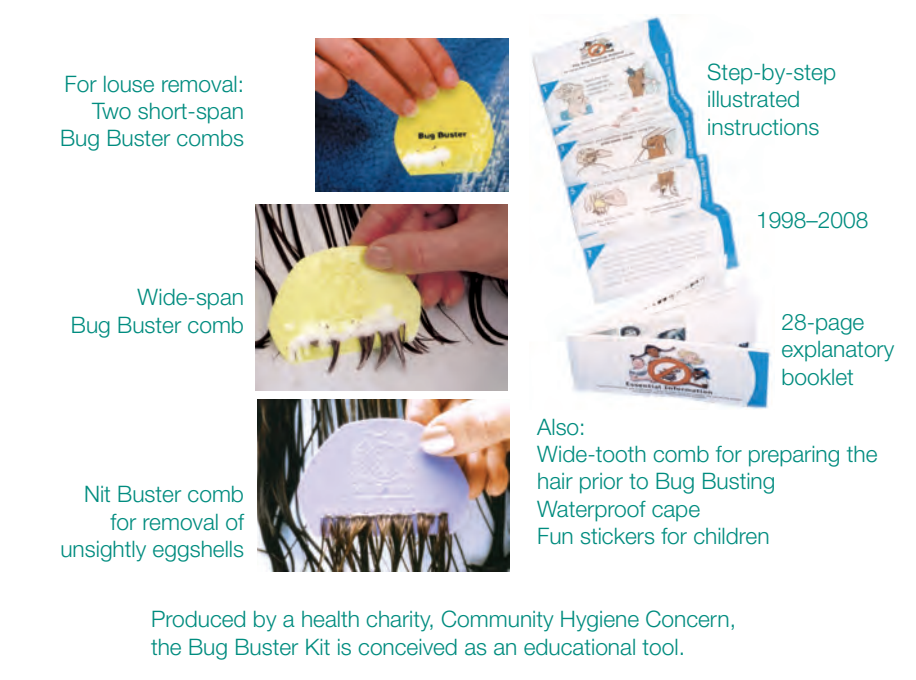
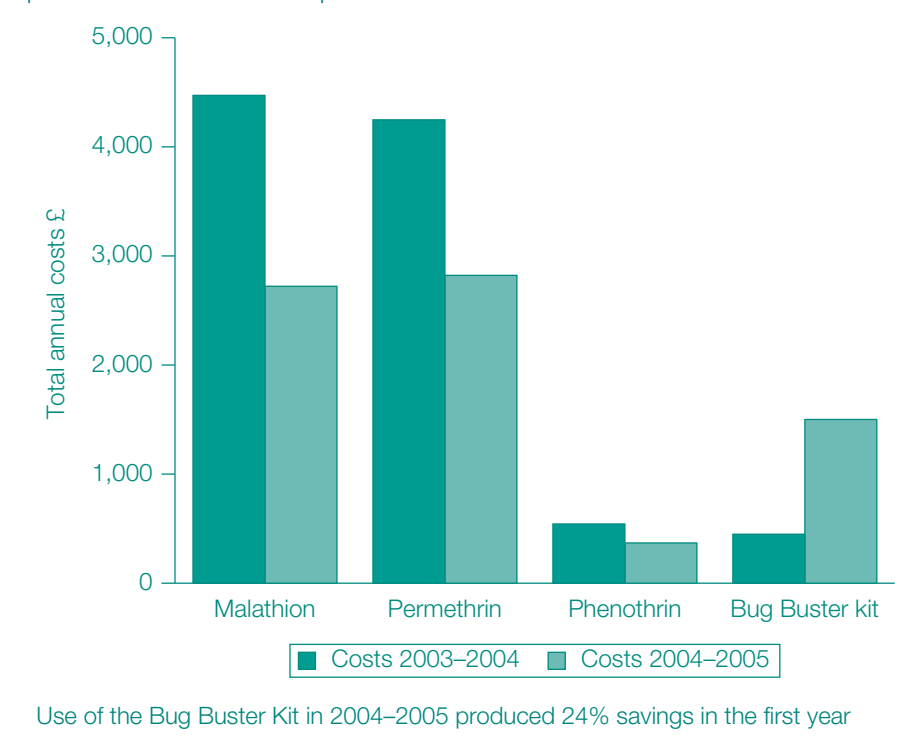


Figure 7

Community health expenditure on treatment for head lice April 2003–March 2004 / April 2004–March 2005



Teaching staff at the three local nurseries and two primary schools commented that unusually there did not appear to be a problem with head lice. Much professional time spent previously with the large number of worried parents could now be saved, and adequate time given to the few families who were dependent on one-to-one guidance.^{51, 52}

DISCUSSION

The 1970–1973 Teesside experience^{10,12,30} revealed that co-ordinated detection compensated for poorly performing treatments in an anti-head louse campaign. Families became aware that they could not rely on medication to kill louse eggs and intensified egg removal with a Derbac comb. This manual activity, which often inflicted pain on patients, was better rewarded in the context of united action at a pre-designated time. In addition Donaldson demonstrated in Teesside that even when treatment is ovicidal, successful community eradication still hinges on the sensitivity of the method used to detect lice. In the 1992 Orkney study, parents used wet combing, a more reliable detection method than inspection of the dry hair, to check their families at home on Bug Busting Day. This facilitated the diagnosis of low level, asymptomatic infestation. The treatment of these previously hidden cases at the same time as obvious cases, eradicated head lice from the community for at least three months.⁴¹ The treated individual often becomes re-infested in the absence of a co-ordinated detection programme.¹ As the Chester experience demonstrated a sustainable strategy for prevention must deliver the means to detect cases with low levels of infestation to the parents of nursery and schoolchildren.^{51,52} Sensitive screening is equally important in post-treatment vigilance.^{51,52,53} A final check to prove the patient is clear of lice, made after the treatment period is completed, is part of the Bug Buster Kit protocol when it is used to cure an infestation. Additionally instructions on checking after using 'quick fix' treatments are included in the

kit. In Chester the provision of a Bug Buster Kit to parents who chose insecticides for treatment, with the requirement to use the kit to make follow-up checks, ensured that treatment was made within a preventative context. The policy reduced professional time spent supporting parents.^{51,52} This argues in favour of the routine instruction of parents in the most sensitive detection method.⁵³ In educational materials the developmental stages of *Pediculus capitis* should be clearly defined as lice, eggs and nits (empty eggshells), as proposed by Maunder.³⁹ This practical information, which helps parents to understand the significance of what they comb off a head, is included in a kit.⁵⁴ Most probably a family's knowledge of reliable detection and possession of the right tools for the purpose play a more important role in their ability to control lice than access to medication for head lice.

CHC's Bug Busting Days build on the Teesside example of how to organize louse detection without imposing a stigma on co-operative families. A 'fun without tears' approach based on sound science is promoted. An educational programme precedes the celebration of a Bug Busting Day. Where schools take part, pupils motivate their parents to learn about the behaviour of head lice. This teaches both the children and their parents that head lice have biological vulnerabilities that can be exploited – e.g. they stay still when thoroughly wet, facilitating their removal from the head with a Bug Buster comb. An accurate understanding of the life cycle and stages of lice, and a clear knowledge of the easiest way to comb them from the head, are empowering. When parents have adequate knowledge, complaints about head lice, disrupting school life, diminish.^{17,52} Unfortunately valuable experience like this is dismissed in the 'Stafford Group' public health guidelines on the management of head lice, produced in 1998.^{55,56} These authors actively discourage schools from participating in Bug Busting Days, ignoring their educational input, on the grounds that they cause hysteria about head lice. Instead the Stafford Group

suggest that parents themselves should conduct contact tracing among their children's school friends, as and when they find lice on their own children. Unsurprisingly when the evidence base of these guidelines was examined in 2002, no convincing evidence against co-ordinated education in detection was put forward.⁵⁷ As Figueroa comments: "The main problem with literature on the subject of head lice is not only the lack of solid scientific evidence but, more importantly, the rather cavalier attitude of the scientific community in accepting or rejecting anecdotal evidence according to personal belief, individual affinities and, in some cases, commercial interests."⁵³

The results of the Orkney study, where the intervention reduced continuous expenditure on treatment to none post-intervention, suggested that there is ample potential for savings on head louse treatment. The instruction of parents in reliable head louse detection, combined with the application of the Donaldson campaign approach, saves public money. Calculations based on the 1989 UK sales figures²² show that country-wide about 3 million doses of the insecticide medication were used that year. This meant that on average every 18th member of the population was treated. Since then the market has expanded.²³ On average every sixth member of the UK population was treated with insecticide medication by 1998. In 2002 the NHS paid £11.5m for half the medicines used, while the general public paid a further £16m buying the rest over the counter at a higher price per unit.^{24,58} The 2004–2005 Chester experience^{51,52} showed once again the economic advantages of participation in the Bug Busting programme. It reduces health authority expenditure on treatment (24% in the first year in Chester) and by nurturing successful self-care, saves expensive professional time. Whatever treatment is first line, when health providers and schools emphasize to parents that they should use a Bug Buster Kit to check the efficacy of any treatment choice, parents become reconciled to the understanding that today there is no such thing as a

'quick-fix' cure. Instead parents find that systematic use of the kit will break the life cycle, a method of cure that is economical.⁶¹ Prompting families to check on national Bug Busting Days develops a community capacity to manage head lice. It is in the interests of local education authorities to join with health authorities in promoting this approach to parents, and to monitor the outcome. Thus they will gain the maximum benefit from the organization of national Bug Busting Days by CHC in partnership with the Department of Health.

CONCLUSION

To advance in head louse control it is important to remain connected with our heritage of scientific knowledge. The Bug Busting programme maintains this continuity and the available evidence shows that resources are used wisely

where it is promoted. National Bug Busting Days offer the structure for co-ordinated action. Meeting individual and collective needs simultaneously provides an economic community solution to the head louse problem. Sustainable control evidently hinges on the sensitivity of the detection method in popular use. As Donaldson established, to manage pediculosis capitis effectively treatment must be couched within a strategy where prevention takes the lead.

ACKNOWLEDGEMENTS

This paper is dedicated to the late Dr RJ Donaldson (1920–2005), affectionately known as Paddy, whose work on head lice provided the solid evidence base on which the Bug Busting programme, organized by Community Hygiene Concern, is built.

The development of the Bug Busting programme was grant-funded by the

Department of Health, The King's Fund, the Big Lottery and the 1998 IMPACT Award for excellence in community health.

COMPETING INTERESTS

Community Hygiene Concern is a charity, part-funded by sales of Bug Busting materials on a not-for-profit basis.

RESOURCES

The leaflet *NHS The prevention and treatment of head lice*, 2007, is available free for distribution at schools from the Department of Health, PO Box 777, London SE1 6XH, UK. Email: doh@prolog.uk.com.

Enquiries about current Bug Busting programme materials should be made via: Help line: 01908 561928; Email: bugbusters2k@yahoo.co.uk; Web: www.chc.org/bugbusting.

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