PESTS That Affect Human Health

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Human Lice

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People can be infested with three types of human lice: head lice, body lice, and pubic (crab) lice (Figures 1 and 2). New evidence based on DNA analysis shows that head lice and body lice are the same species. Lice are very small; adults are only 1/12 to 1/8 inch (1.1 to 3.6 mm) long. Lice are flattened, wingless insects that cannot jump or fly. The color ranges from pale tan or dirty white to grayish black. Lice legs are short and stout, with a claw on each leg for grasping and holding onto hair. Lice have retractable piercing and sucking mouthparts. Human blood is their only source of food.

Figure 1. Human head lice

Lice are spread by sharing infested clothing, hats, scarves, combs, hair brushes, and head gear, or as a result of close physical contact with an infested person. Other occasional sources are bedding, furniture, rugs, and floor surfaces where dislodged lice may be present. Once infested, an individual usually harbors only a few dozen lice. But some people can carry several hundred lice and, occasionally, a few thousand. Lice are more host-specific than ticks and fleas. Human lice do not survive on pets, and lice from other animals do not establish infestations on people.

Figure 2. Human pubic lice

Lice have five life cycle stages: egg, three nymphal stages (first, second, and third instar), and adult. The nymphs are identical in appearance to adult lice except the size and development of reproductive organs. Lice nymphs shed their skin (molt) three times as they gradually develop into adults. Lice spend their entire life as ectoparasites on humans where they maintain constant temperatures of 82° to 86°F, and have an unrestricted food supply of human blood. Lice do not voluntarily leave their hosts unless the body temperature substantially changes due to death or high fever. Once dislodged from a person's body or clothing, lice attempt to infest a new human host in the immediate vicinity.

Pediculosis

Lice penetrate skin with their piercing-sucking mouthparts to obtain blood. During feeding, they inject saliva that causes irritation and itching. Scratching louse bites causes abrasions that may become infected with bacteria from the skin. Prolonged infestation causes a hardening and darkening of the skin known as "vagabond's or hobo disease." Even though infested people experience pain and irritation, they often deny having pediculosis because of embarrassment or shame.

Of the three species of human lice, only body lice have been known to transmit disease-causing microbes. Body lice can transmit the bacterial pathogens that cause relapsing fever, typhus, and trench fever. However, no cases of these diseases have been reported as transmitted by lice in the United States in recent decades.

Head Louse

In the North America, the head louse is the most common human louse species. Infestations are most common in preschool, kindergarten and elementary school-aged children. Up to 10 percent of elementary school children are treated for head lice each year.

The female louse lays four to six eggs (nits) (Figures 3 and 4) per day, usually at night – 50 to 150 eggs in her lifetime. Each egg is attached to an individual hair between 1/16 and 1/8 inch from the scalp, with a

waterproof, glue-like substance that is secreted by the female. The eggs are cylindrical, yellowish-white, and 1/30 inch long . As the embryo develops within, the egg becomes darker and is coffee-colored just before hatching. Nymphs hatch five to 10 days after the eggs are laid. Newly hatched lice are transparent and start feeding on blood within hours. Later, they change to a dirty white or straw color. They feed twice or more each day. The nymphs become adults in as little as eight or nine days. The male and female mate within 10 hours after becoming adults.

Figure 3. Head lice nit

One to two days after reaching maturity, the female is ready to lay eggs. The life cycle (egg to egg-laying female) is completed in 15 to 21 days. Adults are dirty white to grayish black, 2.1 to 3.3 mm long, and live for three to four weeks.

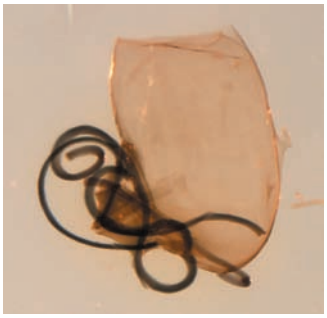

Figure 4. Empty head lice nit

Head lice spend most of the time in the hair near the scalp. They are most common on the back of the neck and behind the ears. Head lice are rarely found on eyelashes or other hairy parts of the body except when numerous on a person. In severe infestations, the hair may become matted as a result of thousands of eggs glued to the hair and serum exuding from louse bites. Head lice rarely survive more than two days once dislodged from the host. They are transferred from person to person through physical contact and the shared use of combs, hair brushes, head apparel, towels, bedding, and clothing.

Body Louse

Body lice are morphologically identical to head lice, but they are usually 10 percent to 20 percent larger, 1/11 to 1/6 inch (2.3 to 4.2 mm) long. Body lice are generally associated with unclean environments, inadequate bathing, clothes sharing, and crowded conditions. Body lice are currently rare in the United States except possibly among "colonies" of homeless people or in crowded shelters.

Body lice are more prolific than head lice but require longer to reach maturity. A fertilized female lays nine to 10 eggs per day, and may lay 250 to 300 in her lifetime. The eggs are commonly glued to fibers of clothing, blankets, or sheets, usually in seams, and occasionally on coarser body hair (Figure 3). Eggs hatch in six to nine days. Newly hatched nymphs begin to suck blood within hours. They feed frequently during day or night, especially when the host is at rest. Nymphs mature in 16 to 18 days. Newly emerged adult males and females mate within a day. Females begin laying eggs one or two days later. The life cycle (egg to egg-laying adult) requires from 22 to 28 days. Adults are grayish-white and live approximately 30 to 40 days. Body lice may bite anywhere on a host body, but bites are usually most numerous around the waist and between the shoulder blades. If removed from the host, body lice can survive as long as eight or 10 days. Body lice are spread through contact with infested persons or bedding or clothing.

Pubic (Crab) Louse

The pubic louse has a crab-like appearance and is pale tan to grayish-white. It infests the pubic and perianal region of the body, but in severe infestations may be found in armpits, mustaches, beards, eyebrows, and on eyelashes. During the 1980s an estimated 2 to 5 percent of sexually active Americans were infested with pubic lice. Their distribution is not uniform; in many communities no one is infested, while in other groups there is a high incidence of infestation.

A fertilized female lays about three eggs per day for a total of 26 eggs in her lifetime. Oval, whitish eggs about 1/50 inch long are glued to coarse hair near the skin (Figure 3). Eggs hatch after six to eight days, and newly hatched nymphs start sucking blood within hours. The nymphs grow into adults in 15 to 17 days. The life cycle (egg to egg-laying adult) requires from 34 to 41 days. The adults are only about 1/16 inch (1.1 to 1.8 mm) long. They live for about a month. If dislodged from a human host, they die within 24 hours.

Both nymphs and adults tend to settle on one spot; feeding continues intermittently for hours or days. Bluish spots on the skin of the pubic area, where lice have fed, are often more easily visible than the lice themselves. Pubic lice are spread most often by intimate physical contact, but they may be spread through contact with bedding or clothing used within the past few hours by an infested person.

Persons infested with pubic lice should be examined for venereal diseases. The lice do not spread such diseases, but pubic lice and venereal disease are frequently

contracted from the same source, and medical workers have noticed a correlation.

Control

Human lice can be successfully controlled through:

- recognition of infestation
- inspection of people associated with the person first found to be infested
- personal hygiene and sanitation
- chemical treatment with a pediculicide
- continued surveillance to assess need for continuing treatment
- insecticides and indoor environment

Recognition of Infestation

Constant scratching of the scalp or other body parts may be the first clue of the lice infestation. Bloodspotted undergarments or bedding may be signs of infestation with body lice or pubic lice, and spots on pillows may be a sign of head lice.

If lice are discovered on a family member, avoid the overreaction that sometimes causes people to shave heads, apply harsh treatments, bathe or shampoo excessively, or use pediculicides repeatedly. School or youth camp officials should also exercise restraint. Insecticidal treatment of buildings and the general environment is not required and is ineffective. County health nurses and school health nurses should be informed about the infestation so they can help prevent a large outbreak.

Inspection

Closely inspect the scalp, head hair, and hair of other body regions (depending on the kind of lice suspected) to confirm infestation. Because lice are small and their color may not contrast with that of skin or scalp, one must look very carefully to see lice. The eggs are even smaller, only 1/50 to 1/30 inch long. Recently laid eggs are all close to the skin, except in extremely dense infestations. As the hair grows (typically about ¼ inch per week) the eggs are pushed farther from the skin. Microscopic examination will show that most of the eggs found more than ¼ inch away from the skin have already hatched and are merely egg "shells." Unless removed, empty eggshells may remain attached to hair shafts for several months, but they do not indicate a continuing infestation, nor do they play a role in transmission of lice.

Magnification also helps distinguish viable louse eggs from empty eggshells, hair follicle casts, knots in the hair, dried globules of hair spray, or hair damaged by too much heat from a hair drier.

Within the family, careful palpation with sensitive fingertips should be used along with visual observation. However, for sanitation, nurses or others examining many people should use sterile techniques including the wearing of latex gloves. Inspect clothing and bedding. Until an infestation or outbreak is controlled, inspect individuals with a history of pediculosis every 2 weeks, along with everyone who might have come in contact with an infested person.

Personal Hygiene and Sanitation

1. Bathing daily with soap and regularly washing hair with shampoo is important to prevent lice infestation. Once an infestation is encountered, apply medicated (pediculicidal) shampoo and remove lice by combing the hair with a special nit comb. Metal combs are best. Nit combs are available at pharmacies and pet supply stores or they can be ordered through the Internet. It is most difficult to comb out the eggs that are closest to the skin, i.e., those most likely to still contain living louse embryos. The eggs containing embryos are dark and difficult to see against most hair colors. Products such as RID Egg and Nit Comb-Out Gel dissolve the glue by which eggs are attached to hair and makes them easier to remove.
2. Soak combs, brushes, and other hair care items for one hour in a louse shampoo solution, or for 10 minutes in water heated to 130°F .
3. Do not share combs, brushes, caps, hair-related items, or clothing with anyone suspected of having lice. Avoid close, physical contact with infested people and their belongings.
4. Machine wash in hot water (more than 130°F) or dry-clean all clothing, including coats, hats, scarves, pillow cases, towels, and bedding materials with which an infested person has come in contact. Dry heat, steam, or pressing with a hot iron will also destroy lice and eggs.
5. Materials that cannot be washed or dry-cleaned should be placed in a freezer for two or three days or placed in a sealed plastic bag and stored at room temperature or below for a week if head lice are involved, three days for pubic lice, or two weeks for body lice. In winter, such bags full of infested items may be left outdoors. This procedure will kill eggs, nymphs, and adults by desiccation (drying), lack of warmth, and starvation.
6. Use a vacuum cleaner to remove lice from couches, chairs, mattresses, carpeting, rugs, and furniture if infested persons came in contact with these items.

Chemical Treatment

There are several excellent medicated shampoos, lotions, and other products available for louse control. Many of these can be purchased without a prescription at most pharmacies. Before using a pediculicide, *always read, understand and follow label directions and precautions.*

Keep these and any other insecticides in their original containers, out of reach of children, and do not contaminate food or water with them. If one person is shampooing several heads, he or she should wear latex or plastic gloves to prevent overexposure to the insecticide.

Pediculicides that may be purchased without prescription include permethrin 1 percent liquid creme rinse under the brand name, Nix. In addition, many formulations contain from 0.2 to 0.3 percent pyrethrins combined with 2 to 4 percent piperonyl butoxide (a synergist). These include for example RID® Lice Killing Shampoo/Mousse, Pyrinyl, Tisit, Tisit Blue, Pronto, R&C, Triple X, and A-200.

Because of permethrin overall safety, efficacy, and duration of residual activity, Nix Liquid Creme Rinse (1% permethrin) should be the pediculicide of choice for most patients. Permethrin may cause temporary increased itching of the skin areas to which it is applied. If the treatment with permethrin fails (possibly because of lice resistance), alternative products based on malathion can be used (below).

Several companies offer complete lice removal kits (RID products, NIX products) that include shampoo, creme, combing gels, combs, and sprays.

Pediculicides available with prescription only include 0.5% malathion (e.g. Ovide lotion). When used as directed, malathion is effective in treating lice. Some medication remains on the hair and can kill newly hatched lice for seven days after treatment. Malathion is intended for use on people 6 years of age and older. Few side effects have been reported including, scalp irritation and increase in dandruff. Malathion may sting if applied to open sores caused by scratching.

Continued surveillance to assess need for continuing treatment

It is important to conduct daily inspections for several days after the treatment to make sure that no lice or lice eggs are present and surviving the insecticide application.

Insecticides and Indoor Environment

Rarely, and usually only with infestations of body lice, is it appropriate to apply insecticides to upholstered furniture, mattresses, carpets, rugs, and interiors of lockers. Such application should be performed only by a properly certified Pest Management Professional. Insecticides labeled for such use include resmethrin, sumithrin, deltamethrin, and permethrin.

Reference: Leo N.P. et al. 2002. Evidence of mitochondrial DNA that head lice and body lice of humans (Phiraptera: Pediculidae) are conspecific. Journal of Medical Entomology. 39(4): 662-666.

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