

# **Guidelines for Treatment of Pediculosis Capitis (Head Lice)**

**District Health Authority Public Health Services  
And  
The Department of Health Promotion and Protection**

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Public Health Services



**Health Promotion  
and Protection**

[www.gov.ns.ca/hpp](http://www.gov.ns.ca/hpp)

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### **Purpose**

This document and supporting materials are based on an up to date review of the literature and is a resource for Public Health staff to guide practice with regards to head lice. The document and supporting materials will be housed electronically with the Healthy Development responsibility centre of HPP. The head lice team at Capital Health, Public Health Services, has agreed to periodically provide recommendations for revising this document and supporting materials based on available evidence to the Healthy Development RC.

### **Acknowledgement**

Public Health Services would like to acknowledge the contributions of Nicky Corkum (B.Sc. Biology, B.Sc. Pharmacy) in the compilation of literature for this protocol. Nicky conducted a comprehensive literature review on the subject, in conjunction with existing resources from Public Health Services, to create an educational course for the Dalhousie University Division of Continuing Pharmacy Education on the subject of head lice.

## Introduction to Pediculosis Capitis (Head Lice)

The beginning of the school year is a stressful time and it often brings added anxiety due to head lice outbreaks. Families are frequently embarrassed and shocked when they learn that a family member has head lice.<sup>1</sup> Misconceptions and misinformation about head lice are widespread. The objective of this protocol is to provide useful information that public health staff can use when assisting families affected by head lice infestations.

### Life Cycle of Head Louse

The life cycle of the head louse is depicted in Figure 1. Within 24 hours of mating, the adult female louse begins to lay eggs; these egg casings are referred to as nits.<sup>3,4</sup> The female louse uses a cement to adhere six to ten nits each day within 1-2 mm of the scalp near the hair shaft.<sup>3,5</sup> Nits are very small and silver-grey in colour.<sup>6</sup> Newly hatched nymphs look like miniature adults and are about the size of a 12-font period or pin head.<sup>7,8</sup> Nymphs can be either red or transparent, depending on the timing of their last blood meal.<sup>7</sup> Nymphs shed several exoskeletons as they develop into adult lice.<sup>7</sup> It achieves adult status in 10 days and the louse has a life span of about 30 days after hatching<sup>6,1</sup>. Adult head lice are about the size of a sesame seed (2-4 mm long<sup>12</sup>); with females being slightly larger than males.<sup>5,6</sup> Adult lice can camouflage themselves by changing colour to match their surroundings.<sup>6</sup> The claws of head lice in North America are specifically adapted to grasp hair with a round cross-section shape.<sup>3,9</sup> These lice are anatomically different than the lice endemic to Africa and cannot easily grip the hair or position the nits on coarse, curly African American hair which has an oval cross-section shape.<sup>9-11</sup> Despite this difference, some lice in the US have adapted and infestations in African American children are increasing in prevalence.<sup>6</sup>

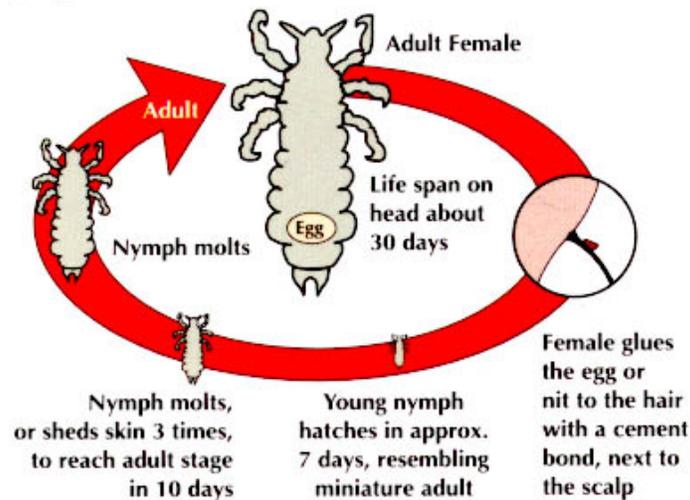


Figure 1: Image credit: <http://www.healthcare.ubc.ca/lice/opponent.html>

## Transmission of Head Lice

Extinction of head lice is highly unlikely; infestations are more common during the summer, although it may seem that September is the peak of outbreaks.<sup>5, 6</sup> This perceived peak can be attributed to increased monitoring.<sup>6</sup> Infestation with head lice is endemic with prevalence of up to 13 % in elementary school children.<sup>3, 6</sup> Head lice do not spread diseases in humans and do not pose a significant health hazard for the infested person.<sup>3, 7, 12</sup>

Nymphs and adult lice usually live off the host for up to three days, however, in favorable conditions they can survive for four days.<sup>5, 13</sup> Nits cannot hatch off the host at temperatures lower than those found near the scalp.<sup>12</sup> However in optimal conditions, such as temperatures from 28-32° C and humidity of 70-90%, nits can survive and hatch after being away from the host for up to 10 days.<sup>10</sup> Lice have a blood meal every four to six hours.<sup>10</sup> Even if nits were able to hatch without a host, they would require a blood meal within hours of hatching in order to survive.<sup>14</sup>

Head lice cannot hop or fly, therefore, direct head to head contact is the most common and efficient means of transmission.<sup>9, 12</sup> Head lice only live on the head – they do not live on an other parts of the body<sup>43</sup>. There is controversy about the likelihood of transmitting head lice via inanimate objects (fomites).<sup>5, 12</sup> Lice and nits can be found on fomites, so measures to disinfect some of these items are recommended.<sup>5, 9</sup> Head lice do not live on pets, so treatment of pets is not required.<sup>12, 15</sup> Please see the Environmental Cleaning section for further details.

## Detection of Head Lice

Although some people may be asymptomatic carriers, the following signs and symptoms may be present:<sup>9, 10, 16</sup>

- Pruritis – requires 2-6 weeks to develop an immune response to an antigen in lice saliva during the first infestation; however itchiness develops within 24-48 hours of future infestations
- Sleeplessness
- Red marks
- Excoriations
- Rash
- Rarely: secondary bacterial infections, fever, irritability and lymphadenopathy

Detection combing is four times more accurate than visual examination in the detection of head lice.<sup>12</sup> It is the only reliable method of detecting active infestations.<sup>17</sup> This process requires a bright light, regular comb, lice comb (a special fine-tooth comb available at any drug store), hair conditioner (white is best, this color makes it easier to see a louse), paper tissues (white is best), and a plastic bag for garbage<sup>8, 55</sup>. A magnifying lens may also be helpful.<sup>4</sup>

**Steps to detect head lice:** <sup>2,4,5,8,18</sup>

1. Apply ample conditioner to dry hair, enough to soak from the scalp to the end of the strands.
2. Remove tangles with a regular comb.
3. Start behind the ears and comb the hair section by section. Separating the hair (with hair clips) is helpful.
4. Place the lice comb against the scalp and pull to the end of the hair.
5. Check the comb for lice after each pull.
6. Wipe the comb with a tissue each time and look for lice.
7. Place the tissue in plastic bag.
8. Check all the hair over the entire head.
9. Repeat combing for every part of the head at least five times.
10. Once finished, tie the bag with the soiled tissues and throw it in the garbage.
11. If lice are detected and treatment is required, make sure that all conditioner is washed from the hair prior to treatment.

The only sure confirmation of an active infestation is finding one or more live lice.<sup>4,17</sup> Detection is difficult because lice can move 6-30 cm per minute and there are usually less than 10 live adult lice per infestation.<sup>2,12,19</sup> Nits are most often found at nape of neck and behind the ears, but are difficult to remove because they are firmly attached to the hair.<sup>3,5,19</sup> Although detection of head lice is not confirmed when only nits are found, the distance of nits from the scalp provides a modest clue.<sup>12</sup> Nits found less than 0.6 cm (the width of the little finger) from the scalp are likely to be viable and may indicate an active infestation.<sup>5,12,15</sup>

Over 75% of children, with nits close to the scalp and no live lice, do not develop active infestations.<sup>12,19</sup> Even with optimal scalp conditions, 10-30% of nits do not hatch.<sup>20</sup> In a large trial which screened 1729 children in Georgia for head lice, 50 children had only nits and were followed for 14 days.<sup>20</sup> Of those 50 children, only nine cases (18%) converted to an active infestation over the observation period.<sup>20</sup> The authors noted that nearly 32% of children with five or more nits close to the scalp converted to active infestations versus 7% of those with fewer nits.<sup>20</sup> Nits found more than 1 cm from the scalp are not usually viable and those 2 - 5 cm from the scalp are likely to be remnants of a past infestation, although in warmer climates viable nits can be found more than 20 cm (8 inches) from the scalp.<sup>1,5,19</sup>

**Misidentification of Head Lice**

Misidentification occurs frequently leading to unnecessary treatments and exclusions from school.<sup>6</sup> The identification of head lice was so inaccurate in one study that children without active infestations were excluded from school more often than children with active infestations.<sup>6</sup> Nits can be confused with many other materials including dandruff, scabs, dirt, sand, lint, residue left from hair spray, hair casts and other debris.<sup>3,5,14</sup> Unlike nits, the materials above are easily removed from the hair shaft.<sup>3,14</sup> Confirmation of an infestation should include questioning about other materials that may have confused the

identification. Post-treatment itching, even 2-3 weeks after treatment, does not indicate re-infestation.<sup>12,17</sup>

### **“No Nit” Policies**

Despite the lack of evidence to support efficacy, some school boards still enforce no nit policies that do not allow children to return to school until all nits and live lice are removed.<sup>2, 5</sup> The Department of Health Promotion and Protection and District Health Authorities do not support these policies.<sup>2</sup> Children should not be forced to miss valuable class time because of head lice.<sup>14</sup> Removal of nits after a pediculicidal treatment is not required to prevent transmission because only live lice can cause an infestation.<sup>14</sup> Complete lice and nit removal have not been shown to produce better outcomes when used concomitantly with pediculicidal treatment.<sup>21</sup> Although nit removal at the time of treatment is not necessary to prevent transmission, it may decrease future confusion with detection and decrease the possibility of unnecessary treatments.<sup>14</sup> Rather than requiring children to be lice-free before returning to school, they should be permitted to return after they have received appropriate head lice treatment.<sup>14</sup>

When an active head lice infestation is discovered, the person has probably been infested for at least one month.<sup>19</sup> There is no immediate risk on the day of detection.<sup>19</sup> These policies are often in place because it is difficult to differentiate between viable and nonviable nits.<sup>9</sup> Dead eggs and empty shells can remain on the hair for up to six months as the hair grows.<sup>1</sup> Since misidentification is very common, no nit policies often result in inappropriate exclusions from school.<sup>5,6</sup> The resulting time lost by children from school and missed work by parents is substantial.<sup>21</sup> “No nit” policies are not based on scientific or medical evidence, do not effectively control head lice transmission and should not be recommended.<sup>19,22</sup>

#### **Public Health Position Statement on No Nit Policies and Mass Screenings**

Public Health Services does not support “No Nit Policies” or mass screenings for nits in schools.

### Pharmacologic Treatments

TABLE 1: Pediculicides Available in Canada<sup>3,10,12,13,15,16,22-26</sup>

| Pediculicide                          | Pyrethrin/Piperonyl butoxide (PPB)                           | Permethrin                                       | Lindane                                                                                                                                                                               |
|---------------------------------------|--------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Brand                                 | R&C®<br>Licetrol®<br>Pronto®                                 | Kwellada P®<br>Nix®                              | PMS-Lindane®                                                                                                                                                                          |
| Classification                        | Pyrethrin                                                    | Pyrethroid - synthetic                           | Organochloride                                                                                                                                                                        |
| Neurotoxic to humans                  | Very low                                                     | Very low                                         | Yes                                                                                                                                                                                   |
| Contraindications<br>Cautions         | Ragweed /<br>chrysanthemum<br>allergy<br>Children ≤ 2 years* | Children < 3<br>months*                          | History of seizures,<br>preterm infants<br>Patients < 50 kg or<br>children < 6 years,<br>pregnancy, breastfeeding,<br>HIV patients (decreased<br>seizure threshold),<br>inflamed skin |
| Adverse Events                        | Dermatitis                                                   | Edema,<br>erythema,<br>hypoesthesia,<br>pruritis | Restlessness, seizure,<br>rash, nausea, vomiting,<br>diarrhea                                                                                                                         |
| 100% Ovicidal                         | No                                                           | No                                               | No                                                                                                                                                                                    |
| 2 <sup>nd</sup> Treatment<br>Required | Yes                                                          | Yes                                              | Yes                                                                                                                                                                                   |

In Canada, pyrethrin/piperonyl butoxide and permethrin are indicated for the treatment of head lice in children ≥ 2 years.<sup>24-25</sup> In the US, permethrin is indicated for use in children ≥ 3 months of age.<sup>26</sup> Despite these governmental approvals, the Centers for Disease Control (CDC) suggests that data to support the use of OTC pediculicides in young children is lacking.<sup>15</sup> For children < 2 years, the CDC recommends manual removal of nits and lice as the initial treatment option.<sup>3,15</sup>

Pediculicidal products should only be used on people with active infestations.<sup>13</sup> It is important to treat all infested family members and close contacts immediately and on the same day to prevent reinfestation.<sup>1,3-4</sup> Public Health Services and the CDC recommend treating “probable cases” if nits (and no live lice) are found close to the scalp of a person that has not been treated with a pediculicide within the last month.<sup>2,8,14-15</sup> However, it is possible to successfully eradicate head lice infestations by treating only those with confirmed infestations<sup>5</sup>.

**Proper Use of Permethrin-Based Head Lice Products<sup>1,24,27</sup>**

1. If the hair is wet, dry it before using Permethrin.
2. Shake the product bottle well.
3. Apply a sufficient amount of product to thoroughly saturate the hair and scalp, paying particular attention to behind the ears and the base of the neck.
4. Leave the product on the hair for 10 minutes.
5. Rinse the product off with water and towel dry.
6. Comb hair with regular comb to remove tangles.
7. Use the techniques described in daily lice combing (without conditioner) to remove dead lice and nits.
8. Repeat the application in 10 days.

None of the non-prescription products available in Canada are 100 percent ovicidal.<sup>12</sup> Regardless of the pediculicidal treatment or labeling, the treatment must be repeated in 7-10 days.<sup>10,12</sup> During days five to seven post-treatment, 70 - 100% of eggs are not yet hatched.<sup>27</sup> Some experts suggest that 10 days is the optimum period to wait between treatments.<sup>1,27</sup>

Many experts now recommend application of all pediculicides to dry hair to avoid dilution of the product.<sup>4-5</sup> When dry, lice spiracles remain open so application of pediculicides to dry hair is expected to achieve maximum penetration.<sup>18</sup> Diluted permethrin has been shown to be less active than undiluted permethrin and may contribute to permethrin resistance.<sup>7,28</sup> Once the pediculicidal product is rinsed from the hair, it should remain unwashed for 1-2 days after treatment.<sup>15</sup> Families should be encouraged to practice daily lice combing and carry out environmental cleaning procedures (See Environmental Cleaning Section Page 10).<sup>8,15</sup> Public Health Services suggest that household members should also be checked for lice at least once per week for three weeks after the affected persons have received their second treatment.<sup>8</sup>

**Oral Antibiotic Use**

Sulfamethoxazole/trimethoprim has been studied for the treatment of head lice in a few small trials.<sup>5</sup> Symbiotic bacteria in the gut of the lice produce B vitamins and are required for lice survival.<sup>5,10,13</sup> It has been proposed that killing these bacteria results in vitamin B deficiency and death of the lice.<sup>5,13</sup> Trials have noted no statistically significant synergism when this therapy was combined with pediculicidal treatment.<sup>10</sup> In addition, concerns have been raised about the potential for development of resistance and the possibility of decreasing efficacy of sulfamethoxazole/trimethoprim in other clinical scenarios.<sup>12</sup> Evidence to date suggests that no antibiotic given to a human host can effectively cure head lice, nor is any antibiotic approved for the treatment of head lice in Canada.<sup>10,24</sup>

**Public Health Services Position Statement on Use of Oral Antibiotics**

There is very limited evidence to support the use of oral antibiotics; trimethoprim-sulfamethoxazole (not approved for this use in Canada) and ivermectin (not available in Canada) have been studied; for the treatment of head lice. In addition, using oral antibiotics for this purpose carries some risk of systemic adverse effects plus increases the potential for creating antibiotic resistance. Therefore, Public Health Services does not support the use of antibiotics for the treatment of head lice.<sup>44, 48, 50</sup>

**Pediculicidal Treatment Safety**

There are few reports of adverse effects associated with the use of non-prescription pediculicidal products.<sup>17</sup> Systematic reviews and post-marketing surveillance of permethrin and pyrethrins reveal only minor adverse events.<sup>10</sup> Itching, mild burning and rash can occur after using pediculicidal products and may be treated with topical corticosteroids with or without anti-histamines.<sup>12</sup> It is not advisable to use pediculicidal products repeatedly as this may contribute to the development of resistance and does improve eradication rates.<sup>28</sup> Public Health Services recommends that if you find live lice after the second treatment has been done, then repeat the appropriate steps using a different product (with a different ingredient) to kill the lice. For example, if you used a product with Permethrin, then choose a different product that has pyrethrins with piperonyl butoxide. Make sure to do 2 treatments with the new product.<sup>43-61</sup>

**TABLE 2: Safety of Pediculicides in Pregnancy and Breastfeeding<sup>3,13,22,29-32</sup>**

| Pediculicide | Pregnancy Risk Category (FDA)** | Details of use in Pregnancy                                                                                                                                                                                                                                | Hale's Lactation Risk Category*** | Details of Use in Breastfeeding                                                                                                                                                                                                                                                        |
|--------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Permethrin*  | BM                              | One retrospective study on the use of permethrin during pregnancy (n=113) showed no increase in the rate of major malformation in babies born to women who had used 1% permethrin topically. Permethrin is generally considered compatible with pregnancy. | L2                                | There is no human data available for the use of permethrin in lactating women, however, it is considered compatible with breastfeeding. Since minimal maternal absorption (less than 2%) is expected following topical application, little permethrin would be expected in breastmilk. |

|                                             |    |                                                                                                                                                                                                                                                                                                                                                                                                           |             |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pyrethrin/<br>Piperonyl<br>butoxide<br>PPB* | C  | There is no data on the use of PPB in pregnant women, however little absorption is expected following topical application.<br>Pyrethrin/piperonyl butoxide is probably compatible with pregnancy and may be preferred over lindane in pregnant women.                                                                                                                                                     | Unavailable | Pyrethrin/piperonyl butoxide is probably compatible with breastfeeding. There is no data on the amount of PPB excreted in human breastmilk; however, little would be expected due to minimal absorption following topical application.                                                                                                                                                                                     |
| Lindane                                     | BM | Pregnancy is considered a contraindication to the use of lindane by some experts, however, there are no reports linking the use of lindane with toxic or congenital defects. Caution is warranted if lindane is used during pregnancy due to the potential for neurotoxicity, convulsions and aplastic anemia. Lindane is contraindicated in preterm infants and caution is required in children < 50 kg. | L4          | Breastfeeding is noted as a contraindication to the use of lindane in many resources. <sup>F</sup> However, there are no reports of the use of lindane in breastfeeding women, so lindane is considered by some to be compatible with breastfeeding. If breastfeeding women are instructed to wait four days after discontinuing lindane use before breastfeeding, the nursing infant would likely avoid lindane exposure. |

\* The CDC recommends PPB or permethrin as first line agents for the treatment of pediculosis pubis (pubic lice) in pregnant and lactating women.<sup>32</sup>

\*\* FDA Pregnancy Risk Category.<sup>29</sup>

BM - Either studies in animals have not demonstrated a fetal risk but there are no controlled studies in pregnant women or studies in animals have shown adverse effects (other than decreased fertility) that have not been confirmed in controlled trials in women in the first trimester and there is no evidence of a risk to the fetus in later trimesters.

C- Either studies in animals have revealed adverse effects on the fetus (teratogenic, embryocidal or other) and there are no controlled studies in women or studies in women and animals are not available. These medications should be given only if the potential benefits outweigh the potential risks to the fetus.

\*\*\*Hale's Lactation Risk Category.<sup>30</sup>

L2 - Drug that has been studied in a limited number of breastfeeding women without an increase in adverse effects in the infant and/or the evidence of a demonstrated risk which is likely to follow the use of this medication in breastfeeding women is remote.

L4 – Drug with positive evidence of risk to breastfed infants or to breastmilk production, but the benefit from the use of the drug in the breastfeeding mother may be acceptable despite the risk to the infant (i.e. if the drug is needed for a life-threatening disease)

## Non-pharmacological Treatment

### Daily Lice Combing

Daily lice combing between pediculicidal treatments is a helpful adjunct and is strongly recommended.<sup>2,8,10</sup> The purpose of daily lice combing is to remove the nymphs that hatch between pediculicidal treatments.<sup>2,8</sup> Lice exhibit various susceptibilities to pediculicides based on their developmental stage.<sup>7</sup> One can expect to find lice at all stages of development on an infested head, therefore they will die at different times following pediculicide application.<sup>7</sup> The process of daily lice removal (combing) is very similar to the technique described in the Detection section, except the hair should be dampened with water, not conditioner. At the end of each session, wash the comb under the tap. Use a nailbrush or old toothbrush to get between the teeth of the comb. If you've been using tissues to wipe the comb, tie the bag closed and throw it away. Soak the comb in very hot water for 10 minutes or store in the freezer for 24 hours before using again.<sup>43-60</sup>

Electronic lice combs do not appear to offer any advantages over traditional lice combs since they do not kill or remove nits.<sup>14</sup> Anecdotal evidence both supports and refutes the use of electronic lice combs.<sup>33</sup> Vinegar diluted 1:1 with water, acid shampoo, 5% acetic acid, conditioner and vegetable oils have been reported to help with nit removal.<sup>1</sup> There are few published trials evaluating the efficacy of these products, however they are unlikely to be harmful.

### “Bug Busting”

Manual removal, “Bug Busting”, is a drug-free lice treatment popular in the UK because of increasing resistance to pediculicides.<sup>5</sup> It involves cleaning with regular shampoo, rinsing, adding a liberal amount of conditioner and intensive combing.<sup>33</sup> This process is similar to that used for detection. As previously discussed, the purpose of combing is to remove the lice that have hatched since the last combing session.<sup>2,8,34</sup> It takes 15-30 minutes per session and is repeated every 4 days for at least 2 weeks or for a total of at least four sessions.<sup>34</sup> If live adult lice are found during any session, then three further sessions at four day intervals are required until no lice are found for three consecutive sessions.<sup>33-34</sup> For some families, especially those with many members, combing protocols may be difficult to follow.<sup>11</sup>

Few published trials exist comparing Bug Busting to pediculicidal treatments and efficacy results vary considerably.<sup>33</sup> Bug Busting is generally considered less effective than use of pediculicides and should not be the sole treatment for head lice recommended to the general population.<sup>3, 12</sup>

## Environmental Cleaning

Lice do not live for a significant period of time off the scalp, thus heroic environmental cleaning efforts are not necessary.<sup>12</sup> Risk of transmission from lice on furniture and floors is very low, so it is unnecessary to spend a lot of time cleaning beyond vacuuming where the infested person usually sits or lays.<sup>15</sup> Insecticidal sprays have not been shown to be effective.<sup>8, 22</sup> Do not use lice sprays around your home. There is no proof that spraying will help control lice, and it may harm family members or pets.<sup>8, 15, 22</sup>

Although fomite transmission is unlikely, items used or worn by infested person during the three days before treatment, such as linens, blankets, coats, stuffed toys and clothing should be disinfected.<sup>8-9</sup> There are several options to rid fomites of the potential for transmission. If possible, the object should be washed in hot water and dried in a hot dryer for 20 minutes.<sup>8,15</sup> Alternatively, the objects may be stored in a tightly-wrapped plastic bag for 10 -14 days or placed in the freezer for 24 hours.<sup>8,15</sup> Ironing may also disinfect items that cannot be washed.<sup>8</sup> Combs, brushes and barrettes may be soaked washed in hot soapy water to remove nits and lice and then soaked in very hot water for 10 minutes or soaked in rubbing alcohol or Lysol® for 1 hour.<sup>8,15</sup>

## Treatment Failure

Many therapeutic failures are not the result of resistance, but are more likely the result of misidentification, treatment non-compliance or reinfestation from contact with another infested individual.<sup>5,14</sup> When evaluating a reported treatment failure, it is important to confirm several details about the treatment.<sup>5</sup> More specifically, the identification, treatment and treatment method should be confirmed.<sup>5</sup> To determine if it is a true case of resistant head lice, the following inquiries should be made:

- Exactly how the treatment was used<sup>5, 17</sup>
- The number of applications<sup>5, 17</sup>
- Simultaneous treatment of all infested persons.<sup>5, 17</sup>

### **Pediculicidal resistance may result from<sup>7,19</sup>:**

- Not drying hair sufficiently leading to permethrin dilution and sub-lethal doses
- Using a pediculicidal product as a preventative when no infestation is present
- Shedding of the exoskeleton by nymphs which can occur after exposure to a pediculicide and may expose the person to sub-lethal doses
- Pediculicidal overexposure from too many applications
- Residual effects of permethrin leading to sub-lethal doses
- Using too little product

If all infested contacts were not treated on same day, reinfestation may have occurred.<sup>1, 4</sup> When assessing a possible treatment failure, one must keep in mind that unhatched lice that are enclosed within nit casings during treatment are not expected to be killed.<sup>2, 17</sup> These small lice do not indicate resistance, but are expected to hatch after the first treatment and appear on the hair before the second treatment.<sup>2, 17, 33</sup>

Although resistance to pyrethrins, permethrin and lindane has been

documented in other parts of the world, there is little data available regarding lice resistance in Canada.<sup>12</sup> Depending on the area, treatment failure rates vary.<sup>5</sup> Resistance is not clearly defined in the literature. Resistance should be suspected if a pediculicidal product is properly used and live, active lice (no dead lice) are detected 8-12 hours after treatment.<sup>15</sup> Others define resistance as finding active young and adult lice 12-24 hours after treatment or when no lice are killed within 24 hours and no other cause for failure can be elucidated.<sup>4,15,33</sup> Re-treatment is not required if live, less active or twitching lice are found 8-12 hours after a pediculicide treatment.<sup>15</sup> In this situation, all remaining lice should be combed out of the hair and the same treatment should be repeated on the scheduled day.<sup>15</sup>

If a true treatment failure is suspected, the person should be retreated with a different product immediately and again in 10 days.<sup>22,27</sup> The literature supports choosing a pediculicidal product with an active agent from a different pediculicidal class.<sup>4,33</sup> It may be better to use a pyrethrin or permethrin product, even in a resistant case, than to use a product with less safety data and possible toxicity.<sup>14</sup> The first line treatments available on the Canadian market, permethrin and PPB, work by the same mechanism of action and cross-resistance is possible.<sup>3-5</sup> However, some suggest pyrethrins may still be effective after permethrin has failed.<sup>35</sup> In clinical practice in Canada, if a treatment failure occurs with permethrin, the person is usually directed to treat two more times with a product that contains PPB. This is also true of the reverse situation. Although widely reported as a means to overcome resistance, increasing the concentration of permethrin to the 5% scabidical product is unlikely to be more effective than 1% permethrin as lice have been shown to be resistant regardless of the strength used.<sup>5,19,21</sup>

### Alternative Treatments

There are anecdotal reports of using various household chemicals and products, such as mayonnaise, petroleum jelly, olive oil, margarine and hair gel to treat head lice but they are not lethal to lice.<sup>10,12</sup> There are no published trials to support the efficacy or safety of these treatments.<sup>12</sup> Although petrolatum is the treatment of choice for lice infestations of the eyelashes and eyebrows, successfully killing lice by smothering can be difficult.<sup>4</sup> The openings to the respiratory system, spiracles, are closed when lice become wet.<sup>5,12</sup> Lice can remain dormant, without oxygen, respiration and muscle movement, for several hours (anaerobic metabolism).<sup>5,28,47</sup> This dormancy can be induced in adult lice by refrigeration, water immersion or application of mayonnaise or petrolatum.<sup>18</sup> People may mistake this “simulated death” as a successful treatment when, in fact, the lice can regain mobility shortly after the product is removed.<sup>10,18</sup> In a laboratory setting, lice are observed for up to 24 hours before concluding that a treatment is fatal to lice.<sup>18</sup> If an occlusive treatment must be used, people should be instructed to apply a thick coat and leave it on for at least 8 hours.<sup>8</sup> One may wish to apply before bedtime, cover hair with a shower cap overnight, and wash hair with regular shampoo in the morning. This may suffocate live lice, but the nits will not be affected and will continue to hatch. You will need to repeat the treatment several times over 2-3 weeks<sup>43-60</sup> People should be instructed to combine smothering treatments with daily lice

combing.<sup>8</sup> Tips for easier removal of petrolatum include using Dawn® dishwashing liquid or Pert® shampoo.<sup>13,36</sup>

Some people have used natural products such as tea tree oil, other essential oils, and aromatherapy products to treat head lice. Public Health Services does not recommend the use of such products because their safety and effectiveness is not yet known. Other products such as gasoline or kerosene are flammable and toxic. They are dangerous and are not recommended by Public Health Services.<sup>43-60</sup>

Cetaphil Gentle Skin Cleanser® (referred to as Nuvo lotion) was used to treat head lice in a preliminary trial and the overall reported cure rate was 96%.<sup>37-38</sup> The author suggests applying the product and drying it with a hairdryer to form an adherent film on the hair.<sup>37</sup> It is suggested that the spiracles are plugged and the lice are smothered.<sup>37</sup> The trial had several methodological flaws, including a lack of randomization, blinding and placebo control. More data is required before this treatment can be confidently recommended.

### **Natural Treatment Alternatives**

There is a lack of efficacy and toxicity data for essential oil products, particularly with regular use, resulting in unanswered questions about safety.<sup>10-12</sup> Natural products are not necessarily non-toxic, for example, ylang ylang oil is a potential contact allergen and anise ingestion has been associated with movement abnormalities, vomiting, nystagmus and pediatric emergency room visits.<sup>5,28,33</sup> There is no data to support the use of tea tree oil or aromatherapy for treatment of head lice.<sup>12</sup>

#### **Public Health Services Position on Use of Tea Tree Oil for Treatment of Head Lice**

There is no evidence that tea tree oil products are effective in treating head lice. In addition, there is no data on the toxicity of such products. Therefore, Public Health Services does not support the use of tea tree oil products for the treatment of head lice.  
55, 56.

HairClean 1-2-3® (Chick-Chack® spray in other countries) is a non-pediculicidal head lice treatment recently marketed in Canada by Quantum, Inc.<sup>9</sup> It is a herbal product that contains anise oil, coconut oil, ylang ylang oil and isopropyl alcohol.<sup>9</sup> The suggested mechanism of action is a phenomenon referred to as flee response.<sup>18</sup> When lice detect danger, such as a noxious smell, they flee to the base of the hair and hold tightly.<sup>18</sup> Alternatively, the lice may flee to the ends of the hair and crawl off to escape the pending threat.<sup>18</sup> The high concentration of anise oil reportedly causes an extreme flee response.<sup>18</sup> Three applications are required at five day intervals.<sup>16,39</sup> At each application the product should be left on the hair for 15 minutes then washed out with regular household shampoo.<sup>16,40</sup>

One manufacturer-sponsored published trial in subjects 6 to 14 years of age, compared HairClean 1-2-3® to an aerosolized spray marketed in Israel containing permethrin, malathion and piperonyl butoxide. Subjects were considered infested when one or more live louse and nits were found in a 3-5 minute combing session. Of 940 people examined, 199 (21.2%) were determined to be infested and were randomly assigned to a treatment group. Of these people, 129 (64.8%) reported using the treatment correctly. Reasons for non-compliance were not reported. Detection sessions were conducted on days 1 or 2 and 10 days after the first treatment. Failure was defined as detection of live lice. Both products were reported to be 92% effective. No significant side effects were reported. One person from each group experienced post-treatment itching.<sup>39</sup> Other manufacturer-sponsored abstracts are available, however the details required to fully evaluate the evidence are lacking.<sup>40</sup>

Another non-pediculicidal head lice product, Resultz®, was recently approved by Health Canada for the treatment of head lice in adults and children 4 years and older.<sup>41</sup> It is marketed by Altana Pharma Inc. and contains 50% isopropyl myristate, an ingredient commonly found in cosmetic products.<sup>41-42</sup> The proposed mechanism of action includes dissolution of the exoskeleton wax of the lice resulting in dehydration and death.<sup>41</sup> A sufficient amount of product to wet the scalp should be applied to dry hair.<sup>41</sup> After 10 minutes, the product should be rinsed with warm water.<sup>41</sup> The manufacturer suggests applying a second application after 7 days to ensure efficacy.<sup>41</sup>

Details of a study in which 30 people (aged 2 to 59 years) were treated with Resultz® have been published in poster format.<sup>42</sup> The trial was not placebo-controlled or randomized. Infestation was defined as detection of at least one live louse and viable nits. People were examined at baseline and on days 7, 14 and 21. The product was applied if live lice were detected during the examination. The product was left on the hair for 10 minutes, rinsed with water for 10 minutes and combed for 10 minutes to collect lice. Efficacy was defined as the need for two or less treatments over the 21 day period. Of the 30 people, one required three treatments and was reported as the only treatment failure. This person was not lice free at Day 21 and received a standard course of permethrin.<sup>41-42</sup> One person withdrew from the study, but the reason for withdrawal was not noted.<sup>42</sup> Adverse events included itchiness; mild skin irritation and redness which the authors suggested were worsened by the dry air in Winnipeg. Other available manufacturer-sponsored abstracts contain scant information making evaluation of efficacy and safety difficult.<sup>41</sup> In one trial, the treatments were reapplied only if lice were present seven days after treatment.<sup>41</sup> Their reported 23% efficacy rate for traditional comparator products, including permethrin and PPB, is very low while efficacy rates reported for Resultz® were 62% and 80%.<sup>41</sup> Better quality evidence is required to evaluate the efficacy and safety of this alternative product.

### **Prevention**

Pediculicidal products should only be used on people with active infestations as they do not protect from re-infestation.<sup>1,13</sup> Prophylactic treatment may perpetuate resistance and increase the risk of adverse events.<sup>1,13</sup> Although most authorities suggest that only those with live lice should be treated, prophylactic treatment of bedmates is sometimes recommended; this practice is not supported by Public Health Services.<sup>2,4,22</sup>

Several measures can be employed to aid in the prevention of head lice. Public Health Services recommends parents / guardians check their child's head regularly: once a week as part of their routine, after every sleepover and every day during lice outbreaks at school.<sup>8</sup> It is also recommended to keep long hair tied back or braided. Although cutting the hair may make lice detection easier, short hair does not prevent infestations.<sup>6,11</sup> Children should be taught not to share personal items that are used on their head. This means things like brushes, combs, barrettes, headbands, elastics, towels, hats, helmets, toques, and scarves.<sup>8,19</sup> Children should also be taught to put their hats and scarves in their coat sleeves or backpacks when they take them off at school to prevent lice transmission.<sup>5,8</sup> If your child has been in contact with someone who has lice, you need to check your child's head carefully to see if they have caught lice. Head lice spreads easily, so if one person in the household has lice, others may have it too. Everyone in the household should be checked on the same day. There is no evidence that "lice repellent" products decrease the prevalence of head lice.<sup>11</sup> Further safety and efficacy data from well designed in vivo studies are required before repellent products can be recommended.<sup>1,11,17</sup> Regular combing with a fine-toothed pocket or lice comb has been reported to prevent head lice infestations, although there is little reliable information to support this practice.<sup>1,17</sup>

### **Summary**

Research is needed to improve the accuracy of detection and to determine the most effective treatments for cases with confirmed, active infestations.<sup>6</sup> Improved pediculicide compliance to limit overexposure and prevent the development of resistance is another area for further research.<sup>6</sup> There is also a need for better designed trials to determine the place of natural products in the management of head lice.

### Clinical Pearls

- Information given to people about head lice by all health professionals must be similar to prevent confusion, decrease frustration and increase the likelihood of successful treatment.
- Treat only those who are infested.
- Treat people with nits close to the scalp (and no live lice) **only** if the person has not been treated with a pediculicide within the last month.
- All pediculicidal products should be used on dry hair.
- Re-treat all cases in 10 days regardless of the pediculicidal product used.
- Use daily lice combing between pediculicidal treatments.
- Don't wash the hair for 1-2 days after the treatment is rinsed from the hair.
- Vacuum the floor and furniture where the infested person usually sits or lays.
- Items, such as such as linens, blankets, coats, stuffed toys and clothing, used or worn by infested person during the three days before treatment should be disinfected.
- Items used near the hair should also be disinfected.
- Insecticidal sprays have not been shown to be effective, pose health risks and should not be recommended.
- Check school age children for lice once per week, after sleepovers and every day during an outbreak.
- There is little quality evidence to support the use of any "natural" head lice product for the treatment of head lice.

### **Websites of Interest**

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Pollack, Richard. Harvard School of Public Health:

[www.hsph.harvard.edu/headlice.html](http://www.hsph.harvard.edu/headlice.html)

Canadian Pediatric Society:

<http://www.caringforkids.cps.ca/whensick/HeadLice.htm>

Summaries UK Clinical Knowledge:

[http://www.cks.library.nhs.uk/head\\_lice/view\\_whole\\_topic\\_review](http://www.cks.library.nhs.uk/head_lice/view_whole_topic_review)

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