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EPIDEMIOLOGY OF PEDICULOSIS CAPITIS

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INTRODUCTION

The recrudescence of pediculosis capitis in the past few years has been the subject of much concern in communities throughout the United States. Efforts to control and eradicate this disease have not always met with success. Some battles seem to have been won against the head louse (*Pediculus humanus capitis*), but the war continues and each year, this persistent and pugnacious pest returns to spread panic and discord in communities closing schools and in some cases even entire school systems. The reasons why there has been an increase in the incidence of pediculosis capitis are not clearly understood, however, ignorance, misunderstanding, apathy and poverty seem to contribute to its persistence in communities.

This paper seeks to re-examine what is known about the epidemiology of the disease. Hopefully, in so doing it may dispel some of the ignorance and misunderstanding which surrounds this disease.

Biology: The head louse, *Pediculus humanus capitis*, is a blood sucking ectoparasite with one host species -- man. It is generally considered to inhabit only the hairy surface of the scalp and hair preferring the nape of the neck and the area behind the ears. It is not known to occur on eyebrows or eyelashes.

Both the immature forms (nymphs) and adult louse feed on human blood. Blood sucking may occur for long periods. Itching, the main symptoms of louse infestation, results from blood sucking. At scratch sites, secondary bacterial infection may occur. Additionally, focal alopecia due to an allergic response to blood sucking has been reported by Salamon et al. (1970).

Transmission of louse-borne diseases: The head louse is generally not thought to transmit louse-borne typhus, trench fever, or relapsing fever as is the body louse. However, the role of the head louse in transmission of louse-borne diseases remains controversial.

Nicolle (1920) claimed that head lice can transmit typhus. Mackenzie (1942) held that the body louse was an evolutionary form of the head louse and that both are regarded as vectors of typhus. Gerberg (1973) suggested that there is a potential hazard for disease transmission by head lice in urban areas. Both laboratory and field studies support a reasonable concern that the head louse might transmit disease.

In the laboratory, Goldberger & Anderson (1912) transmitted typhus from monkeys by cutaneous injection of infected crushed head lice. Weyer (1952) demonstrated that *Rickettsia prowazeki* and *R. quintana* can proliferate in the head louse. Mooser & Weyer (1954) found that spirochetes of relapsing fever can reproduce in the head louse.

In the field, Foster (1915) recorded that head lice may have vectored endemic typhus in the Philippines in 1915. Haight (1917) suggested that a typhus case in Toronto, Canada might have been transmitted by a head louse. Bequaert (1938) stated that the head louse was a carrier of exanthematic typhus in Guatemala. Ruiz-Castaneda (1939) believed that the head louse was responsible for a mild form of typhus in Mexico. The role of the body louse as the sole transmitter of louse borne diseases is further vitiated by Hase's observation (1915) that simultaneous infestations by head and body lice occurred in a significant number of cases.

Gear (1973) reported that during World War II he investigated a typhus epidemic in the Transkei, where both head and body lice were harboring the infection. Gear would not say this observation demonstrated that both kinds of lice transmitted the disease. In Yugoslavia Gaon (1973) reported that both head and body lice have been found in large numbers in many louse borne disease epidemics, but he stated there has never been a case when only head lice were observed, even though 5 or 10% of the population might have had louse infestations. Still, because head lice

may transmit typhus, Gaon believes that great importance must be attached to head lice as a vector of louse borne diseases as body lice disappear.

History: The louse has been with us since early times. Ewing (1924) found nits on the scalps of pre-Columbian Peruvian mummies and all stages of the louse (adult, nymph and egg) on prehistoric American Indian mummy scalps. Later, Armelagos (1969) found 40% of the scalp and hair samples from Nubian mummies (circa 350-550 A.D.) infested with the head louse. Zinsser (1935) cites numerous sources indicating man's close association with this ectoparasite throughout historical times.

Distribution: Head lice are distributed worldwide. No race or country is free of this ectoparasite. Little information is available on the current actual geographic distribution of these infestations of the incidence in infested areas.

From recent reports, it appears that there has been an increase in incidence of pediculosis capitis in widely scattered parts of the globe. In Iran, Jalayer (1967) reported that a survey in Shiraz yielded 31% of the sample population infested with head lice. Nearby, in Israel, Lidror and Lifshitz (1965) found 40% of school children infested in several villages. In Africa, Shalaby (1972) reported head lice in Libya.

In Europe, Gratz (1973), citing the 1970 annual report of the Department of Education and Science of the United Kingdom, reported that 223,422 children in state schools in England and Wales were found infested with head lice that year. Further, Gratz cites the 1971 annual report of the Danish Pest Infestation Laboratory which indicated a great increase in the incidence of head lice infestations in Denmark. In another Baltic country, Chylak et al. (1967) found 1.5% of 93,373 school children infested with head lice in Wroclaw, Poland. Policka et al. (1971) found 4.1% of 4,374 school children infested with head lice in the Karvina region of Czechoslovakia. From Germany,

Littig (1971) examined Berlin school children and found in 1966, 1967 and 1968 that 4.7%, 11.8% and 8.6%, respectively, were infested with head lice.

In Canada, Hooper (1971) reported an outbreak of head lice infestation in schools in an area of British Columbia in which lice had not been reported for 20 years. From Chili, Schenone, et al. (1973) reported that 25.9% of 53,556 persons (the majority were school children) examined in Santiago were infested. In the United States, Slonka et al. (1975) reported that 7.2% of 2,650 school children examined in Buffalo, New York were infested. In another study, Slonka et al. (1975 c) found that 3% of 1,783 pupils examined in Barrow County, Georgia were infested.

In an estimate of the size of the lice problem in the United States, Norins (1974) reported that there are approximately 3 million cases of pediculosis during the period June, 1973 to June, 1974. Norins based this estimate on a sales analysis of a widely distributed pediculicide.

Hair length: Widely circulated educational pamphlets implicate the recent fashion of long hair as a factor contributing to the increased incidence of pediculosis (Pratt & Littig; Keh & Poorbaugh). Reports and books written long ago seem to support this contention. However, this contention is not supported by consistent and conclusive evidence. In 3 reports by Buxton, only 1 (Buxton, 1940) showed a correlation between hair weight and rate of infestation; whereas, two other surveys (Buxton, 1936, 1938) reported no significant correlation. Additionally, although there may be a rough correlation between hair weight and length (Buxton, 1938), such factors as total scalp size, density of hair, hair shaft diameter and degree of coarseness may affect the weight of a hair crop and thus confuse the results.

Recent works by Slonka (1975 b,c) demonstrate that hair length is not a factor in the frequency of infestation. In both studies a significant number of males and females with long hair (hair touching ears and shirt collar) were inspected for pediculosis capitis along with males and females with short (hair not touching ears or shirt collar) and medium length hair (hair touching ears but not shirt collar). Results showed that there was no correlation between hair length and rate of infestation. Additionally, Roy and Ghosh (1944) found that short-haired individuals were more heavily infested than long-haired ones. However, Roy and Ghosh did not define short or long hair.

Sex: The widespread belief that lice are more prevalent in females than in males requires additional scrutiny. The role that sex plays in the distribution of head lice in a population is complex and incompletely defined.

The complex nature of this relationship is supported by conflicting results in epidemiologic studies both in the past (Buxton, 1938) and the present (Slonka,

1975 b). The role that sex plays in the distribution of pediculosis is probably related to sociologic phenomenon, such as the tendency of young females to engage in frequent physical contact, to attend "slumber parties", and share combs and hair brushes in the many elaborate toilets provided for them.

Hygiene: Although ample evidence suggests that hygiene is important in body lice control, no such correlation has been found between the level of hygiene and head lice infestation. Indeed, as early as 1932, Gater reported that although Malays were practically free of body lice infestation due to their high level of hygiene, they had a high prevalence of head lice.

Based on the biology of the ectoparasite, Howlett (1917-18) claims that combing the infested hair with a "pleasantly hot" comb removes head lice with a marked economy of time and trouble. Howlett observed that heat excites the lice to move about and theorized that the hot comb readily removes the parasite from the hair. He did not report the percent efficacy and one can only conclude that his method merely reduces the number of lice but does not necessarily eliminate the infestation. Additionally, Howlett offered "hearty testimonials" to the value of this method but no proof. On the other hand, Roy, et al. (1944) reported that frequent combing of the hair and the use of oil did not seem to dislodge the adults or to prevent the females from laying eggs. However, Roy, et al. do not report the temperature of their combs.

Age: Reports in the literature conclude that the frequency of infestation is greater in young children when compared with older children (Mellanby, 1942; Slonka, 1975 b,c) and greater in persons under 15 years of age compared with those over 15 years of age (Schenone, et al., 1973).

Although age is a factor in the distribution of head lice in a population, this may not always be the case. In a survey of 1428 male prisoners who ranged in age from 18 to over 40, Buxton (1940) computed attack rates according to age and weight of hair. He concluded that age in itself had little or no effect on the rate of infestation. (Prison environment probably reduces lice.)

Most prevalence and incidence studies are reported on children and not adults. However, when scientists look for lice among adults, they invariably find them. The role age plays, therefore, in the distribution of head lice may be an artifact of reporting rather than reflecting the accurate picture of distribution of lice in a population. In Yugoslavia, which has a good surveillance program, Gaon (1973) reported that school children are examined for lousiness as an indicator of lousiness in the general population. Children were used to reflect the situation in the general population.

Schenone's data (1973) supports the notion that whenever a large number of people are examined, all categories, or groups are infested. Slonka (1975 a)

showed that 80% of pupils who were infested had at least one other infested family member. Chylak (1970) and Slonka (1975 b) conclude that family units are the source of persistence of pediculosis foci and provide the nidus from whence pediculosis may recrudescence in a community.

Family size: Head lice infestations are found more frequently in large families compared with small families. This observation has been recorded by Mellanby (1942), Chylak et al. (1969, 1970) and Slonka (1975 b,c). This increased frequency of infestation in large families reflects the bionomic tendency of the parasite to rapidly spread through a group living in intimate contact (Slonka, 1975 b). Additionally, there is the obvious increase in risk that naturally accompanies a group with more members.

Race: Head lice infest all races of man in every part of the world (Ferris, 1935). It seems that there are no parts of the world from which the insect is naturally absent. According to Buxton (1946), even where it is known that lice are very rare or absent, this may generally be attributed to human habits rather than climate.

Although no human race (so far as is known) has been reported without lice or immune to them, lice from different races of man differ from one another in their color (Nuttall, 1918-19) and their preference for infesting individuals of other races (Ashcroft, 1969).

Racial preference by head lice has been observed by Funkhouser (1917-18), Sobel (1913), Greene (1898), Ashcroft (1969) and Slonka (1975 b,c). Little doubt remains, therefore, that race influences the distribution of head lice on a racially mixed population of white and black individuals. Reasons for the racial preference in head lice are unknown but the subject of much speculation. Various researchers suggest that the near absence of infestation in negroids compared with caucasoids is due to differences in hair length (Buxton, 1946), methods of grooming (Nuttall, 1917-18), cosmetic care (Funkhouser, 1917-18), the cross-sectional shape of the hair (Ashcroft, 1969), and actual differences in the anatomical particulars of the various racial strains or varieties of lice (Buxton, 1946; Zumpt, 1966).

Socioeconomic Status: There is a tendency for this parasite to be distributed more widely among members of the low socioeconomic level than middle and high levels. This observation is shared by many (Nuttall, 1918; Buxton, 1946; Chylak, 1969, 1970; Mellanby, 1942 and Slonka, 1975 a,b,c). Reasons for this higher attack rate are speculative. Chylak (1970) alludes to penury as one factor that may contribute to the distribution to lice in a population. Slonka (1975 b) related instances where infested families were unable to pay for proper medical attention; and, thus these families remained infested. These chronically infested families were a potential

source of infestation to others.

Although the observation that the attack rate for head lice is higher in the low socioeconomic group is important, the more significant observation is that this coparasite is not confined to low socioeconomic level but is found in the middle as well as the high socioeconomic levels (Slonka, 1975 a,b,c).

Crowding: Buxton (1946) deduced from the parasites' biology that there is a strong tendency for lice to infest small groups of people and spread rapidly so that the members of a family or men living in close contact on a ship or in a tent may quickly infest one another. This deduction by Buxton is indeed substantiated by Slonka (1975 b,c) who demonstrated the attack rate was significantly higher in families that lived under crowded conditions compared with those families that lived under less crowded conditions.

Transmission and dissemination: The means whereby lice pass from infested individuals is largely speculative. The literature abounds with modes of transmission and dissemination. Much of this is speculation based on the biology of the louse and may be accurate.

The propensity of lice to pass from infested to uninfested persons in a population may be overrated. While Buxton (1946) speculates that lice spread rapidly through small groups of people, Roy and Ghosh (1944) observed that no transmission of head lice occurred in a hospital ward where both infested and uninfested patients were confined. Unfortunately, Roy and Ghosh do not report sufficient detail regarding direct or indirect contact between infested and uninfested patients to fully evaluate their observation.

Nevertheless, based on the biology of the louse, the most common mode of transmission is speculated to be by contact with infested persons. Nuttall (1917-19) observed that head lice frequently wander on the hair. He theorized that this tendency to wander may allow the spread of head lice by contact of children's heads at play. I could find no report in the literature which proves that head lice are transmitted in this fashion. Circumstantial evidence does exist. In Georgia, Slonka (1975 c) found that the attack rate in Special Education pupils was significantly higher compared with the attack rate of students in grades kindergarten through VI. He remarked that this high attack rate in Special Education pupils reflects a greater propensity toward inter-personal contact in this group compared with other classes of students.

Contact with clothing, bedding and brushes previously used by infested persons is reported as a mode of louse transmission. Galewsky (1915) demonstrated that louse-free French prisoners became infested when they exchanged clothes with 9000 lousy Russians. Harding (1898) found lice in school-girls' hats hung in racks of school halls and regarded it probable that lice wander from hat to hat

and are thus distributed. The method of closing garments is a factor in the distribution of lice infestation. Buxton (1946) stated that school cloakrooms and Hooper (1971) alleged that lockers are sites of head lice transmission from infested garments such as caps and coats to non-infested garments, but they offered no proof. However, Slonka (1975 b) demonstrated that students who hung their clothes on individually assigned hooks in cloakrooms had a significantly lower attack rate than those who hung their clothes in cloakrooms where there were no assigned hooks. In addition, Slonka showed that students who shared lockers had a significantly higher attack rate than those with individual lockers.

Transmission may occur in bed. Slonka (1975 c) showed that the attack rate in students who shared a bed with at least one other person was significantly higher compared with those who slept alone.

Nuttall (1917-18) speculated that lice may be disseminated by being dropped by infested persons or from verminous clothing and effects. He further remarks that it has long been known that stray lice may be picked up in public conveyances used by infested persons. Nuttall recalls that when a child, he was warned against leaning his head against the back of seats. This proscription, although deductively reasonable, remains unsubstantiated. However, unreported circumstantial evidence implicates school buses as a site where lice transmission occurs. In outbreaks of head lice, some investigators (personal communication) recovered head lice from school bus seats. These investigators reported that the practice of transporting school children by bus contributed to the increase in incidence of pediculosis.

Although there is a dearth of reports which support the role of obvious means of transmission and dissemination of lice through a population, such as direct contact, reports prove that such bizarre and insignificant mechanical vectors as house-flies may disseminate lice. Calandruccio (1890) stated that he has seen *Pediculus capitis* conveyed from place to place and person to person by flies. Galli-Valerio (1916) put 2 flies in a vessel with head lice and subsequently found a louse clinging to a fly.

Many popular articles and pamphlets categorize pediculosis capitis as a disease of school children and senior citizens. The literature supports this concept by its numerous citations of outbreaks among these groups and practically nothing on other categories of people. Such categorical piffle has no significance in the disease epidemiology for an entire population. This concept which is derived from the literature may be an artifact of reporting and reflects the ease with which these two categories of people are accessible for examination.

More importantly, this categorization of the disease has resulted in emphasis upon

control measures centered around schools. Whenever an outbreak of pediculosis occurs, the immediate reaction is to blame the schools and close them down. Eradication measures which are aimed at children should also provide means to disinfect the entire family.

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